

**Australia's National Skilling System and  
its Trajectory:**

**A Model and Analysis for the Period 2001-  
2006**

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**Thesis submitted in fulfilment of the requirements for the degree of  
Doctor of Philosophy**

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## **STATEMENT OF ORIGINALITY**

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of my knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the thesis, nor does the thesis contain any material that infringes copyright.

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SIGNED

Doug Fraser  
16 October 2009

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## ABSTRACT

This thesis uses models drawn from innovation theory to define a construct and conceptual model of the National Skilling System as an alternative to conventional equilibrium models of the creation and deployment of skill in the economy. The model incorporates and provides a framework for locating ideas developed in European institutional economics since the 1980s and in the tradition of labour market economics particularly associated with SKOPE in the UK and the Workplace Research Centre in Australia. The model is built around a dynamic interaction between supply, demand and deployment, with the key output being the amount and type of skill that is converted into productivity across the economy at any point in time.

Based on this model, a specification and metric are proposed for tracking the skills trajectory of a national or sub-national economy, a concept extensively used by earlier authors but hitherto lacking an unambiguous or operational definition. The metric is based on separate but linked indices of skill-intensity and task discretion, derived from Spenner and modelled on the structure of the UK Skills Surveys, but with substantial modification to accommodate the less rich data available for Australia.

As a first step towards operationalising the model, data from HILDA, an annual panel survey of 8,000 Australian households, are used to analyse patterns of skill-intensity in Australian jobs over the six waves of data currently available and the influences behind them. Australian respondents appear from these data to be more satisfied than their UK counterparts with the degree of skill they exercise in their jobs, the opportunities their work provides for on-the-job learning, and the amount of control they have over their work. However, there is no evidence over this period of aggregate growth in skill-intensity. The significant changes in the key indicators of skill-intensity have been small but uniformly negative, while the trend for task discretion has been flat, slightly declining or slightly positive depending on the measurement method. The analysis examines the distribution of these trends by workforce category and age cohort, and finds significant discrepancies between skill-intensity and task discretion in individual occupations, especially at the higher-skilled end. Possible explanations and policy implications are considered, together with recommendations for follow-up research.

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## Abbreviations used in thesis

ABS	Australian Bureau of Statistics
ACCI	Australian Chamber of Commerce and Industry
AIG	Australian Industry Group
DEET	Department of Employment, Education and Training
DEETYA	Department of Employment, Education Training and Youth Affairs
DEST	Department of Education, Science and Training
DEWR	Department of Employment and Workplace Relations
DEWRSB	Department of Employment, Workplace Relations and Small Business
DOT	Dictionary of Occupational Titles (US)
ESRC	Economic and Social Research Council (UK)
FaHCSIA	Department of Families, Community Services, Housing and Indigenous Affairs
HILDA	Household Income and Labour Dynamics in Australia
NSS	National Skilling System
SKOPE	Centre on Skills, Knowledge and Occupational Performance (UK)
TAFE	Technical and further education (refers in Australia to the public system only)
TCF	Textile, clothing and footwear manufacturing
VET	Vocational education and training

## **Chapter 1**

### **Outline and purpose of the thesis**

#### **1.1. Purpose of the research**

This thesis sets out to serve two purposes:

- to develop a conceptual model of the role of skill in the economy based on a systems paradigm;
- to introduce a unique and hitherto little utilised resource for this aspect of labour market research, the HILDA dataset, and show how it can help to illuminate the characteristics and trajectory of Australia's national skilling system by tracking the skill content of Australian jobs as perceived by the people who work in them.

HILDA is a national panel survey conducted annually since 2001 by the Melbourne University Institute of Applied Economic and Social Research for the Commonwealth Department of Families, Housing, Community Services and Indigenous Affairs. Full details are set out in Chapter 4. The section of the dataset primarily used in this research consists of a sequence of questions in which employed respondents (around 7-8,000 in each wave) are asked about the demands made by their jobs on their skill base.

#### **1.2. Scope and constraints**

The thesis thus has a conceptual and an empirical component, kept largely separate for the purposes of exposition but linked together by the core task of developing a generic metric for the growth and productive application of skill. The conceptual part explains the rationale for this metric, while the empirical part is intended as a first demonstration of how the metric can be operationalised using readily available quantitative data, and of the kinds of understanding of system behaviour that can be gained from its application.

Together the two components of the thesis should contribute to a clearer understanding of several key questions related to innovation, skill and economic growth in Australia which it has not been previously possible to answer reliably by quantitative analysis, notably:

1. whether the overall skill level of Australian jobs is rising, across the board or differentially;
2. how the changing structure of Australian industry is affecting skill requirements, and skill utilisation, in different industries;
3. how the demand for high skill is distributed across levels in the occupational/qualifications hierarchy, and whether this distribution is changing over time; and
4. how the tightening of the Australian labour market over the first seven years of this century affected the skill content of jobs.

More specifically, the main analysis in Chapters 6-9 focuses on two broader empirical questions which bear on the first, second and third of the above issues:

- How has the skill content of Australian jobs changed over the years from 2001 to 2006?
- How has the change, if any, been distributed across industries, occupations and groups within the workforce?

The fourth question cannot be answered conclusively without supplementary data on business behaviour which are not yet available (see footnote 1, page 3). However, Chapter 10 addresses the indications on those issues which have emerged from this research and sketches out an agenda for further research once such supporting data can be obtained.

While the above questions effectively summarise the scope of the empirical work undertaken in this thesis, they do not exhaust the potential of the data in HILDA. Further issues that could be covered in future using the dataset, generally in conjunction with other sources, include:

5. whether innovation leads to greater demands on workforce skills;
6. whether significant differentials exist between the levels of skill exercised in industries traditionally regarded as high-, low- and medium-technology, once allowance is made for the different technical requirements of each;
7. how closely the incidence of work-based or employer-supported training corresponds to actual needs for increased skill;
8. the extent, if any, to which employers are recruiting or developing skills which they do not subsequently put to effective use; and
9. how embodied knowledge flows between industries, and particularly from industries generally regarded as skill-intensive to those seen as lower-skilled, through labour mobility.

Of the two parts of the thesis, the conceptual element is presented as the more substantial and the more likely to provide a useful input to debate, in the policy if not necessarily the scholarly context. The empirical section is intended as an illustration of the potential that exists for research using the model and the dataset, but not as either a comprehensive description of the system or a sophisticated or conclusive exercise in inferential analysis in its own right. The main focus of this component lies on encouraging other researchers and policy analysts with an ordinary working knowledge of quantitative methods to see the raw data in HILDA as a resource which can support useful analysis of real problems without the need for advanced statistical skills or modelling software. At the same time, by exposing some of the analytical problems and uncertainties which remain unresolved by simple analyses, this empirical component may help to set an agenda for future research.

Some of the constraints on the empirical research reflect weaknesses in the data so far available. HILDA itself, while uniquely valuable as the only large-scale quantitative data collection yet undertaken in Australia which provides direct rather than proxy evidence on the kinds of question just outlined, is limited in the scope it offers so far for extrapolation. The most important limitation is the very short run of data publicly available so far – six annual waves – and the absence of any other reliable quantitative data sources covering earlier periods which might help to locate its findings historically or provide longer-term trendlines against which to compare them. Apart from this key limitation, the dataset poses some technical problems of data quality which are set out in Chapter 4, and which mean

that triangulation with other sources is required before inferences can be confidently drawn from the data on the kinds of issue shown in the second of the above lists. Unfortunately, no adequate population-level quantitative data sources are yet available which provide information on the actions and views of industry to match the insights which HILDA provides into the perceptions of workers about their jobs.<sup>1</sup>

Thus, while it is technically feasible to undertake more sophisticated modelling with the HILDA data than is attempted in this thesis (and Chapter 5 describes some examples), the more complex techniques can be expected to show a commensurate return in certainty only once more years of data are available from HILDA, and once more adequate complementary data become available on industry behaviour. The findings of the analyses in this thesis must be treated as provisional, but the same would apply to any analysis relying on the present information base.

Three specific restrictions were placed on the analysis in advance, either to compensate for possible problems of sample adequacy or to keep the scope of the thesis within reasonable bounds. Analyses have been conducted on a national scale without any attempt to look for regional effects or variations. This was done partly for reasons of reliability, given the small cell sizes available for analysis once the data were disaggregated for the smaller States in particular. However, it also reflects the fact that the model and the analyses have been focused in this initial phase in describing a *national* system and skill trajectory. Also for reasons of reliability, disaggregation of the data beyond the second level of crosstabulation has been avoided and inferential analyses have not been carried out on cells with 20 or fewer observations. Finally, in view of the generally small movement in the key indicators of interest over the period for which data were available and the high possibility of random error, inferential analyses have generally been carried out at the .01 level of significance, with any findings that were significant only at the .05 level treated as provisional or indicative.

### 1.3. Rationale for a systems approach

This thesis has its origins in the author's own observations over three decades of research into, and direct engagement with, various aspects of industry and skill policy, which culminated in the drafting of what was at the time the most comprehensive data-based analysis yet undertaken of how Australian industry trained (Fraser 1996). Throughout that period the approach of governments to their responsibility for skilling the nation's workforce has alternated, often rapidly, between two equally inadequate one-way causal models: supply push (governments supply education and some forms of training, industry converts the outputs into productivity) and demand pull (businesses accurately specify their immediate skill requirements, and it is the function of governments to "respond", either

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<sup>1</sup> The Australian Bureau of Statistics (ABS) has been working since around 2004 on a Business Longitudinal Dataset (ABS 2004, 2007) which will combine questions from several existing series on strategic issues of innovation, training and work practices using a rotating panel sample of businesses. A trial version of this survey was conducted over a short period in the 1990s and has provided the basis for some useful research on skilling issues (e.g. Dockery 2001), but none of these data overlap the reference period for HILDA. At the time this thesis was commenced, it was confidently expected that the first waves of data would be available in time to contribute to the analyses undertaken here. However, technical problems and more recently resource constraints have slowed their release, and at the time of completion there were still no publicly available findings from this series.

through the publicly provided training system or through subsidies to private providers, by supplying the precise mix of demanded by industry to meet its short-term needs).

Whichever model is followed, and with only a few exceptions, government initiatives to remedy skill shortages or mismatches have taken the form of supply-side reforms. While such reforms are usually justified today in terms of improving the responsiveness of the training system to industry requirements (Minister for Employment, Education and Workplace Relations 2008), they almost invariably rely heavily on subsidy as the effective component of the intervention. In the author's experience this long-established trend has led not simply to a new form of welfare dependence but to actual inefficiencies which stand in the way of appropriate skill development.

One of the most important inefficiencies has been a progressive weakening of the major equilibrating mechanism in the classical model of the market for training, price signals, with the market no longer conveying accurate information about the relative costs, cost-effectiveness or indeed feasibility of different options for creating and maintaining skill. This in turn has led to expectations on the part of business that it can make open-ended demands on government for the provision of skills closely tailored to individual employers' possibly ephemeral requirements, without regard to the costs and benefits<sup>2</sup>. In the process, many businesses have lost both the capacity and the incentive to strike a cost-effective balance between external and in-house skill formation, and increasingly exert pressure on the public training system to take on the responsibility for highly specialised, task-specific aspects of training and even socialisation into workplace culture which were once universally regarded as part of the ordinary costs of employing labour (ACCI 2007; DEST/ACCI 2002; Grugulis, Warhurst and Keep 2004; Richardson and Liu 2008).

These are the author's own observations and as such, not part of the actual argument of the thesis. However, concerns of this kind are present, explicitly or by implication, even in mainstream literature on vocational education and training (VET). One recent high-profile series of studies from which similar conclusions can be drawn, largely by negative example, is the project with the overall title *A Well-skilled Future*, sponsored by the National Centre for Vocational Education Research (NCVER) (Richardson and Teese 2008).

Different research projects in this suite identified a range of explanations for Australia's apparently growing difficulty in ensuring an adequate supply of the kinds of skill valued in modern industrial economies. These reasons included a growth in the proportion of work undertaken under forms of employment contract traditionally associated with low levels of employer investment in formal training (Richardson and Liu 2008: 31); an associated decline in work-based informal learning because fewer workers are staying in the one job or type of work long enough to gain a really deep experience or understanding of the tacit knowledge involved (Richardson and Liu 2008: 9); the loss of the large contribution to training effort previously made by public utilities which have since been either privatised or put on a quasi-market footing (Richardson and Tan 2008: 22); an apparent absence of progress towards the general adoption of high-productivity work practices or forms of work organisation (Martin and Healy 2008); and a shift in employers' expressed demand from practical to interaction skills (Lowry, Molloy and McGlennon 2008: 27), coupled in many

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<sup>2</sup> This observation reflects in particular the author's experience in attending as a participant observer at four consultative forums carried out with Tasmanian businesses by Skills Tasmania over the period October 2007-March 2008.

cases with a tendency to see these latter as matters of personality rather than acquired skill, and hence as something to be addressed by selective recruitment rather than training (Martin and Healy 2008: 23).

Despite these generally compelling diagnoses, the brief of the overall study confined it to recommending only such solutions as could be achieved by addressing the “responsiveness” of the formal VET system. The recommendations which arise from this limited remit appear to be of doubtful feasibility, onerous and expensive in their implications, and lacking in consistent strategic direction:

- On the one hand, the loss of opportunities for ongoing employer-provided training and informal learning on the job is predicted to mean a shift of responsibility for one of the key elements of skilling from the employer to the external training system, and the task is expected to be harder because the group in the workforce most affected will be those with least aptitude or inclination for formal learning (Richardson and Teese 2008: 21). At the same time, a sustained growth trend in employment for managers and associate professionals is predicted to increase the demand for the more ambitious kinds of long-cycle VET at the diploma or higher level. The sector is thus left stretched between apparently conflicting needs to build up the sophistication of its “serious” offerings aimed at motivated, capable students, and to cater for an ever-increasing proportion of the routine skilling needs of difficult-to-serve populations.
- The main report forecasts a simultaneous need for VET to focus its planning activity on those broad areas of skill for which the demand is growing over the medium-long term *and* develop its capability to provide a rapid ad-hoc response to specific shortages as they emerge (Richardson and Teese 2008: 28).
- When it comes to the uncertain and inconsistent character of change in work organisation, the authors suggest that the only way VET can usefully respond is by helping workers develop the negotiation and administration skills they will need to survive in a climate of precarious employment, low autonomy and work intensification – that is, by concentrating its efforts on ways to mitigate the transaction costs created by continuing dysfunctions in management practice rather than on creating the capacity to move to more functional models of work organisation (Martin and Healy 2008: 27).
- The conclusion to the main report suggests two competing paths towards a more responsive system, one based on community partnerships and one on a stronger role for market forces, and even presents their coexistence today in different regions as evidence that the sector is already responsive – in effect, making a virtue of the present lack of coherent strategic focus (Richardson and Teese 2008: 27).

These judgements should not be seen as reflections on the quality of the research and analysis in the studies, which is consistently high. Rather they are the inevitable consequence of the constraints imposed on its findings. Had the research requirement specified a less one-dimensional perspective, the studies could have presented governments with strong arguments for action, in areas often far removed from the actual mechanisms of publicly supported formal training, to bring about a coordinated adjustment which would have left the formal VET sector to concentrate its resources on those activities where it can

most cost-effectively add value to the other components of the system. Such an approach could have led to the kind of findings that normally justify such a comprehensive research-based review: a single, coherent strategic direction for the sector's administrators and component organisations to plan their investment over the medium term. Instead, the imposition of a unilateral model of adjustment, in which the VET sector alone is presumed to be capable of and responsible for "responding" while all the other drivers must be taken as given, has resulted in a set of recommendations which appear to put the sector on a certain course to future crisis.

The problem, as should be clear in this summary of research from an impeccably mainstream source, is not lack of awareness, nor is it primarily a failure on the part of experts to warn governments of the weaknesses in their present approaches. The persistence of simplistic, one-sided policy models is undoubtedly in large measure the result of political pressures and considerations, in other words of pragmatism. However, part of it – and perhaps more importantly, part of the reason for continued voter acquiescence in dysfunctional and unnecessarily costly approaches on the part of their elected representatives – can be seen as a problem of mindset resulting from inadequate mental models. These inadequacies are found not just in the simplistic one-way models described above, which arguably owe more to convenient political rhetoric than to serious economic theory, but equally in the public contribution of economic theory itself which still too often, especially when it comes from government sources, remains trapped in an outdated and inadequate human capital paradigm. That paradigm, though politically convenient, assumes away many of the real problems that make skilling a challenge for government, businesses and workers alike. Consequently it fails to engage with practitioners or serve as a guide to action, simply because it is seen as having little relevance to real decision needs.

A different paradigm will not necessarily gain acceptance simply because it makes more logical sense than the existing ones. If it changes mindsets, it will be by creating small insights and realisations about the things that really matter, and by providing a better language in which to express doubts, discontents and aspirations that already exist. In the words of Chapman:

...systems thinking and practice do not provide a simple solution... Rather, a systems approach suggests the need for a shift in the goals that can be realistically achieved... Rather than proposing any sort of panacea or silver bullet for policy, I am suggesting a shift of paradigm for it. This shift will have the benefit of failing less...

(2004: 24-5)

For policy purposes, then, the first practical advantage of a systems model is that it admits of intervention at multiple points to correct imbalances in the system or shift its course in a more socially desirable direction. This is important in an area like skilling where, as just noted, it is easy for government to become locked into purely supply-side remedies, often at the price of an escalating shift to the taxpayer of what were once seen as normal costs of running a business. But at the same time as it leaves more options available to policy, a systems approach exposes more vulnerabilities, because it allows for multiple points of potential failure: a large number of elements, some of them operating at several removes from the immediate context, need to be coordinated before the system can either function properly in its own terms, or function in a way that serves higher-order economic and social

needs. This is in fact the second practical advantage of a systems approach: by clarifying where these failure points lie, a systems model can serve as a safeguard against governments getting trapped in a narrow repertoire of responses which cannot be even theoretically effective in the face of many commonly encountered policy problems (Chapman 2004: 65-73).

On a more theoretical level, system models offer the potential to combine and coordinate the contributions made by different disciplines to the pool of relevant knowledge. The question of skill and its application is generally seen through one of three lenses: learning and pedagogy; the creation and management of knowledge, which is an important subset of innovation theory; and labour market theory, a subset of economics. Each of these theoretical frameworks satisfies the needs of a different constituency, but provides only a partial account of the factors at play. While the links between their objects of interest are recognised, it is uncommon for an analysis based on one paradigm to stray far into the territory of another, or to do so competently when the exercise is attempted; often the different paradigms are seen as rival. A comprehensive system model – one which “does not reject or deny the previous modes of thinking. Instead it *adds* another level of thinking... by a strategy of going up a level of abstraction” (Chapman 2004: 66, emphasis in original) - can enhance understanding by providing a common heuristic framework in which to combine the best insights from each paradigm and move beyond their respective limitations.

#### **1.4. Originality and contribution to scholarship**

Very few of the ideas set out in the theoretical section are original in the strict sense. The systems paradigm itself is a fully mature one in many disciplines, as will be further explained in Chapter 2, and the kind of model set out in this thesis is certainly not at the leading edge of system theory. Its application to skilling, in the specific guise of a National Skilling System, is original, though the term has a direct and acknowledged antecedent in the concept of the National Innovation System which is now commonplace among innovation researchers (Freeman 1995; Edquist 2004; Lundvall 2007). However, within the skill context there is already an active literature based on the more restricted concept of a skill ecosystem (Finegold 1999; Hall and Lansbury 2006; Buchanan 2006) and even a Commonwealth-State program to implement policies based on it (Payne 2007). Many of the ideas used as components of the proposed system model are commonplace either in modern European institutional economics or in a tradition of literature on skills that goes back to the Aix-en-Provence school of the 1970s (Rose 1985) and remains very active in the UK through the group of researchers associated with SKOPE, and in Australia through the work of the Workplace Research Centre at Sydney University.

The main contribution of the National Skilling System concept is that it provides a unifying framework which allows these different traditions of scholarship to be coordinated better than was previously possible, and in a way that should appear more sharply relevant to policymakers. In particular, by broadening the construct of interest from individual, possibly isolated ecosystems out to a unified system hypothesised as operating at the national level, it should serve to clarify how issues affecting the optimal generation and use of skill in the national economy grow out of and are constrained by core national institutions and policy settings.

Several of the specific concepts used in Chapter 2 to describe aspects of the system are nevertheless articulated here for the first time, so far as can be ascertained. The most important of these are the development/retention/allocation model of supply and the subdivision of demand into vacancy, projected, replacement, dormant and potential categories. Similarly the metric for skill developed in Chapter 3, though based on a widely used one first devised by Spenner in the 1980s, goes beyond the earlier work by adding a third dimension of skill-intensity to those of substantive complexity and autonomy/control used in Spenner's model. This thesis also appears to be the first study in which the construct of a skill(s) trajectory, much used in British writing over the last decade (e.g. Keep 1999, Wilson and Hogarth 2003), is fully operationalised and given an explicit definition.

The empirical part of the thesis is original in a different sense, in that it appears to be the first comprehensive attempt to map the skill trajectory of the Australian economy using a truly generic metric of skill derived from worker self-report. The UK has a large body of research using such an approach, involving a sequence of large-scale surveys which has been running for over twenty years. The findings of this British research, which represents the main model for the analysis set out in this thesis, are summarised in Chapter 5, and it will be referred to frequently in the course of both the theoretical and the empirical sections. The empirical work in this thesis is an acknowledged attempt to duplicate some of its findings for Australia, though the methodology has needed much adaptation, and the scope of the findings is considerably restricted, because the UK data are so much richer than any yet available for Australia.

Finally, it should be repeated that this thesis is the first really comprehensive analysis of trends at the national level using the skill-related variables in HILDA. HILDA, as will be explained in Chapter 4, is a multi-purpose data collection in which the skill content of jobs is a very subsidiary focus, and the section of the dataset of primary interest for this purpose consists of barely a dozen among more than 3,000 variables in the data file for each wave. Only a small number of studies, which are also summarised in Chapter 5, have so far used these variables at all, and only one of them has used them primarily with a view to investigating skill utilisation as a dependent variable in its own right.

The value of this source is that so far it has only been possible to study issues concerning the skilfulness of individual Australian jobs through qualitative research or proxies. The only population-level data on the extent to which workers use the skills gained from recent training have been a single question repeated over six runs of the ABS *How Workers Get Their Training, Training and Education Experience* and *Education and Training Experience* series (Cat. No. 6278.0) between 1989 and 2005 and a small set of relevant questions in the Australian Workplace Industrial Relations Survey (AWIRS), which was discontinued after its second run in 1995 (Callus, Morehead, Cully and Buchanan 1991). However, the availability of acceptable quantitative data does not reduce the need for more qualitative research, but rather enhances its value by providing a context for the findings and linking the processes identified in individual workplaces to broader trends and unresolved questions at the population level.

## 1.5. Outline of the thesis

The thematic division of the thesis into conceptual and empirical components is reproduced in the arrangement of the chapters. Chapters 2 and 3 cover the conceptual argument, while Chapters 4-6 describe the data source, antecedents and methodology for the empirical section, the findings of which are set out in Chapters 7-9.

Specifically, Chapter 2 examines the characteristics of systems models in general, the reasons for their adoption and how they relate to the more traditional types of economic account used in labour market analysis. The second part of the chapter contains a detailed account of the National Skilling System model and its implications. Chapter 3 follows on from this account with a detailed discussion of the concept of skill, intended partly to define a central aspect of the skilling system model, and partly to form the basis of a metric by which the model can be applied to empirical data. Both chapters involve extensive reviews of the theoretical literature, drawn from a variety of disciplines and traditions, and are long and theory-intense to a degree that would not be necessary if the purpose were simply to lay the groundwork for a methodology for a single research exercise. As stated at the beginning of the present chapter, the real function of these two chapters is to set out a comprehensive paradigm which can serve as a basis for future research extending well beyond the empirical content of this thesis.

Chapters 2 and 3 lay the basis for this empirical work by defining the key output of the national skilling system and developing a metric of skill by which the concept can be operationalised in research to map the skills trajectory of the Australian economy using quantitative data. Chapters 4, 5 and 6 cover the process of converting these elements into a research problem and a methodology. Chapter 4 describes the data source, evaluates the evidence it can provide and identifies the limitations of these data. Chapter 5 sets a context for the research with a selective review of the most relevant empirical literature, including the UK Skills Surveys and the small amount of research that has so far been done using the skill-related variables in HILDA. Chapter 6 defines a research problem and develops a model of skill change and a methodology to investigate it, including the development of composite scales from the relevant variables in HILDA to track two key dimensions of skill.

The model developed in Chapter 6 identifies three mechanisms of skill change: generic change applying across all or most jobs, change specific to individual industries and occupations, and change resulting from the movement of the employed workforce between higher- and lower-skilled industries and occupations. Chapters 7, 8 and 9 use statistical analysis of the HILDA data to test for each of these mechanisms in turn. Chapter 10 summarises the findings, draws some policy implications, and makes recommendations on further research priorities arising out of the findings and the kind of new data resources that will be required to carry out this follow-up work.

## 1.6. Conventions

Two minor stylistic conventions used in this thesis may be unfamiliar to some readers, and hence need to be explained in advance:

1. Where the argument makes it desirable to refer to a representative member of the population in the singular, the issue of gender-specificity has been handled by random assignment of gender: that is, the representative individual is referred to sometimes as “he” and sometimes as “she”, with a general but not obsessive effort made to preserve a balance between the two usages. This is done to maintain the natural flow of the discourse and avoid the awkwardness of conventional non-gender-specific language such as “his/her” or the use of “them” as a singular pronoun, while still providing sufficient surprise to discourage assumptions that the persons referred to are all or predominantly of the same gender;
2. When referring in the quantitative analyses to coefficients which are by their nature fractions of unity, such as correlations and significance levels, the number is written without a zero in front of the dot, e.g. .75. This is done to make such coefficients easily distinguishable from real numbers occurring in the same context, e.g. scores, changes in score or percentages, which are written with the zero (-0.3, 0.25%). Different social sciences vary in their conventions on this matter, but this is the one with which the author is most familiar.

## 1.7. Acknowledgements

This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported in this paper are, however, those of the author and should not be attributed to either FaHCSIA or the MIAESR.

The author acknowledges the cooperation of Skills Tasmania in inviting him to attend the series of consultative forums and focus groups which it carried out with Tasmanian industry and training providers in late 2007 and early 2008 and granting him the opportunity to use material from those meetings in this research. While none of the discussion or findings from these meetings was in fact used explicitly in either the conceptual or the empirical work in the thesis, the experience contributed to the reflection that went into its preparation, as has been acknowledged earlier in this chapter.

The author also acknowledges the informal advice and offers of assistance received from research staff of the NCVER at its 2008 No Frills conference, and the input of two anonymous reviewers of a paper based on this research which he presented at the 2008 annual conference of the Australian Vocational Education and Training Research Association (AVETRA). Helpful input was also received in the planning stages of the research proposal from Dr Ewart Keep of SKOPE, Professor Gerald Burke and his colleagues at the Monash University Centre for the Economics of Education and Training, Dr Sylvain Giguère of the OECD and Dr Tito Bianchi and Laura Tagle and their colleagues at the Italian Ministry of Finance. Much helpful advice on systems theory was given by Bob Williams, Glenda Eoyang, the late Iraj Imam and other members of the Systems in Evaluation topical interest group of the American Evaluation Association. Patrick Sturgis was kind enough to provide the author with a pre-publication copy of a paper setting out new research on panel conditioning. Particular thanks are owed to Jerry Hinbest of

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All statistical analyses in this thesis were carried out by the author using the menu interface of SPSS Version 16. The outputs of these analyses were formatted, sorted and converted into tables and graphics using Microsoft Excel and other programs in the Microsoft Office 2003 suite. No other proprietary software or external data processing assistance was used in the preparation of the thesis.

## Chapter 2

### The national skilling system

This chapter outlines the fundamental concept developed in this thesis, that of a national skilling system (NSS). It begins by describing the background to and generic characteristics of system models and explaining how they complement, or in some cases are preferable to, the kinds of economic model of causality which have traditionally been used in labour market analysis. On this basis, the second part of the chapter develops the specific concept of a national skilling system, describing its antecedents, the components that make up the system and the kinds of metric that could be used to map its contours and trajectory.

#### 2.1. System models

System models originated as a more adequate means than traditional reductionist accounts for describing and explaining the behaviour of complex entities characterised by high levels of interaction between their constituent parts. Originally they were developed to model biological organisms (Koehler 1938) and physical phenomena (von Bertalanffy 1950), but their application had broadened by the 1960s to cover management and business strategy (Emery 1969; Forrester 1971). Their use for organisational diagnosis and development became widespread with the popularisation of a simplified version of “systems thinking” as a management tool by Senge and his collaborators in the 1990s (Senge 1990; Senge, Roberts, Ross, Smith and Kleiner 1994) and they have become increasingly commonplace in fields such as program evaluation (Williams and Imam 2006), community development (Checkland 1981) and political philosophy (Ulrich 1996). System models are now at the core of mainstream innovation theory (Edquist 2005; Malerba 2005; Asheim and Gertler 2005). So far their explicit application to skilling has been limited to the operational concept of a skill ecosystem (Finegold 1999; Hall and Lansbury 2006; Buchanan 2006).

System models seek to explain the behaviour of each constituent in terms of the configuration and interaction of all the constituents (somewhat similar to the psychological construct of Gestalt), rather than of their individual characteristics, propensities or volition (Ackoff, 1971; Chapman, 2004). The governing principle is *holistic organisation* (Angyal 1941), i.e. the whole as more than the sum of the parts. Angyal distinguishes the systems approach from an aggregationist one where the whole is seen as an additive assemblage of interactions between pairs or small groups of individual persons or entities, each of which is capable of being adequately described in its own right, with the sum of these individual interactions making up the behaviour of the whole (Emery 1969: 26).

An important part of this distinction is that the whole behaves *adaptively*, i.e. if one constituent fails to behave as expected, the others will tend to adjust their behaviour in such a way that the system as a whole returns to something closely approaching its original configuration. Most versions of system theory refer to this process as self-correction or *self-organisation* (Ashby 1956, 1962). Systems accounts thus depart from the commonly used linear models of social or economic intervention where the intervention is seen as causing change in its environment through a simple, sequential logical chain with a circumscribed impact confined to its intended purpose, where the environment may offer

resistance but does not change the intervention mechanism. In a systems perspective, impacts that appear collateral or perverse to the policymaker are no different in logical status from the intended impact.

### **2.1.1 Characteristics of systems models**

“System” in this context has a specialised technical sense. The term “national skilling system” needs to be distinguished from more familiar usages such as “the training system” which do not generally imply dynamic interaction, but rather have much the same meaning as “infrastructure” or “arrangements”.

A system may be broadly defined as an entity made up of several interacting components, which in turn interacts holistically with its environment. The nature of the interactions is such that they produce outcomes which cannot be accounted for by the characteristics or behaviour of any component taken in isolation (the whole is greater than the sum of its parts), and as such are *emergent*. The defining characteristic of systems approaches is that they seek to explain and predict the emergent behaviour of the whole by focusing on the interactions and interrelationships rather than the components themselves (Ackoff 1971; Chapman 2004).

For practical policy purposes, a systems approach admits of intervention at multiple points to correct imbalances in the system of interest or shift its course in a more socially desirable direction. Although this leaves more options available to policy, it also makes the system more vulnerable, because it has multiple possible points of failure: a large number of elements, some of them operating at several removes from the immediate context, need to be coordinated before the system can either function properly in its own terms, or function in a way that serves higher-order economic and social needs. These will become clearer when the detailed elements contributing to each of the key processes are teased out below.

Different approaches to systems thinking emphasise widely varying subsets of the characteristics that theoretically define a system (Emery 1969; Midgley 2006). Those listed below are neither exhaustive nor universally encountered in systems-based analytical frameworks, but they appear to be of particular relevance to the situation described in 2.1 above:

1. *reciprocity* – causation occurs in both or multiple directions simultaneously;
2. *long casual chains* - outcomes are influenced by historical processes or background settings which may lie outside the control of present actors, not just by conscious strategies and decisions (Forrester 1971);
3. *probabilistic causality* – no one event causes another in a deterministic sense, but rather affects the dynamic of the system in such a way that in conjunction with the other causal influences in play, it increases the probability of a given outcome. The characteristic type of cause in a system is “necessary but not sufficient” or vice-versa (Ackoff, 1971 664);
4. *feedback loops* – the system has a capacity to self-correct in response to stimuli generated, directly or indirectly, by earlier causal events, so that changes set in

process at one point in time may be reversed, or alternatively amplified, at a later time without conscious human intervention (Forrester 1971);

5. *self-organisation* – a system generates, and in many cases develops spontaneously out of, a tendency for a complex of processes clustered around a single function to converge towards a single self-correcting and self-reproducing dynamic (Ashby 1962). In those systems models which derive from complexity theory (Eoyang 1996, 2006) this implies *scale-independence*, where patterns that characterise the behaviour of the system as a whole are reproduced in its individual subsystems, and/or vice-versa;
6. *multiple optima or equilibria* – a system, even though it has a function, does not function teleologically, but may reach a variety of stable configurations in which it functions smoothly for protracted periods because all its components are “in mesh”;
7. *exogenous value reference* - the question of which among the possible internally optimal configurations is socially or economically optimal needs to be resolved by external criteria, and hence is a political rather than an efficiency issue;
8. *path-dependence* – once it settles into a stable configuration, a system will mature and develop along a single path, until it eventually becomes very hard to reconfigure radically without catastrophic failure or disruption (David 1985, 2000; Pierson 2000). Virtuous and vicious circles are common instances of path-dependence.

Another important aspect of systems models is that they always raise questions of boundary definition (Ulrich 1996). Every system can be described as a subsystem of some larger system exhibiting a single dynamic and trajectory, just as it can be divided into its own subsystems following their individual dynamics. Where one sets the boundary – i.e. what things are seen as system, and what as environment - makes a difference to how the system is understood to work. An example would be whether one treats a firm as a system in its own right, or as a component of its supply chain, of a geographic cluster, or of its industry or sector. There are many physical entities classifiable as systems for which a boundary is objectively identifiable, e.g. the skin and fur of an animal or the bodyshell and tyres of a car; some abstract entities, notably organisations, also have intuitively definable boundaries, e.g. a firm viewed as a system does not generally include non-employees or what its employees do outside working hours. But in the category of highly abstract systems to which the national skilling system belongs, there are no “natural” boundaries and the question of where the individual system begins and ends is intrinsically controversial and always subjective (Serman 2002).

Moreover, to be of any use as a *simplifying* model, a systems model needs to leave out a very high proportion of the observable events that take place *within* its boundaries. As Ackoff wrote in one of the seminal articles:

The state of a system at a moment of time is the set of relevant properties which the system has at that time. Any system has an unlimited number of properties. Only some of these are relevant to any particular research. Hence those which are relevant may change with changes in the purpose of the research.

(1971: 662)

This adds to the element of necessary subjectivity in any systems model and reinforces the caution that a system model is just that – a model, i.e. a fungible heuristic for making sense of what is happening, and not a description of anything that objectively exists (Meirer, Paier, Restarits, Schuster and Zink 2004). Many of the events and processes that take place within the national skilling system can equally be accounted for using an equilibrium model or either of the linear models; provided they all fit the evidence reasonably well, neither they nor any of the systems models that could be chosen is “right” or “wrong”. The difference is simply that for some purposes at least, a system model provides the richest and most useful explanation.

A related and very important caution is that a national system can only be described at the level of aggregates and net outcomes, but each of these is the result of a great many individual processes at the local level which may well be operating in different or opposite directions. Another common characteristic of systems models is that the behaviour of the whole can be strongly influenced by small perturbations at critical points which may be neither intuitively obvious nor representative of the causal processes applying across the system generally.

### **2.1.2. Two kinds of system failure**

Given the above characteristics, a system can be said to fail in two quite different senses:

- the interactions between the components cease to function coherently, so that it ceases to behave efficiently as a single system. This can be likened to a train of gears that falls out of mesh, or to a piece of DNA in which the strands unravel and disintegrate into their component atoms;
- the different components interact coherently, but produce an outcome which is contrary to the intent of best interests of the constituency for whose benefit it is meant to operate. This kind of dysfunction is equivalent, still using the DNA analogy, to cancer or teratogenesis.

Since the term “system failure” (Chapman 2004) tends to be used indiscriminately to convey either meaning, it will be avoided here wherever possible. Where it is necessary to refer to failure, the two meanings will be distinguished by referring to them as Type 1 and Type 2 failures respectively. More precisely, the two kinds of dysfunction could be described respectively as failures in system *functioning* and system *functionality*; the latter are not evident or explicable from within the system, in its own terms, but often relate to the consonance of the particular system in question with some broader system of which it constitutes a subsystem. For example, a skilling system can function efficiently and sustainably for long periods by creating low average levels of skill and matching incentives to firms to invest in low-value-added activities which require only small inputs of skill (the case of the low-skill equilibrium, described below). However, the skilling system generally needs to be viewed for policy purposes as part of larger systems such as the economy, governance and/or society which may have functions that are not effectively served by such a dynamic – for example, if the function of the economy includes maximising productivity and maintaining a competitive role for domestic businesses in a global marketplace, or if that of society is seen to include maintaining welfare and social cohesion through a relatively equal income distribution.

The practical significance of this distinction is that the two kinds of dysfunction require different remedies. In the first case, attention is needed to the dissonances, discontinuities or mismatches which prevent the system from functioning smoothly, i.e. from self-organising. In the second, it is necessary to divert an efficiently but perversely self-organising system from the path it has taken, and this will often evolve radically disrupting the system, or even dismantling and rebuilding it.

An example of Type I failure in the area of skilling would be the commonly cited case of engineering graduates in the 60s and 70s, where adjustment lags, in conjunction with cyclical factors affecting activity in industries which employed engineers, meant that at some points there was a drastic oversupply of engineers, with the surplus struggling to find work in other graduate-level professions, but their distress sent a signal to the market which led to a corresponding over-adjustment and an equally drastic undersupply some years later. Here, normal market mechanisms were failing to produce an efficiently self-correcting system which reliably matched supply to demand without policy intervention. An example of Type 2 failure is the low-skill equilibrium that was identified by Finegold and Soskice (1988) in the UK, where the workforce was seen to be underskilled by comparison with its European counterparts, not primarily because of a shortfall in training capacity, but on the contrary because the supply side was responding efficiently to a sustained shortfall in demand for high skill, attributable to other institutional settings in the UK economy which made it more profitable and less risky for firms, in all but a handful of lead industries, to continue competing in low value-added market segments where a high-skilled workforce conferred no competitive advantage.

### **2.1.3. Relationship between systems and economic approaches**

A systems model can incorporate many of the same features and arguments as the analyses traditionally used by labour economists. For many purposes, indeed, the two approaches overlap and provide very similar insights. Thus, for example, Richardson (2007), writing within a wholly orthodox neoclassical paradigm, provides an analysis of the various causal mechanisms behind a skill shortage which captures the complexity and dynamism of the real market for skill as employers, workers and jobseekers experience it in very much the same terms that a systems-based analysis would use. One reason for the overlap is that economic reasoning can itself be seen as a form of systems logic, and its central concept of equilibrium as a simple form of self-organisation. Hence normal economic logic provides a corrective to the one-way models of causation referred to in Chapter 1 just as effectively as a systems approach, because the equilibrium mechanism allows adjustment to occur in either direction.

However, there are circumstances where the systems approach needs to be viewed as an alternative to normal economic reasoning. Two factors in particular can result in cases where the two paradigms need to be treated as rival:

- the economic paradigm does not easily incorporate other types of causal mechanism, e.g. political processes or social norms, which shape the supply and use of skill, tending to subordinate or assimilate them to its own set of causal assumptions. To accommodate these diverse mechanisms, it is sometimes necessary to pull back the focus and look at a broader system than simple economic causation;

- not all economic paradigms are equal. The kind of sophisticated institutional economics quoted later in this chapter is thoroughly compatible with the NSS approach and indeed essential to its development. Newer strands of economic thought such as the neo-Schumpeterian and evolutionary schools (Nelson and Winter 1982; Winter 2006) also start from a systems perspective close to the one which is argued in this section. However, much writing by economists on skilling issues, and more specifically most of the econometric analyses that have appeared in Australia on the topic, still resort to older and more simplistic models such as human capital, or else rely on schematic market-clearing assumptions – presupposing, for example, that the price paid for labour accurately reflects its net contribution to productivity – which do not reflect the realities of today's labour market. A systems approach may thus appear to at variance with economic reasoning because it needs to reject such oversimplified assumptions, even though more sophisticated economists operating outside the systems paradigm would be equally critical of them.

Thus, when the systems approach is compared here against traditional economic arguments, the comparison will often relate to assumptions in the economic reasoning which are not core postulates of economic theory in general, but simply established conventions or accepted wisdom among some mainstream labour economists. A few examples should illustrate where these disagreements lie.

The Human Capital model in particular, with its core assumption that knowledgeable individuals invest strategically in education and training in the rational expectation of a payoff in future income (Becker 1965; Blaug 1976; Stevens 1999; Nerdrum 1999), has demonstrated increasing limitations over the last few decades. One key factor for which it cannot adequately provide is the growing recognition that only a part of the learning required for competitiveness, and indeed for the effective application of formal skills, results from activities that can be separately identified as training. Along with the growing evidence of complementarity between formal training and on-the-job learning (Fuller, Ashton, Felstead, Unwin, Walters and Quinn 2003; Long, Ryan, Burke and Hopkins 2000) has come a new awareness, stemming in large part from the innovation literature, of the importance of work itself as a source of new knowledge and learning on which firms and national industries depend for their competitive edge. This jointness in production, along with a growing awareness that many of the most valuable skills are situated and collective, has complicated any efforts to account for work-related learning in terms of the conscious investment behaviour of individuals. In fairness, classical human capital theory does provide that workers will maximise their long-term utility by showing a preference for employers who offer transferable skills training, even if they do not pay better wages; this argument could easily be extended to include a preference for workplaces where more transferable learning takes place by means other than training. However, such an account would still need to cope with the interactive and emergent nature of much work-based learning, which is not easily conceptualised in simple terms of conscious, forward-looking individual utility maximisation.

A more fundamental problem with economic models in general is that they typically concentrate on the *external* market transaction, i.e. the creation and takeup of pools of variously skilled labour, but ignore the *internal* dynamics of how each type of skill is converted into productivity in the individual workplace. Authors such as Ewart Keep and

Ken Mayhew have been arguing since the 1990s that for most firms, skills are essentially a third-order issue in overall enterprise strategy: the first-order decisions on what markets a firm will compete in, what it will produce, and how, are what primarily determine its productivity, and these decisions in most cases depend primarily on factors like the nature of the product markets and level of competition, the innovative and entrepreneurial capacity of the firm's principals and managers, technological opportunity, the regulatory environment, the availability of different forms of capital and the conditions on which each is available, and a range of characteristics developed over time, e.g. the firm's knowledge base and complementary assets, that constitute its peculiar competitive strengths. Decisions on the inputs (including labour) required to pursue this product strategy flow logically from these first-order strategic decisions, and in turn determine the characteristics required in each input, including the price the firm is prepared to pay for labour and the skills it needs in its labour force (Keep and Mayhew 1988, 1999; Keep 1999; Crouch, Finegold and Sako 2004).

Of course the process is not as unidirectional as this. Factor costs and characteristics will often feed back into the primary strategic decisions as a source of opportunities and constraints; sometimes they may even be the decisive considerations. In a period marked by critical shortages of skills relevant to its operations, these shortages may represent an insuperable constraint on a firm's ability to pursuing a product strategy that would otherwise maximise its competitive potential. Conversely, where a firm has a body of well-attached employees with rare skills and knowledge, this resource may be the main thing that determines the markets in which it will be most competitive. Even where their influence is less salient, considerations of workforce skill are likely to be factored into top-level strategic decisions as one of a wide range of contributory variables.

The important thing is that skills are only one consideration which firms take into account when deciding their strategies, and not necessarily the deciding one. If skill comes into corporate strategies only as a subsidiary concern, it follows that such strategies may not be designed primarily either to maximise the return on workforce skills or to optimise the firm's stock of relevant skills. A firm may satisfice on its skilling decisions if other drivers are seen as more critical to the success of the underlying business strategy. Hence it can no longer be assumed automatically that every firm at any point in time will use its skill base to its maximum theoretical advantage. That realisation leaves the way open, even in the absence of market failures on the supply side, for such things as credentialism, underinvestment in training, underutilisation of individual employees' skills, and working arrangements that fail to make the most effective use of the available skills.

This possibility casts into doubt, among many others, one of the central methodological assumptions of human capital theory, namely that the wage premium paid for skilled labour is a direct reflection of the marginal contribution of its skills to productivity. It renders even more precarious the central assumption of the supply-push model that an increased supply of skilled labour will necessarily lead to increased productive use. While at first sight lending support to the demand-pull model, it calls into question the core premise of that model, that industry's expressed demand for skills corresponds to its actual or optimal use of skill.

A much more important implication flows from these examples: the simple pairing of supply and demand is no longer adequate to capture the dynamics of the process by which skill is created, appropriated and converted into productivity. Other considerations apart,

the supply-demand discourse generally centres on formal skills, and formal skills are often of limited usefulness as they come straight out of the training institutions, needing first to be operationalised through on-the-job experience. Similarly, experience is often not directly transferable from one workplace to another. Hence, the economic value of a skill depends in part on whether, when and how it is utilised in individual workplaces: differences in productivity and profitability can emerge between firms with matching skill bases because of the way each uses those skills. A third element is therefore needed to complete the cycle: *utilisation* or *deployment*, which refers to the processes by which skill is applied in the work environment. The interplay of these three processes is the central mechanism in the systems model that will be outlined in the second part of this chapter.

The cases just discussed are ones where it is perfectly admissible, within the overall paradigm of economic theory, for a mainstream economist to contradict and correct assumptions commonly used in economic reasoning, but systems models simply approach the job more comfortably. However, there is one area at least where the systems approach and the traditional economic approach appear to part company inevitably. This concerns the central economic premise of equilibrium (Metcalf 2001).

The practical problem here is adjustment lag. Except in the case of very simple skills which can be picked up in a matter of days, the market cannot respond instantaneously to changing demand signals because of the time it takes to train people up to meet the new demand (and just as importantly, to shut off the increase in supply once it has been met). This is especially the case for long-cycle training such as is needed for qualification at the graduate or trades level, where most of the recent emphasis on specific skills shortages has been concentrated. It takes an extended period for the labour market to recognise the signs of changing demand and train new apprentices or graduates, and sometimes much longer to create the additional capacity needed in the training system to support a major increase in output; equally, once young people have begun to study for a long-cycle qualification, they face strong disincentives to dropping out or changing courses even if the labour market demand that initially attracted them no longer exists. This disrupts the ideal feedback cycle in that supply-side behaviour is driven by market incentives reflecting the state of market demand at least 2-3 years before the supply of new tradespeople and graduates begins to emerge, by which time the current demand might be quite different. Because there is no possibility of timely feedback to indicate when the point has been reached where supply and demand come into balance, there is a natural tendency towards cycles of over-adjustment in either direction.

This means that in all but the most static economies, equilibrium is unlikely to be reached even in an ideally functioning market, except perhaps fortuitously and temporarily. The normal expectation is that supply and demand for each kind of skilled labour will be in constant dynamic imbalance. The key question which then arises is whether it is productive to approach the problem conceptually on the basis that the system will inevitably trend towards equilibrium, albeit with repeated setbacks which may prevent it ever getting there in practice, or whether a better analysis can be reached if one accepts that the whole process is driven by inherent disequilibrium. Some of the more radical schools of modern economic thought such as evolutionary and neo-Schumpeterian economics do in fact start from this premise (Winter 2006; Pianta 2005), but mainstream economics would lose much of its theoretical basis if it took the same path. This is a key distinction between the two paradigms, and a clear case where systems approaches cease to function as enhancements of the standard economic model of causation and emerge as a preferable alternative.

### 2.1.4. Components of a system

The two attributes of a system which are specified by nearly all models are a boundary and a function or purpose. These are the two things that primarily define a given system. Other components of a system, and the generic terms used to denote them, vary widely from model to model, depending on the theoretical standpoint of those who describe it and the purpose it is seen as serving. Thus, looking purely at innovation system models, Edquist (2005: 188) speaks of the components of a national system as organisations and institutions, linked by functions and activities; Lundvall (2007) writes in terms of firms interacting with one another and the knowledge infrastructure; Asheim and Gertler (2005: 300) describe them at the regional level as the economic (or production) structure and the institutional set-up; Malerba (2005: 385) lists the three “main dimensions” of a sectoral innovation system as knowledge and technical domain, actors and networks, and institutions; while Bergek, Jacobsson, Carlsson, Lindmarki and Rickne (2005: 3) use “structural components” (actors, networks and institutions) and “functions” (knowledge development, resource utilisation, market formation, search, legitimation, entrepreneurial experimentation and positive externalities). On a much more generic level, Ackoff (1971) builds a model around the concepts of state, environment, events, reactions, responses, acts, behaviour, goals, processes and objectives, and on these bases constructs a definition of organisations, the nearest things in his model to a concrete entity.

It will be seen that many of these different definitions are matters of degree of generality. Looking, for example, at economic actors, we can think of individual workers nested within work teams and functional components of organisations, which in turn form part of organisations or firms, which collectively make up networks, supply chains, regional clusters, industries, sectors, the economy, etc. While it is often possible to identify *meaningful* categories at many levels on this scale, only some of them will be *relevant* to the working of a given system. This goes back to Ackoff's point, quoted above, that a system has an infinite number of properties, but only some of them will be relevant to the description or functioning of any given system. The more limited and specific in its purpose a given system is, the more likely the relevant model is to be built around tangible entities and specific processes and functions.

Generally speaking, the elements, components or dimensions can be subdivided into entities and relationships. Entities can be seen as the nodes in a network of relationships. At least where economic systems are concerned, they can be further divided into the broad categories of persons, organisations, resources or objects, and institutions. The last mentioned are especially important in most economic system models.

“Institutions” is used here in the economist's sense of “formal regulations, legislation and systems as well as informal social norms that regulate the behaviour of economic actors” (Gertler 2004: 7). Amable (2000: 648) quotes North (1990) to the effect that “[h]istory-dependent institutions influence individual behaviour by defining the incentive framework in which agents take decisions.” He then goes on to argue that “institutions matter because they partly and imperfectly solve problems of coordination among agents, help promote and overcome opportunistic behaviour, make agents internalise externalities, whether inter-temporal or inter-personal, reduce uncertainty, etc.” Put briefly, institutions work by creating common *expectations* across national cultures about how others will react to the individual's actions. In the words of Hollingsworth, who equates pure institutions to social habits, these latter “are the results of earlier choices and are a means of avoiding endless deliberation... institutions provide cognitive frameworks for individuals, make their

environments predictable, provide the information for coping with complex problems and environments.” (2000: 602-3)

The word in this technical sense is abstract and does not apply to organisational entities such as firms or universities. Most institutional economists emphasise this distinction as fundamental to their models (Amable 2000: 653). However, real entities often *embody* institutions to the point where they are difficult to disentangle in practice. The courts, for example, collectively represent an important legal institution because they embody rules, processes and expectations that determine how the rule of law will be implemented in a given polity, but this institutional role exists independently of the location or remit of any given court, of the judges or magistrates who run it, or of the decisions it makes. Large non-market public enterprises, such as railways and telecommunications carriers, are not individually institutions in their own right, but their *existence* is (or was) an economic institution with particular importance for skill formation in certain areas. A trade union, taken individually, is an organisation and not an institution; however, trade unions collectively represent an economic institution because they affect the way things are done, especially at the workplace level, and clear behavioural differences are evident between nations or sectors which have active trade unions and those which do not.

One significant characteristic of institutions in the economist's sense is that they are subject to increasing returns to adoption – in effect, a kind of network externality – and hence to path-dependence and lock-in which limit their flexibility to change in response to changing circumstances. This means that they are historically rooted, relatively stable features of a nation's economic culture that survive through business cycles, changes of government, changes in political and market fashion, and structural change, and regularly outlive the original organisations or pieces of legislation that embody them. Another important feature of institutions is their polyvalence (e.g. Hall and Thelen 2006). The same institutions that govern economic behaviour can also function as institutions of governance or social interaction. Indeed, they are one of the main channels by which a nation's society, polity and economy are coordinated, and hence explain the influence of each of these systems on the others.

Relationships are the means, processes and patterns through which entities interact, and thus make up the dynamic of the system. They include observable processes, activities, actions and events as well as more abstract dependencies and influences. As with entities, the choice of relationships to include in a model is subjective and depends on the purpose of the analysis and the perspective of the builders and users of the model. As noted earlier, systems approaches are characterised by a focus on relationships as opposed to the behaviour of entities in isolation. This implies that their choice is generally more critical than that of the nodal entities to the working and appropriateness of the model. Given this, the choice of significant entities is often more or less arbitrary, at least in the initial stages of constructing a model.

Like many of the other distinctions made in this chapter, this one is neither necessary (an objective attribute of things or events) nor always self-evident. Certain elements of a system often seem to lie right on the boundary between entities and relationships. Institutions are an obvious case in point: their role in a system derives not from their physical existence or that of the instruments or organisations that embody them, but from the way they condition or constrain interactions between other entities. A less obvious case is networks. A network is a way of describing a pattern of interactions between several

entities, but once established, networks can often be treated as physical or virtual entities in the same way as the firms that make them up. Even organisations, in a pure systems paradigm (e.g. Ackoff 1971: 669), are systems in their own right defined by their interactions, but most models treat them as entities with an existence distinct from their behaviour. This can be seen as a special kind of boundary problem: individual systems describable as a pattern of interactions often behave as if they were entities once they assume the role of subsystems making up a broader system.

This abstract and generic account has been necessary for an understanding of the intellectual bedrock on which the specific model set out in this thesis is constructed. Like many such accounts, it may appear confusing, vague and counter-intuitive in places precisely because of its abstraction and lack of specificity. Many aspects of the systems paradigm that do not make immediate sense when set out at this level of generality should become much more self-evident when they are grounded in a specific system model and linked to familiar types of evidence.

## 2.2. A model of the national skilling system

This section of the chapter starts from the generic features of systems outlined in 2.1 and applies them to skilling. The model developed here, though still very abstract and conceptual rather than predictive, should provide a more tangible illustration of how the approach can contribute to the understanding of practical as well as academic problems. The concept is developed in the first instance at the national level, as this is where the contribution of institutional factors to the overall dynamic of the system can best be demonstrated.

### 2.2.1. Precedents and antecedents

The concept of a national skilling system is novel in the sense that nobody appears previously to have developed an explicit systems model with its function and boundary defined by skill. Its content and configuration derive from a growing body of theoretical literature since the 1970s on national systems of innovation, production or both and their institutional determinants. Amable (2000: 661-665) lists seven main schools of institutionalist thought that have developed such system models. In addition, an influential tradition of skills-related literature in the UK and Australia has addressed aspects of system failure, in some cases using that explicit term, though without specifically describing a formal system. The model developed here derives principally from five themes in the skills and innovation literatures:

- the *skill ecosystem* model originally devised by Finegold (1999) and further developed by Buchanan and his collaborators (e.g. Hall and Lansbury 2006). This in turn derives from Finegold and Soskice's earlier (1988) model of a low-skill, and subsequently a high-skill *equilibrium*, and is related to the concept of a *skill trajectory* used by Wilson and Hogarth (2003: ix);
- the concept of a *national innovation system* which originated in the 1980s with authors such as Freeman (1982) and Lundvall (1985) and is now commonplace in the innovation literature to characterise the combination of institutional factors which determine the potential of a nation (or on a lesser scale, a region or an industry sector) to undertake different kinds of innovation successfully;

- the matched-firm international case studies carried out by Prais and colleagues for the UK National Institute for Economic and Social Research in the 1980s and 90s, which examined the relationship between national approaches to skill formation and workplace dynamics, and their impact on the sources of each nation's competitiveness (Daly, Hitchens and Wagner 1985; Jarvis and Prais 1989; Prais, Jarvis and Wagner 1989; Steedman and Wagner 1989; Mason, van Ark and Wagner 1994);
- the work in evolutionary economics done initially by Lazonick and O'Sullivan (1994) and subsequently continued by authors including Lazonick (2005) and Lam (2005) on the relationship between the institutions of skill formation, organisational forms and national competitive advantage, especially in different styles of innovation;
- the "Varieties of capitalism" literature (Hall and Soskice 2001) which builds the elements of the last mentioned tradition into more structured comprehensive models of different ways of running a market economy.

Innovation system models, which generally include learning and skill formation among their key processes, form the most direct model for the concept as set out here. This reflects the degree to which they have been articulated in systems terms, and the presence of many common elements. There is considerable overlap between the two types of system, though neither subsumes the other (see 2.2.2.1 below). However, much of the conceptual legacy, and the majority of its evidentiary underpinning, derives from the more conventional literature on skills and work organisation in the evolutionary and institutionalist traditions.

The skilling system is essentially a larger-scale version of skill ecosystems, defined by Buchanan (2006: 14) as "clusters of high, intermediate and low-level competences in a particular region or industry, which are shaped by interlocking networks of firms, markets and institutions". One difference, as is clear from this quotation, is that ecosystems are seen as *specific* to subsets of the economy: Finegold, who invented the concept, gave as one of his main reasons for preferring it over the high/low-skill equilibrium model the evidence that multiple skill ecosystems, with different characteristics and different optimum skill profiles, could coexist more or less independently within the one economy (1999: 63).

Consequently, they are seen as relatively fluid and transient, though different authors approach their fluidity in different terms. Finegold is at pains to emphasise the role of chance in the emergence of high-skill ecosystems (1999: 66), but also argues that their sustainability is precarious, and indeed that they often contain the seeds of their own ultimate destruction (1999: 74). Buchanan, taking a different perspective, argues that dysfunctional (low-skill) ecosystems are the product not only of system failure but of coordination failure (2006: 12), and hence that they can be manipulated or even new ones created through collective action directed primarily at the latter.

By contrast, the national skilling system (NSS) is seen as more durable and pervasive, the foundation on which diverse ecosystems can rise or decay at different moments or in different parts of the economy, and a source of constraints as well as incentives shaping the directions in which individual ecosystems can develop. While the outputs of an NSS and

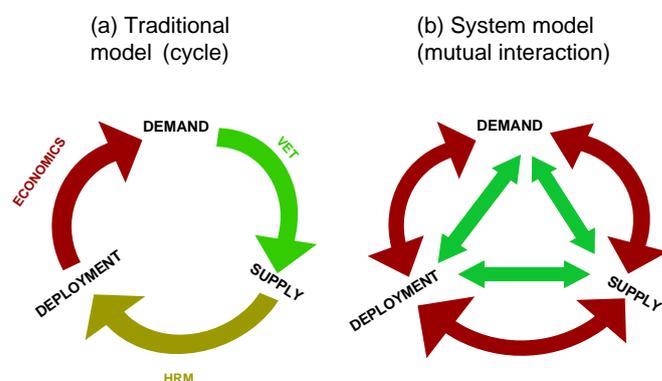
the activities of its constituents are constantly changing, the system as a whole can be expected to behave in relatively constant and predictable ways, changing mostly in response to changes in the underlying institutions, or through the intermediary of such changes in response to exogenous shocks (cf. Hall and Thelen, 2006: 14). In this it has more in common with a national innovation system, but also with the original concept of an equilibrium, with its connotations of path-dependence at the level of the economy as a whole. It is thus more enduring and ubiquitous than the individual ecosystems that develop within it, but less so than the underlying institutions.

### 2.2.2. Definition of an NSS

The “skilling system” concept developed in this thesis is an eclectic one which builds on aspects of the literature mentioned in 2.2.1 above but does not rest on the authority of any one of the precedent approaches. Consequently it is put forward, in part, without supporting references because no such prior construct exists. It is presented as the first cut at an evolving concept which is coherent and lends itself to empirical testing but will almost certainly be improved and refined over time with further empirical testing. Once again, though, it should be pointed out that models such as this are meant as heuristics rather than as accurate or authoritative representations of an objectively existing reality.

As foreshadowed earlier, the core of the model is a dynamic interaction between the three key mechanisms of *supply*, *demand* and *utilisation* or *deployment*. (The latter term will be preferred for the sake of consistency, and coincides with the usage of other authors who have contributed to the development of the concept, notably Keep and Buchanan.) These three elements are further defined in 2.2.4 below.

Other, non-system models also incorporate the same mechanisms. However, a linear model would treat them as stages in a unidirectional cycle: demand leads to supply, leads to deployment, leads to the creation of new demand, etc. The system model differs in that it sees the three as interacting constantly with one another in a non-sequential, non-hierarchical way (Fig. 2.1). An alternative way of representing this would be a triple helix, where the three strands interact continuously at all points along their length, and would unravel and dissolve into their component elements once they ceased to do so.



**Figure 2.1**  
Cyclical and system models of interaction between supply, demand and deployment

The output of this interaction, at any point in time, is the quantum and mix of skills *actually converted into productivity*<sup>1</sup> across the economy, or in any given part of it. Consequently, the *function* of the system is to optimise this output to the other characteristics of the broader national economic system. Note that this is a different matter from either creating or deploying the highest achievable volume or level of skills; the mix of high, intermediate and low skills across the full range of technical domains must be appropriate to current firm capabilities and market opportunities if the maximum achievable productivity is to be attained, and hence must evolve continuously.

This immediately raises a boundary issue. Since the function of the NSS does not extend to maximising things like individual welfare, social happiness or economic prosperity, its contribution to such outcomes can be assessed only by viewing it in the context of a larger system (e.g. the economy, society) of which it forms a subsystem. Its boundary must therefore be set more narrowly than those. Conversely, the NSS extends beyond the traditionally recognised domains of the education and formal training systems, or of the factors which influence individuals' conscious decisions to participate in them. The dynamics of demand mean that broader factors influencing the pattern of economic activity (e.g. the financial system) and the sources of national competitiveness (e.g. resource endowments) form an important part of the relevant interactions. Deployment embraces aspects of work organisation and managerial practices, and hence is affected by such things as industrial relations law, managerial culture and indeed social capital (Arundel, Lorenz, Lundvall and Valeyre 2006: 27). Whether key institutions such as the industrial relations framework, the law of employment contract and the financial system should be regarded as part of the NSS or part of its environment is still moot, and may need to be resolved over time by trial and error, as is often the case for emerging system models (Bergek et al 2005: 6). Even if they lie outside the system, their interaction with its elements is constant and important to its working. Similarly, the outcomes of the broader socio-economic systems feed back into the NSS through their effect on the motivation of actors. Hence, wherever the boundaries are set in terms of the range of entities and relationships regarded as making up the system, it is probably prudent to regard them as tentative and highly permeable.

Boundary issues also affect more tangible aspects of geographic and sectoral coverage. While systems of production have so far been described only at the national level, innovation systems are recognised to exist not only at the national but at the regional and sectoral levels (Edquist 2005: 183, 198ff; Asheim and Gertler 2005; Malerba 2005). The NSS concept has been developed, at least initially, on a national scale because many of the key institutions involved, notably the education/training system, industry policy, industrial relations law and the laws and conventions governing the provision of capital, are broadly consistent across the nation, albeit in Australia's case with detail variations between States. Given that some of these, notably education and finance, show significant variation across economic sectors, it probably makes sense to talk of sectoral skilling systems as subsets of the national one. It is unclear at this stage whether a regional skilling system can be

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<sup>1</sup> "Productivity" in this context should not be understood purely in the lay definition of getting the highest *volume* of output for a given input of labour. Productivity can equally be increased by commanding a higher price for the same or a lesser volume of output, and hence also embraces elements of quality, design, innovativeness, customisation, market fit, etc. In the present context, it would seem reasonable to extend the normal definition of productivity to include productivity overflows or externalities, e.g. through the creation of new knowledge offering potential returns to the industry or economy as a whole which are not fully captured by the initiating enterprise, and which often emerge over a much longer timescale than enterprise-level productivity.

usefully defined in its own terms, as distinct from divergent regional impacts of a national system; the possibility of developing such a model probably depends as always on which of the many possible definitions of “region” one adopts.

### 2.2.2.1. The NSS and the national innovation system

An NSS overlaps in part with its associated national innovation system, in accordance with Edquist's view that this latter model “places... learning processes at the centre of focus” (2005: 184) and that “competence building [is] an important activity in SIs” (2005: 191) and Lundvall's earlier view that “the most important process [in innovation] was learning” (2007: 99). However, despite the high prominence given to learning, skill and training institutions in most innovation systems models, the NSS concept diverges in two important respects:

- while the NIS focuses on those institutional interactions which specifically affect firms' propensity to innovate, the NSS covers all parts of the economy, including those sectors in which little innovation takes place. Indeed, the latter were the inspiration behind Finegold and Soskice's original concept of the low-skill equilibrium. Analyses of the NSS consequently have the potential to cast light on the *net* or *marginal* incentive for firms to innovate, something which cannot be derived from NIS analyses in isolation;
- the conceptual definition of skilling in most NIS literature to date has been relatively unsophisticated, treating it purely as a supply-side phenomenon. Edquist, for example, refers to “competence building” as taking place “in schools and universities... as well as in firms” and to its output by the old neoclassical term “human capital”. He even reproduces the neoclassical argument by going on immediately to assert that “Since human capital is controlled by individuals, it is a matter of individual learning”. By contrast, he defines the output of organisational learning, which he equates with innovation, as “structural capital”, defined as “a knowledge-related asset controlled by firms” (2005: 192). A systems perspective on skilling which acknowledges the interdependence and complementarity between formal training and experiential learning and between individual, collective and organisational learning, and which acknowledges a constant tension between competence building and competence loss, is not only wholly compatible with the NIS concept but has the potential to refine its implementation.

### 2.2.3. Components of an NSS

#### 2.2.3.1. Relationships

The core relationships in an NSS are the three coordinating mechanisms already referred to:

- **Supply:** the processes contributing to the development, maintenance and improvement of skills across the economy. Includes the activity of the formal education and training system, training provided in workplaces, private training provision accessed by organisations or individuals, adult and community education, self-initiated informal learning, and the collective and individual informal learning which takes place as part of the work process. It also includes the mechanisms by

which skills, once formed, are made available to firms and organisations that need them;

- **Demand:** the processes affecting the amount and mix of skills which is collectively required by employing organisations, and also for self-employment, across the economy, considered independently of how or indeed whether those skills are used in the work process;
- **Deployment:** the ways in which the available skills, and their holders, are utilised in the work process. This includes the kinds of product they produce, the methods of production, the organisation of the work process and the nature of the employment relationship.

Most of the more specific processes and activities that make up the system are encompassed in one or more of these coordinating mechanisms, and as such will be introduced separately in the next section.

### 2.2.3.2. Actors

The relevant *entities* can usefully be subdivided into actors (individual and collective) and institutions. The significant actors fall into five classes:

**Individuals** in, or intending to join, the workforce are the first-line experiential and agents of learning, and are responsible for many decisions affecting what skills will be developed and practised. They are also the front-line actors in converting skill into productivity. As will be argued in the next chapter, skill is an attribute of persons even when it is exercised and developed collectively; in this respect it differs from knowledge, some of which can be codified, stored and accessed independently of any particular knowing agent.

**Firms** are the primary agents of deployment and the primary channel through which demand is expressed. They provide the means by which the skills held by individual employees are coordinated to produce outputs which can only be achieved by collective effort, and they also coordinate and provide the means for productive interactions between human skills and technology. In this model at least, it is assumed that most of the critical strategic decisions affecting these practices are made at the firm level. Firms are agents and enablers of learning, both directly through the formal training and informal learning opportunities they provide for their employees, and indirectly through the impact of their demand signals on the supply side; they are also capable of their own organisational learning, and indeed represent the most important repositories for innovative knowledge developed in the productive process. Finally, some of the most important impacts of the institutions are felt at the firm level because of the firm's primary role as the strategic decisionmaker. Note that in the terminology of this model, public and non-profit organisations are included in the category of firms wherever the analysis relates purely to their activity as employers of labour to produce outputs.

**Associations** include industry associations, professional bodies, trade unions and various kinds of network that link firms with one another or with educational or governmental agencies on an ongoing basis. Their importance lies in providing a

means of resolving problems of collective action (e.g. setting standards) which the individuals, firms or agencies which belong to them could not resolve by themselves through market or regulatory mechanisms. One key aspect of this collective action is to marshal market or bargaining power to affect outcomes which the constituent firms or individuals would have little chance of influencing on their own. They also provide important opportunities for learning and for the transfer and transformation of knowledge learned in the productive process.

**Educational, training and research agencies** (which would normally be referred to as institutions, but cannot be here because the word is used in a different meaning) play perhaps the most important role on the supply side. They make it possible to bring about learning outcomes which individuals and firms would have great difficulty achieving on their own individual account, and coordinate the supply and characteristics of the more generic elements of skill (e.g. though mass pre-employment education). They are also key generators of knowledge which represents new productive potential and hence influences the demand and deployment sides through product, process or organisational innovation.

**Public agencies**, including legislatures, play the primary role of supplying public goods, e.g. regulation, coordination and legal protection, as well as goods (mass education, basic research, libraries and public databases) which are semi-private in economic terms<sup>2</sup> but which the market would under-provide at a given point in time. Often they also provide purely private benefits, mostly in the form of subsidies, income support and tax incentives, to influence the decisions of individuals and firms. This is aside from their role as custodians of many important national institutions, covered under the next category.

**Institutional agents** are those tangible entities which embody significant institutions. Although novel and without exact parallels in other socio-economic system models, such a concept is useful if only because it coincides with the colloquial sense in which "national institutions" is used in non-academic discourse. But more importantly, it captures an aspect of the dynamic which is easily lost by following a strictly abstract view of institutions. Institutions in their strict theoretical definition are intangible, impersonal and incapable of exercising volition. As they are experienced by actors in the system, however, their impact is generally mediated through persons or organisations who have a particular responsibility to act as their custodians or enforcers: the courts exercise and perpetuate the rules and conventions of the legal system, the national concept of the Rule of Law is or should be enforced by some higher organ of governance such as the sovereign or the attorney-general, conventions limiting the scope of legitimate activity in the market are continuously reinterpreted and proclaimed as well as enforced by regulatory organs such as the Australian Competition and Consumer Commission and the Australian Securities and Investment Commission, professional bodies articulate and protect nationally accepted expectations of proper professional behaviour.

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<sup>2</sup> Economists define a pure public good by the presence of three attributes: indivisibility (either the good is provided for everybody, or it is provided for nobody), non-rivalry (one person's enjoyment of the good does not detract from anyone else's) and non-excludability (once the good is provided for one user, it is impossible or impracticable to prevent anyone else from accessing it). To these is sometimes added a fourth, simultaneity of production and consumption (the good, once produced, cannot be withheld and stored for enjoyment or sale at a later time).

Unlike institutions in their theoretical guise, such agents generally have some legitimate decision-making latitude in individual cases, and it is largely through this discretion that institutions evolve.

From the last category in particular, it should be clear that actors do not always belong to a single category. Governments act as institutional agents when they pass laws to guarantee citizens' rights, as public agencies when they bring down budgets or implement policies to encourage particular types of investment, and as firms when they employ labour to produce outputs that form part of economic activity, e.g. health care. Leading universities interact with the NSS not just as creators of skill and generators of new knowledge, but through their institutional role in setting public expectations and standards of scholarly rigour, academic independence, etc. A bank's decision on whether or not to finance a given investment can be seen both as a strategic decision of a profit-maximising firm, and as an institutionally driven reflection and reassertion of the expectations of proper and legitimate lending behaviour that underlie the national financial system. In each case the role is as much determined by the interaction which is currently of interest as it is an intrinsic attribute of the actor.

Equally, it would be possible to identify many other categories of actor which have some meaning in the context of the NSS. For example, families are known to play a very important role in shaping young people's career intentions and study decisions, and many employers now suggest they play the biggest role in propagating the kind of conventions of appropriate behaviour in the workplace which are increasingly being redefined as essential soft skills. Important decisions on training are shaped by collectives which have no fixed or recognised status, e.g. informal networks of training and HR managers from different firms. As was stressed in 2.1.1 above, to have value as a simplifying model, a system model should ideally get by with as few core categories as will capture the most significant interactions, and those just mentioned have been left out because they feed into the dynamics of the system through the decisions of individuals and firms respectively, and can be tracked more or less adequately through those (i.e. as networking behaviour of firms or an institutional relationship between individuals). However, as already noted, such decisions are necessarily provisional at such an early stage in the development of a model, and there should be no great difficulty in adding such new categories if the evidence should show that they would add useful information.

### **2.2.3.3. Institutions**

Several institutions are so fundamental to the working of the system that they can only be seen as internal to it. The most obvious are listed below.

#### **The education system:**

Once again, it must be understood that this term has a different meaning from that encountered in common speech. It does not include the schools, universities and other organisations that provide education, nor even the administrative and policy organs which control them, but broader framework rules and conventions that shape the way education is provided. They include the number of years of compulsory and available schooling; whether and how these are divided into primary, lower and upper secondary years taught in different kinds of school; the rules and conventions governing progression from one level to another; the amount of specialisation that occurs at different points in progression through the system; the degree to which

provision of schooling, especially in the compulsory years, is universal or polarised on class, income or locational lines; the prevalence and structure of post-secondary education (unitary model or divided into universities, polytechnics, higher vocational institutes, etc.); where and how the boundaries are set between general, professional and vocational education; expectations of what is a reasonable amount of education for a young person to have completed before entering the full-time workforce, and how these vary across social classes or locations; the respective value placed on rigour, competition and accessibility at different points along the educational path; the selectivity of the system at different levels; and the importance of common standards and content, especially as regulated by external examinations, common curricula, etc. Some of these, in a given national system at a point in time, may be matters of contingent practice which can be readily and quickly modified by government policy or individual choice, but many will be the result of historical processes which have become deeply embedded in the public culture, the statutory framework and the instruments of provision, and hence count as institutions.

**The vocational training system:**

This includes the division of training activity between the external training apparatus (TAFE, universities and polytechnics, commercial training providers) and in-firm training; the respective roles given to formal training and informal learning; the role of apprenticeship vs classroom training; the structure of formal qualifications and the degree of articulation and transferability between them; the relative importance of accredited and ad-hoc training (including regulatory requirements for the former); the amount of variation between the training structures of different industries or occupational categories; the location of responsibility for funding and coordination (federal or state governments, industry, professional or tripartite bodies, the market); and the availability and conditions of government support for firms and individuals to participate.

**The employment contract:**

This term, used generically for present purposes, characterises the extent to which various laws and conventions combine to encourage long-term attachments between firms and employees, with job security, regular hours of work and safeguards against defection on either side, or alternatively facilitate rapid and pervasive labour mobility. The probability of long-term attachments affects both the ability of firms to make a return on costly investments in long-cycle or intensive training and the loyalty of workers, which in turn affects their willingness to contribute to building the knowledge base of the firm and the degree to which they are trusted to exercise discretion in their work. The impact of the employment contract is closely related to that of labour markets.

**Labour markets:**

The specific aspect of labour markets which is important as an institution is the relative prevalence of internal labour markets (long-term opportunities for career progression within the one firm), occupational labour markets (where individual career progress depends on the development of a recognised common set of specialised skills which the worker can practise across a range of firms) and unstructured labour markets which fall into neither of those categories. Internal labour markets make it possible for firms to develop a skills base closely tailored to their technology, work organisation and product strategy, make the most appropriate

use of the mix of skilled labour they can recruit from the education system, and appropriate a high proportion of the knowledge they generate through the production process. Occupational labour markets can facilitate the development of a broad, future-compatible industry skills base which extends beyond the skill needs of any one firm, and assist in the propagation of new knowledge between firms. Unstructured labour markets are generally less effective in producing either of these types of output, but may offer advantages in responsiveness (e.g. through minimising the sunk costs of any existing employment relationship), particularly in circumstances where firms have a short life expectancy or skills become rapidly obsolete. Both labour markets and employment contracts often vary widely between sectors in the same economy, suggesting that they would be important constituents in a sectoral skilling system model. However, at a basic level they generally derive from a set of beliefs and values, e.g. about the relationship between the firm and the individual or the role of professionalism (Brown 1999), which are historically derived and held more or less in common across the national culture, and hence qualify as national institutions.

**The occupational hierarchy:**

The conventional hierarchy of jobs (e.g. unskilled, semi-skilled, trades, paraprofessional, professional) determines the levels of responsibility and competence which are recognised within and across industries, the kinds of work expected to be performed at each level, the extent to which there are opportunities for vertical mobility between them or alternatively each represents effectively a separate labour market, and the extent to which they are commonly recognised, and/or allow lateral mobility, between firms and industries.

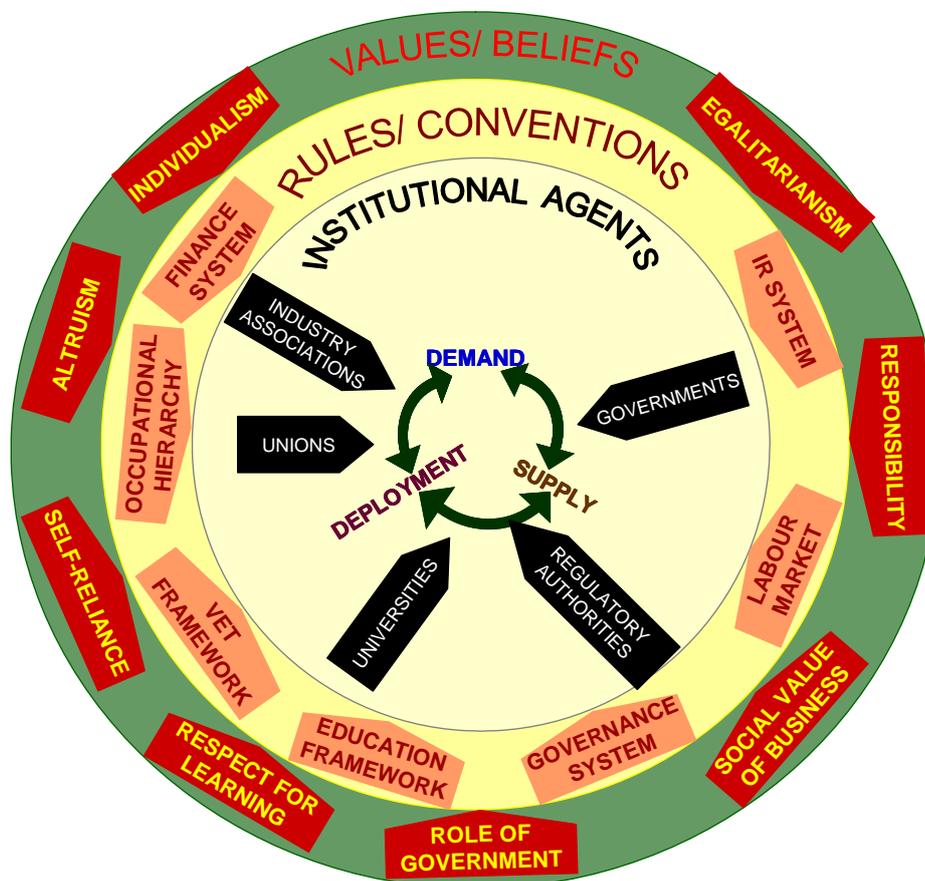
**Managerial culture:**

The skilling system is shaped in large part by the attitudes and values commonly held between managers across firms and industries on issues such as the roles of hierarchy, egalitarianism, consultation, command-and-control and devolution in work organisation, the rights and responsibilities of individual workers, the need for managerial autonomy and the entitlement of industry to various kinds of support from government. Other important intuitional influences of managerial culture occur through the readiness or otherwise of firms to sacrifice some of their competitive independence in order to share knowledge and resources and/or form voluntary associations, and whether the purpose of the latter is to create collective bargaining power, to lobby government for subsidies or regulatory protections or concessions, to provide mutual self-help, etc. Another important element is the extent to which management is seen as a job requiring special knowledge and skills, and what those skills are; for example, German managers in the 20<sup>th</sup> century often had scientific or technological backgrounds, American managers had specialised training in general management but often little technical knowledge, and British managers were typically graduates in the Humanities with no relevant specialist training (Lazonick and O'Sullivan 1994).

**Meta-institutions:**

In many of the areas listed above, observed practice in the one economy can vary widely across sectors and even between firms. However, even these variations rest on a common foundation of deeply ingrained, historically determined values (meta-institutions) which are specific to the national culture, e.g. on the relative value of

hierarchy and egalitarianism, the social value and standing of business, the nature and rules of competition, and the right of society to overrule the self-interest of business. Such meta-institutions may also be entrenched in central statutes, e.g. competition law, which resist radical change because of their flow-on impacts on subsidiary legislation, professional codes of practice, case law and the like.



**Figure 2.2**  
Levels of institutional influence on the NSS

In addition to the above, there are a number of institutions which strongly influence the NSS but lie either just on or outside its boundaries. They include the industrial relations system, which largely determines the employment contract and the nature of labour markets, but may also have some influence over the way decision-making is centralised or devolved at the firm level; the finance system, which influences the kinds of firm that will attract capital and helps to determine the relative attractiveness and feasibility of long-term investment strategies requiring sustained skill development, as opposed to high-risk, high-return or short-term opportunistic ventures; and the science and technology system which creates the technological conditions for new skills requirements and may produce codified knowledge which is a more satisfactory substitute for tacit knowledge hitherto gained in the production process. These can be considered as superordinate institutions providing a base for more specialised institutions which are internal to the system of interest.

From a systems point of view, the primary importance of these institutions lies not in their individual existence or effects but in their *complementarity* (Amable 2000: 652-659), i.e.

the extent to which each reinforces the impact of the others. Skilling systems, like systems of production and innovation, reach stable configurations only insofar as the different institutions that shape them represent a coherent set of incentives operating at different points in the system (e.g. there must be a good match between the occupational hierarchy, the dominant forms of labour market and the levels of qualification produced by the training system). When that coherence is lost through evolutionary or deliberately induced changes in one institution in isolation, the system often ceases to function viably. This interdependence sets limits on the extent and ways in which the system can be changed in the short term, and in particular, to the feasibility of adopting successful features drawn from another national system which operates in a different institutional mix.

One of the most commonly cited examples (e.g. Soskice 1994; Culpepper 1999) is the limited international portability of the German system of mass apprenticeship, which extends well beyond the scope of trades training in the English-speaking countries to cover virtually all areas of sub-professional work in the formal economy. While many commentators have pointed to the success of this system in minimising youth unemployment and creating a large, versatile skill base at the middle levels of the workforce, its feasibility is deeply rooted in institutional features of the German skilling system which are not present in countries like Australia. The widespread industry acceptance of this type of qualification rests largely on the involvement of formal tripartite bodies in its administration (an aspect of the industrial relations system and the system of governance), but also on the willingness of young people to put up with very low training wages in the early years because these are centrally set and enforced (an aspect of the industrial relations system) and the certainty that graduates will enter a guaranteed occupational labour market offering secure employment with wage rates and a status in the workforce commensurate with their skills. The stability of employment is related partly to the German financial system, which provides little support to risky startups, and partly to the requirement at least until recently that anyone wanting to set up their own business (an aspect of the business law framework) must hold a *Meisterbrief*, a higher-level trades qualification which includes a substantial element of business management studies. However, this was only possible because of the very high levels of participation (ranging at times up to 75% of school leavers) in the trades training system which represented the first step towards the *Meisterbrief*, the large and well-funded training infrastructure supported by this level of demand, and the historically high social standing of *Meister* as compared to master tradesmen in contemporary Australia. The type and level of skills that can be exercised by German tradespeople rests on a content of theoretical knowledge in the apprentice training which is unusually prominent and rigorous by comparison with English-speaking countries where apprenticeship is seen as an option for the less academically able (an aspect of the education system).

Thus the education system, business law, the financial system, the prevailing type of labour market and the industrial relations system are grounded in a common set of meta-institutions relating to social partnership, the legitimacy of the state, work ethic, the character of legitimate competition and the value of education. Together they support the ability of the training system in Germany to maintain its characteristic configuration and concentrate its resources into a particular type of output. The stability of this institutional configuration over more than a century, the momentum generated by high intergenerational levels of participation and the large sunk investment in training infrastructure have kept this system robust through two world wars, a depression, a transition from authoritarian monarchy to democracy to fascism and back to democracy, and major changes in the

national and world economy, though its robustness and indeed its continuing functionality are coming under question since the advent of global capital markets, reunification and a common European labour market (i.e. changing institutions in a broader system).

In countries like the UK and Australia, the corresponding institutions are very different and more or less as resistant to change, and some of the complementary institutions are much weaker or missing altogether. Hence, attempts in these countries to reproduce the superficial outlines of the German scheme, e.g. New Apprenticeships, have failed to produce similar outcomes and have proved highly vulnerable to expedient pressures to dilute the original concept (Steedman 2001).

## 2.2.4. The core mechanisms

### 2.2.4.1. Supply

Supply includes all inputs up to the time when a skill is operationalised in a workplace. This includes not only its development in the education and training systems, but the informal and formal processes by which employers provide specific training in the workplace; the learning which workers undertake on their own initiative through such means as taking courses at their own expense, reading and internet searching, observing colleagues at work, asking questions and practice; learning by doing, individually and collectively, in specific workplace environments; and new practical knowledge which is developed in work teams, especially when engaged on innovative projects. It also includes the processes by which skill, once developed, is maintained and kept relevant to the needs of industry, and those by which it is made available to employers as they require it.

The important criterion in all these cases is that skill in the supply phase represents *potential* for productivity rather than an active input to current productivity; this is what distinguishes supply from deployment.

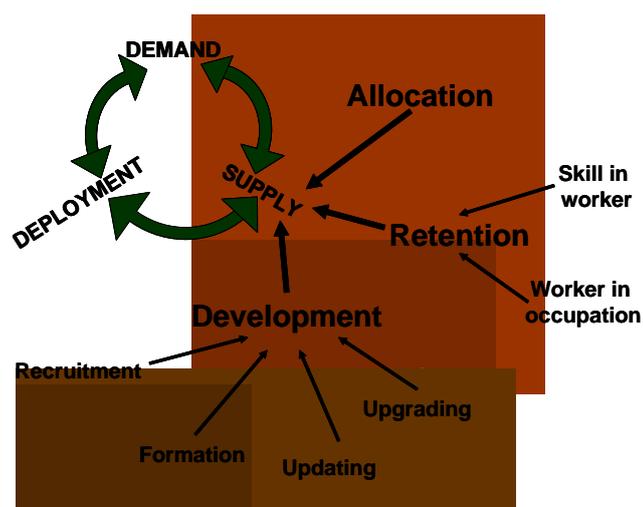


Figure 2.4  
Components of supply

The activities embraced in supply, and the institutional forces that drive it, are best explained jointly, but in three main subdivisions.

**Development:**

This term covers the processes by which skill is developed in members or potential members of the workforce who do not currently possess it. These processes in turn fall into four sub-categories. *Recruitment* is the decision by members of the workforce or potential entrants to it to acquire the skills necessary to pursue a given occupation or class of occupations, e.g. the choice to seek an apprenticeship, to apply for entry to a particular faculty at university, to join an organisation with an internal labour market and its own training program, or to undertake the training necessary for a promotion or change of job. *Formation* covers all the learning processes and infrastructure which enable a worker to acquire that initial armoury of skills. *Updating* means the processes by which skill, once acquired, is kept relevant to the changing demands of the workplace. *Upgrading* means the further development of those skills, whether by formal or informal means, so that the bearer is able to do things which someone with a normal or basic competence in that field would not be able to do. It thus embraces the means by which such characteristics as mastery (Braverman, 1974), expertise (Swap, Leonard, Shields and Abrams, 2001: 97) and virtuosity (Attewell, 1990: 433) are developed, and by which generic skills become specialised or personalised;

**Retention:**

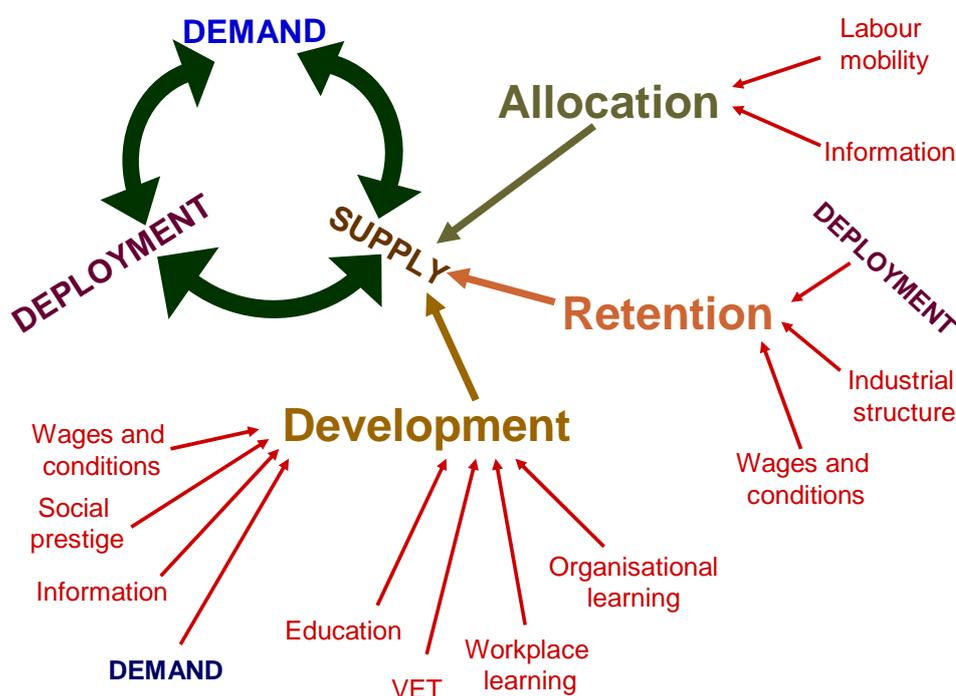
This set of processes is necessary to ensure that a skill, once developed, remains current and available to contribute to productivity. The two components are the *retention of the skill in the worker*, which generally means that the worker has enough continuing opportunity for exercising the skill to prevent it from decaying; and *retention of the worker in the occupation*, implying that the holder of a given set of skills has sufficient incentive and opportunity to remain active in the kind of work to which that skill set is relevant, rather than moving into a different occupation which offers better rewards or working conditions but does not use his full skill base;

**Allocation:**

Once skills have been created, some processes are required to ensure they flow to employers who need them. These processes occur both within the labour market, and through non-market agents such as government-run employment exchanges and non-market processes such as the voluntary sharing of skilled or expert labour between firms. The system-level function of these allocative mechanisms is to direct the available skilled workforce to those employers who can make the most productive use of each type of skill. Two main factors determine how efficient this process will be. The first is *information* – information for employers about what skills exist in the workforce and where, about the kinds of remuneration and working conditions required to attract each kind of skilled labour, and about how useful these skills could be either to their existing business activities or to potential areas of new business strategy; and information for skilled workers about what requirements exist, and where, for their particular mix of skills, which employers offer the most attractive wages and working conditions, and where they are likely to get the most second-order benefits (e.g. in prestige, promotion prospects or wider subsequent career opportunities) from exercising their skills. The second is *labour mobility*, which in turn has a locational dimension (how feasible and attractive is it for skilled workers to move to those locations where their skills can be most productively deployed?) and a temporal one (how quickly is it

feasible or attractive for skilled workers to move to a new job when one comes into existence that will make more productive use of their skills than their present job?).

From this account it should be clear that formation, the primary focus of policy discussion about the supply of skills, is only one of multiple factors contributing to the genesis of skill. Beyond that, the performance of the supply mechanism – whether in terms of the effective functioning of the system as a whole, or in terms of its effectiveness in filling higher-order social or economic objectives - cannot be adequately described just or even predominantly in terms of the efficiency, output or responsiveness of the training infrastructure.



**Figure 2.5**  
**Determinants of supply**

Taking as an example the severe skill shortages which emerged in the building trades in the early 2000s, it can be assumed for the purposes of argument that they resulted in part from underinvestment or undercapacity in building trades apprenticeships in the 1990s, some of which may have been attributable to the public VET system. However, a part of the shortfall might equally be attributable to a decline in the popularity of apprenticeship among school leavers around that time or earlier – i.e. a recruitment failure which would have inhibited an adjustment to the increased demand even if there had been spare capacity in the training system. Another strong contributor might be the relatively high proportion of building tradespeople who had made new careers outside their trade and were at least initially unable or unwilling to move back when demand revived – a retention failure. A third element, especially relevant to areas where the mining industry expanded rapidly over this period, was that few building tradespeople were willing to move to remote areas with

poor facilities for workers and their families – an allocation failure resulting from inadequate geographic mobility of labour, which was exacerbated by the contemporaneous excess demand for skilled labour in more attractive locations. This is aside from the arguably more important question of whether the shortage was driven by supply considerations in the first place, or whether it resulted primarily from a rapid cyclical or policy-induced spike in demand to which even the most efficient supply mechanism could not have responded adequately.

The question of causality will also often be complicated when the same institutional forces exercise divergent or contradictory influences on different elements of the supply mechanism. An institutional culture that favours strong attachment between employees and firms, generating loyalty, trust and long-term security, represents a form of “patient social capital” which can be essential to the creation and upgrading of specialised high-level skills for which the training takes many years to show net returns; but it can also set back the efficiency of allocation by inhibiting the migration of labour with such skills to start-ups which might be able to use them more flexibly and innovatively.

Feedback can also have important impacts on the outputs of the supply mechanism, most notably in the form of lagged response, as noted earlier in this chapter. Once again, the core problem is not one of training infrastructure capacity alone, but a combination of recruitment, capacity, retention and information problems, and in different cases it may require intervention in any one or any combination of these mechanisms to alleviate the imbalance.

Given these complexities, the aggregate supply of skills at any point in time is extremely difficult to quantify, even in concept. The kinds of indicator commonly used – the output of graduates from the formal training system, hours of training undertaken in workplaces and the number of persons in the workforce holding each type and level of qualification - not only fail to capture the contribution of informal and emergent learning in workplaces, but overlook the fact that a skill, once formed, does not persist as a permanent and unalterable feature of the economy. Skills are modified and developed in use to the point where they eventually can no longer be called the same skills, they decay from disuse, and they become obsolete or irrelevant to current needs. While it is possible to identify and to some extent quantify gaps between demand and supply, or between supply and deployment, the actual quantum of supply remains permanently uncertain in its own terms. This complicates the task of finding a metric for the activity or state of the skilling system at any given time, a question that will be further addressed in Section 2.4.

#### **2.2.4.2. Demand**

Estimating demand poses comparable problems of definition. One way to conceptualise it at the system level would be to ask the hypothetical question: if every employer in the country wished or needed to re-fill all the positions in their current workforce today with new appointees, what qualifications, experience and other competences would they require (and be prepared to pay the going price for) in each of those recruits? But such a definition, though defensible in principle, is so hypothetical in that it sheds little light on the demand actually influencing the dynamics of the skilling system at any point in time. The model set out below subdivides demand into the ways it appears to different interest groups, in each case implying a different definition.

**Vacancy demand** is defined in terms of the levels and types of skill required to fill all the positions which are actually vacant at any given time and the object of current action to fill them. This is the demand that shows up, for example, in the national vacancy statistics, and is the kind most relevant to current jobseekers, most employers, employment exchanges and agencies, and lay observers of the labour market (including politicians).

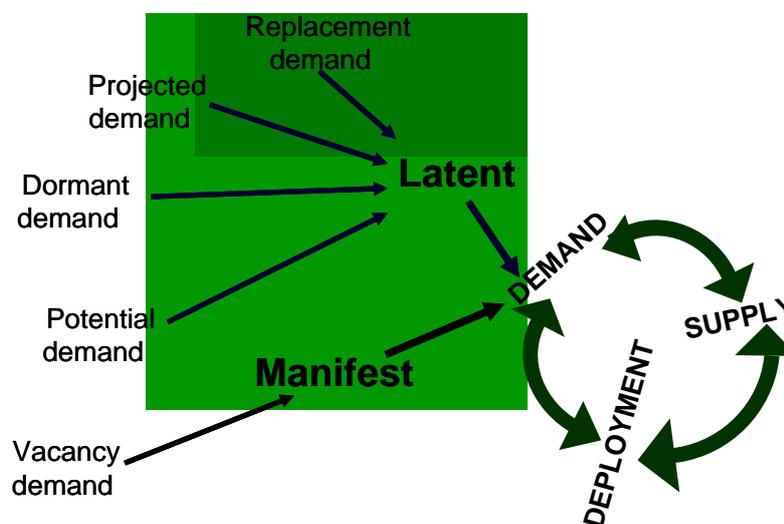
**Projected demand** means the skill requirements that will exist if present trends in each type of employment are prolonged, say, three, five or ten years into the future, and the skills required for each type of job remain as they are today. This could include making allowance for the likelihood that the present vacancy demand for some skills represents a cyclical spike which will not be sustained. This kind of demand is the most relevant to school leavers choosing a long-cycle training option, to larger firms planning internal skill development strategies, and to training organisations when they undertake capacity planning.

**Replacement demand** covers the skills that will be needed to fill those positions likely to become vacant over a given planning timeline as a result of churn or retirement. This is likely to be of interest to the same groups as projected demand. However, because it is affected by large-scale demographic shifts (e.g. the retirement of the baby-boomer generation), it may sometimes be beyond the capacity of individuals or individual firms to respond adequately to it, so that governments and other collective institutions need to take greater responsibility;

**Dormant demand** refers to skills which employers would like their present workforce to possess in order to do their present jobs, but are not actively attempting or intending to gain through recruitment. This may happen because they have no confidence that the missing skills will be available on the open labour market, because they lack the resources or motivation to recruit additional staff or pay the going market rate for the skills in question, because of undesirable tradeoffs (e.g. loss of internal trust, or loss of firm-specific tacit knowledge) that would arise from laying off existing employees to replace them with better-skilled ones, or because of constraints on doing so, e.g. industrial laws or union bargaining power. This kind of demand includes what are generally called skill gaps, i.e. where an employee meets the qualification requirements to do a particular job but lacks some of the practical skills or current knowledge that are required to do it well. Firms with sufficient capacity may try to equip their current staff with the missing skills through enterprise-based training, but many will simply make do without them and adjust their strategies and expectations. This kind of dormant demand has heavily influenced advocacy by peak employer groups (e.g. ACCI 2007; Australian Industry Group 2004);

**Potential demand** is made up of skills which employers would use if they were more readily available, e.g. to move into new areas of business, to step up their activity in their current ones, or to upgrade their production processes. The category also embraces demand from new businesses or new sectors which would emerge if a suitable skills base were available. Unlike the other kinds listed above, which assume a static balance between different types of economic activity or between the growth rates of different industry sectors, potential demand is based on the expected presence in the economy of dynamism, innovation and structural change; but for

just that reason, it is much harder than the others to forecast consensually and to quantify or prove objectively. This kind of demand is particularly relevant to long-term economic and educational planners and to students of innovation.

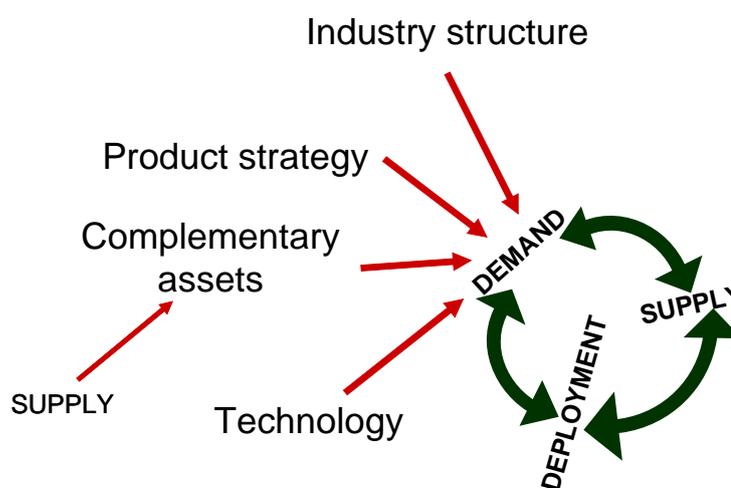


**Figure 2.6**  
**Components of demand**

Except for the first, all the above categories go some way beyond the hypothetical point-in-time demand estimate which introduced this topic. They all have a future orientation and assume the working-through of changes which are already present in embryo in the current structure of industry. Between them, in effect, they ask the same underlying question as the original hypothetical, but answer it with reference to a point in the future. From the point of view of a descriptive economist focusing on the economy at the present point in time, only vacancy demand would strictly qualify as demand. However, from a strategic and policy viewpoint it is rational to use such a future reference point, given the inevitable lag which has already been mentioned between changes in demand and the response of the supply side.

Another way of explaining the difference is that the original hypothetical calculation was an estimate of a *stock* – the volume and mix of skills which either are actively in demand across the economy at a point in time, or else are in active use, and hence would be in active demand if their current practitioners ceased to work for any reason. The subcategories refer to aspects of the *flow* of skilled labour between different kinds of economic activity. Among these latter, vacancy demand represents *manifest demand*, whereas the remainder represent *latent demand*. The dynamic on the demand side of the labour market can thus be conceptualised, in part, as a process by which latent demand becomes manifest. However, latent demand also evolves in its own right as the economic structure, product markets, technology, labour force demographics and firms' practices change, and this provides the second and arguably more important element to the dynamic. Given that only highly anticipatory policy responses are likely to be effective in addressing demand-side challenges, there would appear to be more value in mapping the trajectory of latent demand in its various forms. From that perspective, the size and composition of the present "stock" of demand appears to have subsidiary relevance at best.

The most important factors influencing demand are what goods and services the economy produces, and how each of them is produced. Some industries are more skill-intensive than others, simply as a consequence of the intrinsic difficulty of deriving the product from the inputs and inter-industry differences in the availability of suitable technology to reduce the need for skilled human inputs to the process. Hence, demand will be driven to a large extent by structural and institutional factors, including resource endowments and historically developed strengths in particular sectors, which determine the kinds of product in which an economy specialises. A further very important dynamic influence in changing the mix over time is the global balance of economic activity, as changing technology, markets and cost, among many other factors, result in the competitive advantage in particular kinds of production or services passing from one nation to another.



**Figure 2.7**  
**Determinants of demand**

In addition, product specification will vary within product categories according to individual firms' strategic approach, with strong implications for the skills required to bring the good to market. Keep and Mayhew (1999: 6) posit a critical dichotomy between *specification* (the features and aspects of quality in a product that make it intrinsically attractive to a given type of consumer) and *delivery to specification* (the reliability with which the product measures up to its intended level of specification, i.e. "does what it says on the box"). A product strategy which aims to achieve competitiveness through specification will concentrate on maximising the quality, distinctiveness, performance, innovativeness and/or customisation of the product, which the authors suggest can be proxied by its complexity. One which aims at competitive advantage in delivery to specification focuses on prompt supply, accuracy in meeting orders, constant quality, and consistency in meeting consumer expectations, which are often best achieved by sticking to a simple, proven, standardised product. This dichotomy is applicable not just to manufactured products but to many kinds of service, call centres and restaurants being clear examples.

The two polar approaches imply very different skill needs. High specification requires a workforce who understand not just the product and its characteristics but the underlying principles which give it those characteristics, and who are capable of communicating effectively with the customer and adapting those characteristics to her distinctive

requirements. Effective delivery to specification is often best achieved either by mechanisation (resulting in less overall labour demand, though some of the workers who remain may be more skilled than otherwise) or by Taylorist forms of work organisation which presuppose labour with limited technical, conceptual and communication skills and capacity for initiative. In practice, most product strategies will strike some kind of balance between the two, though the Keep and Mayhew suggest that the institutional incentives in a national economy will bias it towards one or the other pole.

While these demands derive directly from the requirements of the product or production process, the amount of actual demand they create at the point of recruitment will vary according to how efficiently labour is deployed. Put bluntly, the more inefficiency, the more demand. However, this process can go only so far before it starts to operate in the reverse direction. So long as highly skilled specialist labour is a more or less scarce commodity commanding a price premium over less skilled labour, its marginal contribution to productivity must exceed the marginal cost of employing it before there is any point in doing so. This implies that in practice, it should be just as common to find cases where inefficient deployment results in less demand for certain kinds of skilled labour than it would be profitable for an efficient firm to employ. Such inefficiency can even lead to the abandonment of product strategies which would lead to more productive deployment of labour. In either case, deployment represents a kind of filter between potential or ideal demand (i.e. assuming perfect efficiency) and actual expressed demand. Changing national capabilities in global markets place further barriers on the extent to which any nation can afford to use its skill base inefficiently.

A final constraint on demand is the presence or absence of complementary assets, which can include other kinds of skilled labour that are required for any one type to achieve full productivity. If these are lacking, even very highly skilled workers may not be able to generate sufficient marginal productivity to offset the cost of employing them. The most skilled carpenter cannot be productive without tools; the best-qualified investment analyst will operate with reduced productivity if he has to work with unreliable IT or slow communications; and the absence of critical skilled staff, e.g. technical experts or people who can communicate in different languages, may eventually make it necessary to lay off workers who are perfectly productive in their own right and in their own line of work. This loss of demand may be prolonged if the firm loses customers to overseas competitors as a result. This is the reason skill shortages create multiplier effects which can outlast the actual shortage in question.

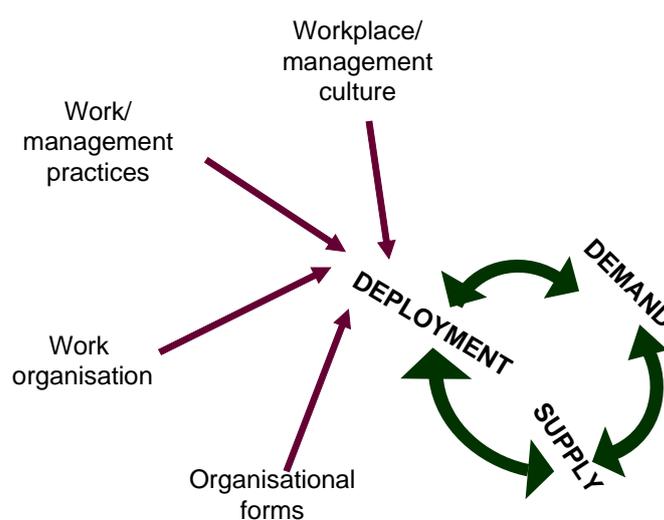
The complexity of these determinants does not prevent the problem of quantifying and predicting the demand for skills from being tackled every day at the firm level. However, the multiplicity of interactions and the uncertainty attaching to each of them make it difficult by increasing orders of magnitude to resolve as one moves out from the firm to the industry to the national scale. This was one among several reasons for the poor success record of manpower planning when the OECD promoted it as a tool of economic policy in the 1960s and 70s. It means that even if it were feasible in practice (as it certainly is in principle) to estimate the total point-in-time manifest demand for any one skill, it would still be impossible to quantify the dynamic aspects of demand. The task is complicated further by the fact that most real jobs require workers with combinations of skills that do not fall neatly into single skill categories, and these skills need to adapt to local requirements and evolve into new forms over time.

Once again, therefore, there is a tracking problem when it comes to quantifying the state or trend of the NSS at any point in time. The best that can probably be achieved is to track broader and more unequivocally observable factors which are known to have a significant influence on different categories of demand and use this information as an aid to extrapolating from recent trends in the demand for specific skill categories that emerge from the available time-series data.

### 2.2.4.3. Deployment

Supply-push approaches to skilling tend to incorporate an assumption that productivity is inherent in a skill, and that it is only necessary to employ people with a certain skill, or to train existing staff in it, in order to reap an automatic productivity benefit. This misconception is commonly encountered on a macro scale in attempts by economists to quantify the net contribution of training to various indicators of productivity on the basis of large cross-industry data collections, and on a micro scale in demands made on the evaluators of internal training courses offered by firms or organisations to demonstrate a productivity gain directly attributable to the training in question. In neither case has a compelling body of evidence been adduced even after many decades (see for example Dockery 2001: 6-17).

This lack of success is understandable when one considers the definitional point made about supply in 2.2.4.1 above: skill at the point of supply represents *potential* productivity. Actual productivity is achieved only when the skill is deployed in a productive task. The way a skill is deployed contributes at least as much to the achievement of productivity gains as the skill itself. Effective deployment can amplify the productivity potential of a skill by providing opportunities for its development through experience and combination with complementary skills. Inappropriate deployment can negate some or all of its potential by denying opportunities to practise key components of the skill. In the case of many individual training programs, the productivity gain comes from the adoption of new technology or work practices for which the presence of the new skill represents a necessary but not a sufficient condition.



**Figure 2.8**  
**Components of deployment**

Deployment is the area in which the greatest overlap occurs between the NSS model and the human resources management (HRM) literature. Given how extensive this literature is, no attempt will be made to include a comprehensive survey here, though the overlap and distinction between the two discourses receives further attention in the next section.

The HRM literature contains numerous examples of how failures in deployment can occur through local and contingent factors such as inflexible management, lack of managerial knowledge, inertia, legislated or consensually enforced work practices specific to a given workplace, or bad interpersonal relations within the workplace. Job design is another obvious source of variation in the efficiency with which skills are deployed. The innovation literature also shows how the absence of complementary assets can be a barrier to effective deployment. For the present purposes, which are confined to a summary account of how deployment fits into the system model, it is only necessary at this point to mention that regular, generalisable patterns can be found which influence deployment across a range of firms or industries. These regularities can be divided into three categories of ascending complexity: work (or management) practices, work organisation, and organisational forms.

**Work practices:**

This term refers to individual standardised routines that characterise aspects of HRM across organisational contexts. Thus for example, writers in the HRM discipline have identified a set of “high-performance work practices” which are commonly found in organisations that make creative use of highly skilled labour and which, when taken together, are seen to provide a broad indication of a firm’s capacity to benefit from and retain a skilled workforce. The set commonly includes such practices as teamwork, quality circles, job rotation, developmental performance management and self-managing teams (Martin and Healy 2008). Corresponding work practices under different styles of management include close supervision, communication through foremen and middle managers, individual output quotas, detailed job prescription, competitive performance appraisal and scripted interactions (as applied in many call centres). Because such practices are well documented, widely understood and commonly featured in corporate strategy documents, it is relatively straightforward to gather data on whether a firm applies them. Such data can readily be collected in surveys and used as indicators or building-blocks to form a composite picture of work organisation within firms or changes in deployment practice across a sector or an economy.

**Work organisation:**

The next step up in generality is to identify the underlying structures and philosophies that govern interactions between management and labour, or among different groups of workers, in the one organisation. These common frameworks lead to coherent patterns of synergistic work practices which are referred to here as work organisation. Terms such as mechanistic, organic, Taylorist, devolved, command-and-control, informal and trust-based are among those commonly used to characterise forms of work organisation. The term also covers aspects such as the nature of communication between the elements of an organisation, both vertically up and down the corporate hierarchy (inclusive *vs* need-to-know) and horizontally between employees at the same level in different areas or divisions (lateral networking *vs* stovepipes).

**Organisational forms:**

Starting with Miles and Snow (1988), a small but growing literature has examined coherent patterns of work and management organisation which appear to be repeated across a range of firms or organisations, often within the same (national or sectoral) context, to the point where they can be seen as generic models of how to structure and manage an organisation. These are variously referred to as organisational forms, archetypes, organisational configurations and styles of governance<sup>3</sup>. Organisational forms commonly cited in the innovation literature include Mintzberg's (1979) five "configurational archetypes" of simple structure, machine bureaucracy, professional bureaucracy, divisionalised and adhocracy, Lam's J-form, Nonaka and Takeuchi's "hypertext organisation" and Foss's "spaghetti organisation" (Lam 2005).

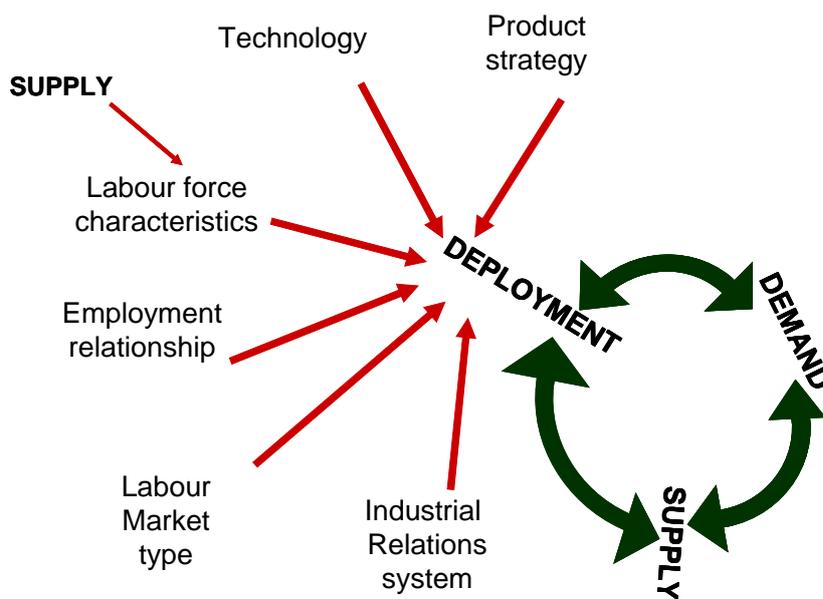
Although perhaps less likely to be encountered in empirical research than the first two categories, organisational forms in this definition represent a further step up in coherence, because they reflect the premise that "some configurations fit better than others within any given context" (Short, Payne and Ketchen 2008: 1054). They could be seen as forms of work organisation which have become established across industries or national business systems as stable and sustainable configurations, resembling institutional configurations on a reduced scale, or possibly even representing institutions in their own right. This is certainly the sense in which Lazonick and O'Sullivan (1994), Lazonick (2005) and Lam (2005) use the concept, suggesting that there are a limited range of particularly successful organisational models that have become effectively institutionalised in some nations at successful points in their industrial development. Thus for example, the J-form organisation presents a stylised version of the organisational form typically found in large Japanese corporations in the late 20<sup>th</sup> century and associated with Japan's exceptional performance in manufacturing over much of that period.

Thus, while deployment would seem on the surface to be the mechanism that most requires qualitative description, in practice it proves to be at least as amenable as either supply or demand to useful quantitative research. None of the above is intended to play down the importance of qualitative research into aspects of deployment. The management of employees is an intrinsically qualitative matter, good qualitative research is required in the first place to develop valid indicators capable of generalisation across firms, and differences between the practices of firms or even of divisions within a firm which are too subtle to be captured by a numeric or dichotomous indicator can make all the difference to the way things work on the ground. But in a dynamic system, quantitative data – however crude -

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<sup>3</sup>Short, Payne and Ketchen (2008), in what appears to be the most recent and comprehensive review of this literature, use "configurations" as the umbrella term. However, they include under it forms of clustering based on common strategy as well as categories based on common organisational or structural principles, distinguishing the former ("strategic groups") from the latter which they subdivide into "archetypes" (context-specific) and "organisational forms" (which occur across industries). This last category also appears to be somewhat different from the concept of organisational form under consideration here, since they link the form of organisation to firm-level strategy rather than to broader social or cultural determinants. In a survey of the US management literature from 1993 to 2007, they identify 110 articles relevant to their broad category, but only fifteen of these related directly to "archetypes" and 29 to "forms", and many of these appear to be focused on the purely technical question of methodologies to identify these commonalities. The authors admit (2008: 1067) that this management-related literature has so far made relatively little contribution to organisational theory, and that its application to HRM awaits further research. As will be apparent from this account, most of this literature is only peripherally relevant to the way the concept is introduced here, which owes more to the innovation and systems of production literatures.

are indispensable for tracking the dynamics, especially where the complexity of the system itself or the volume of environmental noise make them impossible to capture by simple observation. For reasons already stated, quantitative data on supply and demand would be inadequate by themselves to describe the working or evolution of the NSS even if they did not lose much of their validity and reliability when generalised and aggregated up to the system level. Complementary data on deployment, whatever their shortcomings, open up the possibility of triangulation which allows one type of data to compensate for failings in the other and makes the whole dynamic visible, however imperfectly.



**Figure 2.9**  
**Determinants of deployment**

## 2.3. The NSS model in context

### 2.3.1. The NSS concept and management studies

The discussion up to this point has located the NSS approach in the context of economic models of skill. However, it must not be forgotten that by far the largest literatures on skill-related topics are found within the broad disciplines of education and management. The amount of literature in both which is at least peripherally relevant to the definition of the NSS and the role of skill within it is so great that even a superficial literature survey would take up most of the thesis.

Indeed, this is one of the powerful things about the NSS model: it provides a framework for linking a large number of literatures which have evolved in relative isolation, so that they can share their insights and build logical pathways between their respective key concepts. However, the core concept has a distinctive object of interest and frame of reference which represent a boundary (albeit a very porous one) between studies of the system and the main body of studies in those broad disciplines.

Much of the discussion in Chapter 3 is derived from the education literature, insofar as it deals with the nature of learning and the skill creation. Here, the distinction between the two discourses is fairly self-evident: learning, though a core element in the NSS, is only one of many drivers which influence the behaviour of the system as a whole. It represents only one of several factors contributing to the skill development side alone, which in turn represents only one of three processes influencing skill supply. Moreover, only part of the learning which shapes the supply side of the system occurs in the formal educational contexts to which most of the education and VET literature applies. The supply element, in turn, interacts with the equally important processes of demand and deployment to produce system-level outcomes.

Where the management literature is concerned, the distinction has less to do with subsidiarity than with scale. Management studies resemble the system approach in that they view skill in terms of a synergistic interaction between supply, demand and deployment, albeit primarily through the lens of the third. However, their primary focus lies on the achievement of outcomes at the level of the firm. They serve a useful purpose by providing a theoretical framework for individual firms to compete better within their respective markets. Managerial decision-making is seen as the most important variable for bringing about desired outcomes, and managerial control over outcomes is generally a core assumption. The system approach concentrates more on influences, interactions and outcomes which are too broad-ranging to be within the control of an individual firm, and which effectively constrain the decision-making discretion of managers at that level. In this perspective the survival or performance of any one firm or industry is less important than whether the economy as a whole uses its human potential to the best effect. This means that the main intended users of the system model are governments, who possess both the capacity and authority (however limited in practice) to influence such cross-firm determinants, and the responsibility (however unevenly exercised) to put the optimal performance of the economy as a whole ahead of the fortunes of any one interest within it.

The skill-relevant area of management studies can be divided for the purpose of demonstration into two main strands. One is the traditional school of human resources management which is based on a human capital philosophy and draws primarily on psychology for its theoretical framework (Wright, Dunford and Snell 2001: 710). The concentration here is on the competences and behaviours of individual workers, how they are acquired and how they can be manipulated. In line with the economic theory of human capital, skill is seen as a property, and indeed the property, of individuals, and the challenge for HRM lies in creating a pattern of incentives that enables and encourages individuals to deploy their already existing skills to the best advantage of the business (Wright, Dunford and Snell 2001: 705).

A second tradition is embodied in such important currents of thought as organisational learning, knowledge management, the knowledge-based enterprise and the resource-based model of the firm. It focuses on competences and work-related knowledge that are developed collectively within the firm, are owned by the firm and provide it with a unique source of competitive advantage. The term "skill" is not generally used in this latter strand, but the concepts of capability, competence and knowledge have much in common with skill and can be conceptually difficult to disentangle from it. (These distinctions will be discussed in Chapter 3).

Once again, the NSS model applies at a third and more general level: it sees skill as the combined product of individual and collective learning, but more importantly, it treats skill as a resource belonging to the economy as a whole. Thus, while the challenge for the first strand of thought is how the firm can draw the greatest benefit from the skills of its individual workers and managers, and the focus in the second lies on how the knowledge, capability and unique skills generated within the firm can be appropriated and optimally exploited by the firm, a key function of the NSS is to allocate the total pool of skill in the economy among firms and industries in a way that generates the greatest public good.

A number of attempts have been made to link the first and second strands of thought, one of the most sophisticated being that of Wright, Dunford and Snell (2001). In the same way there is potential for the third, system level of analysis to be coordinated with the other strands, in particular the second where there is a strong isomorphism which allows many of the theoretical tools developed in that tradition to be applied to the NSS. In this sense, individual firms could be viewed as subsystems operating within the broader national system and repeating some of the same behavioural patterns on a smaller scale, just as a firm's HRM system (Lado and Wilson 1994) represents a sub-system of the firm itself.

However, in systems theory (see 2.1 above) the fact that two systems operating at different levels of generality are isomorphic does not necessarily make them commensurable. The same problem can look very different depending on whether one sees it from the perspective of an individual business's managers, for whom the primary objective is to out-compete other firms in the same market, irrespective of their merits or potential to create new welfare gains, or from that of government for whom the objective is to maximise the realisation of that potential across an industry, a region or the national economy, even if in the process particular firms are constrained from maximising their own utility. Put differently, we are looking at two different though nested systems with different functions, and though the functions of both include coordination, it is coordination of a different kind serving a different purpose.

These considerations imply that the NSS model lends itself less to a critical analysis of a firm's skilling practices for its own benefit than to a kind of meta-analysis of different firms' skilling practices, explaining how they arrived at their present configuration or indicating the circumstances in which different approaches are appropriate. Given this different focus, it seems intuitively reasonable to expect that existing management theory, even if it is potentially enlightening, will need some re-thinking or at least careful adaptation before it can be usefully applied at the system level. This is an exercise well beyond the scope of an introductory account of the core NSS model, and for that reason the thesis does not go into a comprehensive review of that literature, except where it is relevant to the central argument.

However, one school of recent management literature does stand out as directly relevant to the NSS concept and provides much of its theoretical underpinning. This is the resource-based model of the firm (RBM) which originated with Penrose (1959), was first formalised by Wernerfeld (1984) and Rumelt (1984), and is now most commonly associated with the work of Barney (1991, 1996, 2001, Barney and Clark 2007). The RBM is one of the founding theories of current innovation theory (Smith 2005: 151; Lazonick 2005: 33) from which the NSS model is drawn.

The RBM, like other theories of the firm, addresses the question of how firms achieve outcomes which cannot be achieved by market relationships between individuals. It links the competitive advantage of a firm to its possession of a bundle of “resources”, tangible and unobservable, which are valuable, unique to the firm and hard to imitate. In the formulation of Lado and Wilson:

... the firm is viewed a nexus of resources and capabilities that are not freely bought and sold on the spot market... To the extent that these firm-specific resources and capabilities yield economic benefits that cannot perfectly be generated through competitors' actions, they may be potent sources of sustained competitive advantage.

(1994: 701)

These resources (perhaps more informatively referred to as organisational capabilities or competences) have been defined by Hunt (1995: 322) as “anything that has an enabling capacity”. They include such things as an organisation's culture, its strategic vision, its reputation, its internal routines, its distinctive internal knowledge base, its pool of human capital (i.e. the skills held individually by its employees) and its arrangements for deploying those skills. Such assets do not lead to *sustained* competitive advantage in their own right, but only to the extent that they are not easily copied or appropriated by competitors. This excludability requires the presence of what Rumelt (1994) calls isolating mechanisms; such mechanisms can include unique historical conditions, specialised assets, tacit knowledge and causal ambiguity (Lado and Wilson 1994: 702). The last mentioned term refers to situations where it is difficult for an outsider to deduce how a firm's practices lead to given outcomes (King and Zeithamel 2001). An important aspect of these mechanisms is complexity, e.g. when synergistic combinations of (individually imitable) practices develop within a firm. A different but equally essential prerequisite is that there should be no close substitutes for these capabilities.

They other key common characteristic of these resources is that they have evolved, and continue to evolve, in a path-dependent way and bear the traces of the firm's idiosyncratic history. This implies that they can be traced back to initial conditions or decisions taken early in the firm's history which have set the firm on a given path of increasing returns, but which it might be impossible or inadvisable to repeat in current circumstances. Even when they can be, the learning process will often be subject to what Dierickx and Cool (1989) call time compression diseconomies which make it impracticable for an imitator to accelerate it.

The common themes between this model and the NSS are clear. In particular, the core concept of complex, non-imitable capabilities reflecting a unique corporate history bears a strong resemblance to the role of institutions in the NSS. In a sense, institutions could be seen as the counterpart on a national scale of resources at the firm level. Like the NSS, the RBM places strong emphasis on the interdependence between skill and deployment, while the more recent attempts to reconcile traditional individualistic HRM and the RBM centre on the way individual and organisational knowledge interact, and on the flows from one to the other (Boxall 1996; Wright, Dunford and Snell 2001; cf. also Nonaka 1994). Both models emphasise the need for high levels of coherence between apparently unconnected practices (Teece, Pisano and Shuen 1997: 519).

Path-dependence and time compression diseconomies are other important common features of the two models. Both these characteristics are critical to the question of how far national skilling systems can retain their national character in a globalising labour market, a subject to be treated in more detail in the next subsection. At both levels, the synergy between core competences and path dependence is not always positive: for national systems as for firm strategies, core competences can easily turn into core rigidities (Leonard-Barton 1992) as the economic environment changes. There has been concern that this may have occurred with some of the best established national systems, notably the German one (Finegold 1999), as changes in the technological environment and the global distribution of skills reduce the competitive value of the kind of output they are best suited to produce.

This risk is addressed by a later development of the RBM, the concept of *dynamic capabilities* (Teece, Pisano and Shuen 1997). The central object of this approach is an organisation's capability to reconfigure its processes and renew its competences in order to adapt smoothly to a changing environment. Such capabilities place a strong reliance on the organisation's ability to learn, and hence on how well it facilitates and encourages both learning by individual employees and the absorption of new knowledge into the organisation's routines. They also require routines that encourage flexibility and adaptation, and sometimes these routines need to be robust enough to cope with high levels of employee turnover, where the firm needs to acquire new technical skills and shed old ones. Dynamic capabilities can thus be viewed as a kind of enduring meta-competences that equip a firm, not just to do one thing well, but to do different things well, including ones that are not currently foreseeable.

Dynamism is obviously even more of a key requirement for national economies than for firms. National economies, at any rate diverse industrialised ones, are by their nature more dynamic than most firms anyhow, since they consist of a portfolio of economic activities with mechanisms to reallocate resources between them as each kind of activity becomes more or less productive and competitive. The skilling system stands alongside the financial system as one of the most important adaptive mechanisms; hence its performance needs to be judged not just on its ability to maximise the return from human potential in a given set of economic strengths and settings, but on how quickly and effectively it enables the economy to adapt to changing markets and new opportunities. One of the more commonly agreed implications is that a skilling system which develops broad-ranging, flexible capabilities in individual members of the workforce – partly though not exclusively through a high-quality, universal general education – is better able to meet the needs of innovation and a rapidly changing global environment than one which produces a workforce geared very precisely to the needs of the existing mix of industries and business types.

A final key dimension in which the RBM, and indeed the management literature more generally, prefigures the NSS model is by emphasising the centrality of people. Skill is developed in persons and exercised by persons; how well they deploy their skills is determined not just by the nature of tasks they are set or the tools they are given to do them, but by their motivation to exercise their skills. Generating and maintaining that motivation involves considerations which are not easily captured by a simple calculus of economic efficiency. Whether they are motivated to deploy their skills, or for that matter to develop them, often rests on individual experiences and life trajectories that are at least as idiosyncratic as those of firms, and cannot be generalised in a single generic model of the rational utility-maximising individual. On the other hand, learning is at least partly a social process, and the conditions of its emergence have little to do with conventional market-

clearing assumptions. All these considerations mean that the NSS is as much a social as an economic phenomenon, and needs to be approached from multiple disciplinary perspectives.

Two specific instances will give an illustration of how the RBM adds to an understanding of the dynamics of the NSS.

Firstly, it illuminates a critical dimension in which the a systems approach differs from common responses to the skill shortage problem. Most treatments of the issue assess the unmet need for skill in terms of a mixture of generic and standardised technical skills: the economy cannot move forward unless there are more building tradesmen, more science paraprofessionals, more computer literacy, more employees with the ability to work in teams, etc. Skills such as these could be called *threshold skills*, since they represent the minimum competence without which a particular task cannot be done. Their presence is undoubtedly crucial in determining *whether* a business, an industry or a nation can compete in new product markets, in adopting new production processes or through more effective types of work organisation. However, the RBM shares the core premise of the NSS model that such skill only represents potential competitiveness (Boxall 1996: 65). *How well* a firm, industry or nation competes in these new markets depends more on the kind of *unique* skills and capabilities that are developed within that unit and provide it with a competitive edge which is difficult to copy. By definition this latter kind of skills cannot be bought in, sourced from overseas or delivered as a standard product of the VET system. At the firm level their development can be stimulated only through organisational culture, organisational processes or managerial strategy. At the broader system level, there are things governments can do to create a more favourable environment for the development of this critical class of skills, but they involve things other than simply boosting the output or “responsiveness” of publicly funded VET. (This subject will be raised again in Chapter 10.)

A different kind of insight provided by the RBM concerns the degree to which sources of variation within the system can be deduced from aggregate data about its behaviour. The normal means of making sense of such aggregate data is to assume that variation is related to significant categories within the population – in this case, that variations in skilling practice can be explained by differences between industries, occupations, forms of employment contract, educational characteristics of the workforce, positions in the occupational hierarchy and other such conventional variables of interest to labour market economics (Lowry, Molloy and McGlennon 2008: 15). This approach has been followed in the empirical part of this thesis, partly because the present research keys into a long-running debate on whether changes over time in the average skilfulness of jobs are the result of generic processes affecting the nature of work or a reflection of compositional change in the labour market (see Section 5.1), but partly just because the available data lend themselves best to this kind of categorical analysis.

By contrast, as has been seen, the RBM emphasises the degree to which the routines and capabilities of individual firms can be determined by their unique histories, because of the path-dependent nature of firm evolution and the tendency of firms with unique and non-imitable competences to survive best in highly competitive environments (Teece, Pisano and Shuen 1997: 525; Nelson and Winter 1982). In some circumstances or on certain criteria, the amount of variation attributable to such idiosyncratic paths can exceed that due to inter-industry differences, as was demonstrated empirically by Rumelt (1991) in the

specific case of rates of return. Since these firm trajectories are likely to be traceable back to initial conditions or decisions which pre-date the run of source data, perhaps by decades, they will show up in any conventional type of inferential analysis as unobserved heterogeneity. Generalisable patterns may well be present in these idiosyncratic histories, and such patterns should be meaningful in the terms of the NSS model, but it would probably require specially designed data sources, building on a large body of new, targeted qualitative research, to reveal them through statistical analysis.

This possibly critical blind spot must be recognised as an important limitation of the methodology in this thesis, and will be revisited in Chapter 10 when the possibilities for future research into the NSS are discussed.

### 2.3.2. The NSS in a globalising world

Given the recent evidence of growing international mobility of skilled labour, a growing internationalisation of education, and a corresponding or greater increase in the mobility of skilled work with the emergence underutilised pools of university-educated labour in developing countries and improvements in communication technology that make the international outsourcing of knowledge-intensive work more practicable, it could be objected that it makes decreasing sense to talk of a *national* skilling system. Would it not be more informative to study Australia's skilling arrangements as part of what is rapidly becoming a global skilling system, located in a global labour market? Should it be accepted, at the very least, that the boundaries of the national system are so porous as to create another problematic boundary issue?

One way of answering this criticism is to point out that the porosity of the boundary has already been recognised in this chapter as the source of one of the most important dynamics in the NSS. Change in demand is driven largely by the changing balance of economic activity between nations. More recently industrialised countries acquire the capacity to undertake types of activity that were previously feasible only in the industrialised world. Industries lose competitiveness or viability in their traditional homes as a result of such things as resource depletion, changing economies of scale, labour costs, change in the location of key markets, public concern over their environmental impacts, or technological change which makes it possible to increase the distance between corporate headquarters and production facilities. Even where industries remain in Australia, technological change has made it feasible to export the more routine elements of many jobs, possibly leading to an overall increase in the skill requirement of work in Australia (a possibility that will be further explored in Chapter 7).

To repeat: this is all part of the core dynamic of the national system, and always has been. Far from undermining or disrupting the system, such developments help to force its evolution. Mobility of labour and work has been a feature of the international economy through most of recorded history, and most national skilling systems show some legacy of attempts to adjust to it. Examples would be the long persistence of English laws placing limits on the residence and practice of foreign tradesmen, and closer to home, the (partly coincidental) relaxation in the Postwar Reconstruction period of some barriers to the recognition of trades qualifications gained outside Australia. Indeed, Australia's national skilling system could be said to have its origins in the convict era when the authorities in charge of the colonies faced the task of harnessing necessary skills where they existed, and

developing them where they did not, in the first big (involuntary) wave of European immigration.

The only development of recent years which could be seen as creating a new boundary issue has come on the supply side with the emergence of education and training as an export industry in their own right. Now that many universities have set up offshore campuses to serve offshore populations, and Australian-based educational establishments at several levels in the system are increasingly needing to adjust their offerings and capacity planning to the demands of overseas labour markets, a genuine question arises over how much of this new activity can properly be attributed to the Australian skilling system. However, it is too early to say whether this issue will reach the scale where it seriously affects the definition or coherence of the system.

A more fundamental response to the original objection is that the concept of national skilling systems has been developed, on the analogy of national systems of innovation and production, precisely to explain why there are limits to the globalisation of the market for skill. Both these latter concepts are intended to demonstrate how and why some countries are better than others at producing certain kinds of good or service, organising work in particular ways, or generating and sustaining certain types of innovation, and hence why such activities tend to cluster in those nations even where costs and technical feasibility would seem to make it practicable for them to be much more widely diffused. In the same way, the NSS model explains why, in some nations at least, certain types of skills are uniquely likely to be developed and/or fully utilised, so that these nations come to specialise in kinds of work which depend on those skills, and holders of such skills tend to gravitate to those countries. Thus, provided a nation can establish a unique and relevant skill-based advantage, globalisation trends will work to its net advantage.

The conditions of sustainability for that unique advantage are the same as for the mix of resources needed by a firm to achieve sustained competitive success: it must be valuable (i.e. relevant to the emerging world market opportunities), coherent (effective at coordinating complexity), path-dependent (firmly enough grounded in distinctive features of that nation's history, culture and institutions to resist economic shocks and short-term political pressures) and difficult to imitate, and there must be few or no close substitutes (i.e. other nations must not be able to attain the same competitive advantage by different paths).

Complexity in particular is a much more important isolating mechanism for nations than it is for most firms, given that national economies consist of a diverse portfolio of economic activities. Hence skilling systems that establish a distinctive competitive advantage tend to be based on synergistic combinations of a great many factors spread across the entire system. One of the best demonstrations of this has already been given in 2.2.3.3 above, where it was explained how the success of the German Dual System relied on a very specific combination of features drawn from that country's governance system, business law, financial system, industrial relations system, occupational hierarchy, culture of government-business relations and broader cultural values regarding such things as the role of competition, the work ethic and the value of education. Other examples have been described, especially in the systems of production literature, which offer even greater complexity. For example, Fujimoto (1994: 18-20) lists no fewer than 24 interacting work practices, each with its own jargon term, which contributed to the success of the production

model followed in the Japanese car industry in the 1980s, supported in turn by seven synergistic HRM practices.

Difficulty of imitation is, of course, not enough in itself to ensure sustainable competitive advantage. Causal ambiguity can be a weakness if it leads to lack of strategic coordination or common purpose. Institutional path dependence is at least as likely to be a weakness as a strength: an example would be Australia's historically entrenched culture of highly adversarial industrial relations which, despite some encouraging progress in the late 1980s, seems to have been partly instrumental in ensuring that high-productivity work practices never really gained traction in Australian manufacturing. The output of an NSS also has to be relevant to a continuing and preferably growing need in the international market; this is the problem alleged previously with the German Dual System, as its distinctive strength in "incremental customisation" has been partly superseded by new technologies of "mass customisation" which require a different type of skill base. Finally, the risk of substitutability may well be greater for national systems than for firms. An example is how it was commonly assumed, less than two decades ago, that Korea and Singapore could not catch up with the strength of Europe and the US in leading-edge electronic industries because their education systems, based on rote learning and deference to authority, did not develop a sufficiently innovative mindset. Yet experience shows that both have caught up with, and in Australia's case comfortably passed, that lead by a quite different route, aided in large part by exogenous changes in technological capability.

Hence it is not enough to establish that a nation has a distinctive skilling system which is internally coherent, congruent with its history and institutions, and difficult for other nations to copy. Before such a system can be viewed as a source of international competitive advantage and a hedge against destructive globalisation, it needs to be rigorously evaluated on its other dimensions of sustainability. In particular it needs to be evaluated for its dynamic capabilities, i.e. whether it creates an adequate capacity to adapt rapidly and stay (or move) ahead as the environment changes. The empirical section of this thesis is intended as a first step, albeit a very modest one, towards that evaluation.

However, the reason globalisation has not been empirically tested as a driver of change in this thesis is a more prosaic one. There is general agreement that globalisation affects some kinds of domestic economic activity more than it does others. In particular, it is least likely to affect those types of activity where the economies of scale do not support the development of an international market, where the costs of moving a process offshore are high in relation to the total value it adds, where there is no suitably skilled and underutilised workforce available in other countries to take over the work, where regulatory barriers continue to protect local jobs, or where proximity between the provider and the customer is essential to the effective delivery of the product or service. Taken together, those variables do not co-vary in any meaningful way with the level of skill required, and hence the aggregate impacts of globalisation on a domestic economy are unlikely to be skill-biased, at least over the relatively short period covered by this research.

Shah and Burke (2003), following on work previously done by Maglen (2001), made one of the best recent attempts to model this aggregate impact. They divided the Australian workforce into three categories: globally advantaged, insulated occupations, and vulnerable occupations. Each group was predicted to suffer different impacts from globalisation, but even there some of the outcomes they predict are counter-intuitive, with the "vulnerable" group expected to have a higher annual replacement rate for the period 2002-06 than the

“globally advantaged”. This apparently contradictory result is the net product of long-term changes in the occupational balance of the economy and short-term labour turnover (Shah and Burke 2003:4). Even within each broad group there is a mixture of high- and low-skilled occupations: for example the insulated category includes both low-skilled retail and service work and occupations like health and education professionals which lie right at the top of the skill scale.

As a consequence of these conflicting imperatives, little consistent pattern appears in the predicted effects of globalisation on the aggregate demand for skill. Thus, the highest growth rate was predicted in the lowest-skilled sector of the insulated group, whose share of new job openings was projected to reach 23% by 2006 despite this sector representing only 14% of all employment in 2001. The only other sector whose 2006 new vacancy rate was expected to exceed its share of employment in 2001 is the “globally advantaged (conceptual)”, mostly consisting of business-related occupations.

Given that these projections cover almost exactly the same period as the run of data used in this research, it is hardly surprising that exploratory analyses were unable to find any clear evidence of a globalisation effect in the change in the skilfulness of Australian jobs that took place over the five years. It is always possible that such an impact will become apparent when there is a longer run of data. It may even be that the evidence is there already, but remains hidden because of the limited amount of disaggregation that can be reliably achieved with a sample of this size. But taken together, the practical and theoretical considerations meant that the issue would not repay the effort of serious empirical investigation at this stage in the research, and using the evidence currently available.

## 2.4. Tracking the state and evolution of an NSS

Traditional approaches, as noted above, have viewed the skill endowment of an economy in terms of a stock, whether of persons holding particular levels and types of qualification, or of persons employed at different levels in the occupational hierarchy which are seen as representing discrete levels of skill. Skill shortages are seen as an imbalance between that stock and industry's current demand for each type and level of skill. Both the “stock” of available skills and the “stock” of demand are seen as measurable. The goal of policy in this view should be to adjust the size and composition of the skills stock – preferably in an anticipatory way, to compensate for the adjustment lag - until it matches the “stock” of demand, now or at some point in the future. This was essentially the philosophy behind manpower planning in the postwar decades.

In the dynamic perspective that has been presented in this chapter, the difficulty with this approach is that neither demand nor supply will stand still while the other is adjusted. Each is in continual, non-linear adjustment to imperfect signals about the state of the other, with the intermediary and partly independent mechanism of deployment as a further confounding factor which needs to be described and tracked in its own right. More importantly, neither demand or supply will stand still to be measured. The constant metamorphosis of latent into manifest demand raises the issue of whether the former or the latter should be measured, and if the former, how. Given that disequilibrium is an inherent characteristic of an NSS and point-in-time estimates of either demand or supply are likely

to be obsolete even by the time they are formulated, it makes more sense to measure something that moves than something presumed to be static: a flow rather than a stock.

The proper object of such tracking exercises is best described as a *skill trajectory* (Wilson and Hogarth 2003: 9). While Wilson and Hogarth argue that “trajectory” should be preferred over the earlier term “equilibrium” because of the latter’s perceived connotations of stability or stagnation, they also suggest that a skills trajectory is most informatively defined in terms of an equilibrium state towards which the system is currently trending, even if it never actually reaches that state (cf. Freeman and Louça 2001, who develop the parallel concept of a technological trajectory). Indeed, the situation described as an equilibrium by Finegold and Soskice and their successors can equally well be defined in dynamic terms as a particular sub-class of trajectories taking the form of a vicious or virtuous circle, whereby a consistent set of self-reproducing incentives results in the repetition and/or amplification of certain behavioural patterns until such time as the cycle is disrupted.

Two strategies are available for defining and tracing a skills trajectory. Perhaps the more straightforward is to measure and follow the evolution of the enabling and constraining conditions that shape the behaviour of the system. Given an adequate model of the causal factors that drive the system, it generally proves much more practicable to find hard evidence of change in such things as institutional settings, product strategies and work organisation which can be taken as predictors of change in the core workings of the system than to observe or measure those workings in their own right. A large body of literature now exists describing the results of such exercises. To cite three papers that exemplify different possible focal points:

- At the level of high-order or meta-institutions, Brown (1999) suggests that the capacity of a nation to move to a high-skill economy can be mapped through four “pressure points”: the relationship between the state and the market, how the capacity for skills upgrading is embedded in the economy, the balance between positional competition and social inclusion, and the relative importance of individualism and collective action. He does not propose a specific methodology, suggesting instead that this kind of study should be on the agenda for future research;
- Focusing on institutional influences on deployment and their consequences for innovation styles, Arundel, Lorenz, Lundvall and Valeyre (2006) draw on data from the European Survey of Working Conditions to map national influences on work organisation across the fifteen “old” EU countries, in a framework built around two polar models of organisational innovation: lean production and discretionary learning;
- Del Bono and Mayhew (2001) seek evidence on a key determinant of demand through a systematic review of studies using diverse methodologies to measure the relative “specification” of British products.

The weakness of such approaches is that their credibility relies on that of the model which informs the research. If that model comes under challenge, the only way of defending its adequacy as a means of determining the state and trajectory of the system is to identify changes in the outputs of the system corresponding to those which the research has

identified in the presumed causal factors. This alternative and complementary version of the skills trajectory as a trace of the system *outputs* represents the second of the possible approaches to the tracking problem.

If one assumes the key output of the NSS to be productivity, the data requirement is readily enough met (albeit still with methodological and definitional issues) by National Accounts and similar statistical collections which measure economic output at regular intervals and in great detail across industries. Productivity then represents a relationship between the value of output at a given time and the combined value of the different factors – notably capital and labour – employed in economic activity at that time. In the classic type of growth accounting analysis (Solow 1956), weighted growth rates of the capital stock and employment are subtracted from GDP growth, allowing the contribution of the skilling system (conceptualised in this approach as human capital) to emerge in the form of a residual representing total factor productivity (TFP) growth. The difficulty is that this residual includes the impact of several other factors besides skill, notably technological change and knowledge, and there is no reliable means of isolating the specific contribution of skill to TFP. This lack of clarity about the composition of Solow's residual led Abramowitz (1956, cited in Verspagen 2005: 490) to characterise it as “a measure of our ignorance”.

While overall output and productivity statistics remain important to the analysis of the NSS, if only as a gross check and for the purposes of international comparison, it must be remembered that productivity represents a second-order output of the system. The first-order output, as the system has been defined in this chapter, is something much more specific: the amount of skill converted into productivity, viewed independently of the actual quantum of productivity that results. To capture this, it is necessary first to reach an estimate of the amount of skill exercised, across the economy, at the point where it is converted to productivity: that is, at the moment of deployment. Movements in this figure, both as an aggregate and in terms of its distribution across industries, skill categories and the workforce, can be seen as the purest measurement of the skills trajectory of the national economy.

This thesis rests on the proposition that such a construct can be estimated, not in an absolute sense at any point in time, but with sufficient reliability to capture movements across time. Before this can be attempted, however, it is necessary to find a neutral metric for skill that can be applied consistently across industries, skill types and levels in the workforce hierarchy. This is an exceptionally challenging problem in itself, and as such will form the subject of the next chapter.

## 2.5. Summary

This chapter has developed a model of a national skilling system (NSS) as an aid to understanding the complex, multilateral interactions which go into the creation and application of skill in the national economy. The model derives from a large and diverse body of systems theory which has not previously been applied to skill, but more specifically from models of innovation systems found in the innovation literature which are broadly comparable in scope and in the types of interaction they cover.

The systems approach is a useful tool of policy analysis because it counteracts the common tendency in skills policy to concentrate on the supply side, when many of the problems actually experienced are matters of demand constraint or suboptimal labour utilisation which cannot be effectively addressed by supply-side remedies. A system model has the potential to pinpoint the most important impediments to the development and application of skill and identify the areas where policy interventions are most likely to be effective.

Although the equilibrium models traditionally used by economists can fulfil the same function in many cases, the systems approach offers several significant advantages in explanatory power, while still drawing on much of the same theory and empirical evidence. Notably, it provides a more elegant framework for incorporating the dynamics of lagged feedback, the emergent nature of much work-related learning, and the role played by influences and motivations which do not fit easily into the economist's concept of rational maximisation. It takes better account of the contribution of labour deployment, which is often overlooked in conventional supply-demand models. A system model also provides a different perspective by viewing the system as inherently dynamic and unstable rather than driven by a tendency to stabilise in an equilibrium state.

It should be understood, however, that the model developed here, like any other systems model, is just that: a model. It does not purport to be an accurate or exhaustive account of something that exists empirically in its own right. It is an abstract conceptual framework overlaid on consciously selected elements of a much more complex and unknowable reality as an aid to making sense of it. The choice of elements in the system is ultimately arbitrary and determined by the observer's interests. The "fit" of the model is a matter of its explanatory power rather than of empirical validation or – importantly – predictive power. In this last respect the model outlined here differs from some earlier types of simulation model in the system dynamics tradition.

The function of the NSS, as it is defined in this model, is to ensure that an optimal amount and mix of skill is converted into productivity, having regard to the other properties of the economy at each point in time. Its core dynamic involves the three key processes of supply, demand and deployment, which interact continuously and reciprocally. These incorporate a range of subordinate processes and practices including recruitment, formation, updating, upgrading, retention and allocation under the heading of supply, and work/management practices, work organisation and organisational forms under the heading of deployment. The system is constantly evolving, with one of the key dynamics on the demand side being the transformation of latent into manifest demand.

Another critically important feature of this model is the role played by national institutions in enabling and constraining the behaviour of actors. Institutions are relatively persistent and pervasive features of the system environment, and the coherence of the system depends largely on their complementing one another. They are difficult to change, and widespread and unpredictable consequences can ensue if they are forced to change. Nevertheless, major dysfunctions can occur in the NSS if any of the institutions become inappropriate to the environment or cease to be complementary, and in such cases it is necessary for policy to focus on adapting them to present requirements. The most important institutions for the NSS are the education, VET and industrial relations systems, labour markets, the occupational hierarchy, the employment contract and the commonly held values that shape managerial culture. Other important institutions that influence the system but straddle its boundary are the financial system, the science and technology system and the knowledge

system. In this model the institutions interact with the actors in the system through institutional agents, real individuals and organisations who embody them (as in the colloquial sense of “institution”). This construct is unique to the present model.

It is not possible within the time and resources available for this thesis to apply the model comprehensively to the Australian economy. For the purposes of defining a manageable empirical component, this thesis will concentrate on tracking the key output, the amount of skill actually deployed in productive activity, over the six years from 2001 to 2006 for which suitable data are available.

## Chapter 3

### Problems with the measurement of skill

The central problem in this chapter is to develop a means of measuring skill in order to map the trajectory of Australia's national skilling system as it was defined at the end of Chapter 2. Consistent with the requirements identified in Section 2.3, six criteria need to be satisfied for a metric to serve this purpose effectively:

- (i) to capture accurately the amount of skill present in the economy, it must be truly generic and sufficiently inclusive to capture skill in all its relevant dimensions without over- or under-counting any type of skill;
- (ii) conversely, to avoid biasing the calculation or diluting the model with irrelevant considerations, it must exclude constructs which are related to skill but not the same thing;
- (iii) it must measure skill directly, rather than through proxies;
- (iv) it should if possible capture qualitative as well as quantitative variation;
- (v) it must be both conceptually and practically feasible to measure;
- (vi) it must be compatible with at least the most relevant literature and prior research and if possible allow meaningful comparison with data gathered in the past.

This is a demanding set of requirements, which ultimately cannot be fully met using the data resources available for this thesis. The chapter works through these aspects of design in roughly the order listed, ending with the specification of a composite metric that comes closest to satisfying them all. However, before any of these issues can be addressed, there is a need to achieve clarity on the underlying question of what is meant by "skill".

The discussion in Chapter 2 could be read as implying that skill was an unproblematic concept and its meaning was generally agreed. In fact, the concept of skill is one of the most contested in the social sciences. Lowry, Molloy and McGlennon (2008: 10) describe it as "elusive and difficult to define". The authors of the British research which forms the most important reference point of this thesis note that

Despite the enormous interest in how skills in Britain have changed over time, how they are distributed, and how these trends and patterns compare with competing nations, there is surprisingly little agreement on what 'skills' actually refer to. In practice, different authors often refer to different aspects of skill and are influenced by the theoretical standpoint from which their interest in the phenomenon stems. This variety is evident from the empirical evidence on skills patterns, trends and future trajectories...

(Felstead, Gallie and Green 2004: 149)

Important debates have run for decades, and in some cases centuries, over such basic issues as what skill is, where the boundaries of skill should be set, what makes some skills “higher” than others, how skill contributes to economic outcomes and, critically for present purposes, how skill can be generically measured.

Consequently, this chapter begins by looking briefly at the range of meanings attached to skill and their respective relevance to economic and social issues. This discussion is necessary not just for the pragmatic purpose of defining an object of measurement and a means of measuring it. It is equally critical to the definition of the NSS, since one of the most important boundary issues in defining the system itself is where to set the boundaries of skill. Hence the discussion will go into implications of different definitions of skill and how they affect the working of the system, sometimes to an extent that would not be necessary for the strictly practical purpose. This part of the discussion should be seen as referring back to, and clarifying, the issues raised in Chapter 2, even as the more practical parts look forward to the later empirical chapters.

### 3.1. Defining skill

The degree of uncertainty that exists about the meaning of skill is evidenced by the absence of a universally accepted technical definition. The ABS includes no standard definition of “skill” in the glossaries for its statistical series on training, nor does the OECD in its macrothesaurus. Other reputable sources which use the word as a high-level descriptor show subtle variations which suggest somewhat different interpretations of what it covers. The US government’s ERIC thesaurus refers to “complex mental and/or physical behaviors that require practice to be performed proficiently”. The ILO thesaurus speaks of “an acquired and practised ability to carry out competently a task or job, usually of a manual nature”. In Australia, the VOCED thesaurus developed by the NCVET defines skill as “the ability to perform a particular mental or physical activity which may be developed by training or practice”. Bullard, Capper, Hawes, Hill and Tustin (1995: 2) refer to a definition that allegedly goes back as far as Plato: “becoming adept at doing something by the application of knowledge refined through experience”.

Such definitions are primarily concerned with distinguishing skill from related concepts such as knowledge, aptitude, personal characteristics, attitudes, qualification and competence. As such they will be covered below under the general heading of boundary issues. A second, more intense and politically charged debate relates to philosophical questions about the nature of skill, how it is developed and exercised, and the characteristics that make one skill more valuable than another. That discussion goes back at least as far as Adam Smith:

The policy of Europe considers the labour of all mechanics, artificers, and manufacturers, as skilled labour; and that of all country labourers as common labour. It seems to suppose that of the former to be of a nicer and more delicate nature than that of the latter... but in the greater part it is quite otherwise, as I shall endeavour to shew by and by.

(1950: 103)

That debate about the distinction between skilled and unskilled work, and latterly between higher- and lower-skilled work, has been central to industrial relations for at least 150 years, though its antecedents can be traced back to the Middle Ages. A related controversy, over whether skills are destroyed or enhanced by technological change, has been running since the Industrial Revolution and has regained prominence since the 1970s in the deskilling debate which is reviewed in section 5.1 below. In recent decades, public discourse over the role of skill in the economy has run through a succession of changes in what counts as skill and what skills matter:

- Up to around the 1980s, discussions of skill usually centred around credentialled trades-level or professional qualifications, or else around generic practical skills, mostly aspects of literacy, numeracy and reasoning ability, which the education system was expected to produce as a foundation for formal technical training or on-the-job learning.
- Subsequent theories of high-performance organisations or economies often focused their attention on highly evolved workplace skills at the intermediate level between trade and professional (Finegold and Soskice 1988) or at the advanced professional level (Finegold 1999); this line of thought also shifted its attention away from standardised, accredited skills towards specialised skills which differentiated a firm from its competitors and hence represented a source of competitive advantage.
- Almost simultaneously, however, active labour market policy began to be structured around the thesis that youth unemployment occurred because school leavers lacked “foundation skills” or “employability skills” (DEST/ACCI 2002). The emphasis of labour market programs during the 1990s, in both Australia and the UK, shifted strongly towards the development of low-level, highly generic and often ill-defined skills through short pre-employment training packages.
- Since the mid-1990s the demand from employer organisations, and increasingly the strategic focus of the training sector, have gravitated away from strictly practical skills and towards “soft” skills. These have been defined as including not only more or less tangible capabilities such as communication and reasoning, but things like “teamwork skills”, “customer orientation” and even “aesthetic skills” which had seldom previously been recognised as subjects for training in their own right (Grugulis, Warhurst and Keep 2004; Borghans et al 2001).

### **3.1.1. The multiple dimensions of skill**

These changes illustrate a central characteristic of skill which complicates its measurement: its *multidimensionality* (Spenner 1990: 402). Boundary issues imply that there are some things which it is correct to classify as skill, and some which it is not. Multidimensionality means that there is a multiplicity of ways, both of defining skill and of distinguishing one skill from another, all of which are correct, but in different contexts, and depending on the purpose for which skill needs to be described or classified. So for example, the same set of skills can be described and ranked with equal validity depending on whether they are:

- simple or complex;
- entry-level or advanced;
- manual or cognitive;

- technical or behavioural/interactional (“hard” or “soft”);
- attributes of a person or aspects of a job;
- based on formal or tacit knowledge;
- generic (portable) or specific (whether to an industry, an occupation, a firm or an operation);
- codified and accurately repeatable, or adaptive and responsive;
- practised by an individual or in conjunction with other people.

Each of these dimensions, as argued in the quote from Felstead, Gallie and Green at the beginning of this chapter, is associated with a different philosophical, economic or political tradition, controversy or position. Each relates to a particular set of strategic or policy challenges. Each provides its own distinctive set of criteria for judging one kind of skill to be more valuable, or more suited to a given need, than another. Moreover, what constitutes centrally relevant information for studying one dimension often functions as “noise” for the study of other dimensions. Aside from the measurement issue, there needs to be clarity about the dimension which is of interest in any discussion of the impact of social, economic and technological change on skill if different players are not to end up arguing at cross purposes.

In fact, it is just this characteristic which lies at the heart of the measurement problem. On the one hand, to measure the full range of skills with equal validity, a metric needs to be “blind” to as many as possible of the dimensions in order to minimise conflict of criteria, or at any rate externalise any such conflict to a point in the discussion where the measurement has already occurred (i.e. we all agree on what we’ve measured: now what does it mean?). So the chosen criterion must not effectively over- or underestimate the incidence or other measured qualities of any one skill because of where it lies on an irrelevant dimension. On the other hand, to capture any element of variability (even if just in quantity) a metric needs to privilege at least one dimension which can provide the criteria for assessing variation. In keeping with the concept of multidimensionality, the choice of the dimension from which to derive the metric must be driven by the purpose for which the measurement is being undertaken.

Thus we arrive back at the position where there is no single correct metric, but rather a choice of dimension-specific metrics each of which is best (though seldom perfectly) suited to a different purpose. Economists often use the costs incurred in training and the returns to the individual in higher wages, and/or treat the same wage margins as a proxy for skill-related productivity gains; educational planners view the object of interest in terms of years and type of education and training; workforce planners measure numbers of people in the workforce holding different levels of formal qualification in different occupational specialisations. Some of these may serve as proxies for the true object of interest in another application, but such proxies generally meet the need imperfectly. This issue is taken up again in 3.3 below.

To take the most obvious example, one of the key dimensions in which skills vary is their technical content. If the task is to choose a single indicator with which to track the overall skill trajectory of an economy, that metric cannot be concerned with the technical dimension because there is no single indicator that can impartially capture the core technical content of each skill or skill set, e.g. no common basis for comparing the amount of skill exercised by a banker with that exercised by an instrument-maker, at least so far as the occupationally specific content of each kind of work is concerned. Common

characteristics could be abstracted from each type of work to provide the basis for a neutral metric (e.g. complexity, need for precision, amount and scarcity of the specialist knowledge required), but the very act of abstracting them from the whole deprives each skill of the thing that makes it distinctive on the dimension of technical content.

A more complex example concerns the way skills are viewed and valued. Researchers who have studied the deskilling debate and the associated issues over the last 25 years have generally concurred that two dimensions are of primary interest: the socially constructed dimension, and the dimension of where skill is located – in the worker or in the job. The first – one of the outstanding cases of “noise” – is treated in 3.2 as an important factor influencing the definition of one skill as “more” or “better” than another. The second will be discussed immediately below because of its implications for the deskilling controversy and for the conceptual basis of this thesis.

### 3.1.1.1. The locational dimension

This dimension starts from the question: where does skill reside? Traditionally, there were two ways of answering this question. One saw the skill, once acquired, as being the property or an attribute of the trained worker. The other viewed skill as something linked to a particular job, i.e. a job could be viewed as a particular cluster of competencies being exercised in a defined context (Spenner 1990: 400; Lowry et al 2008: 10). Obviously both definitions hold good to some extent in any individual situation, but the implications arise from placing the greater emphasis on one or the other.

While no standard names exist for these competing definitions, it is convenient for the purpose of this thesis to coin two specific terms. *Embodied* skill will be used here in the sense of “embodied *in the person* who exercises it”: the trained worker is viewed as a set of embodied skills that can move from one task or job to the next. *Embedded* skill will be used to describe the concept of a skill as embedded *in the job* and relevant primarily to that job, so that the worker needs to acquire it as and when needed to practise that job.

The first definition is central to the classical economic view of skill, typified by the human capital tradition which sees skilling as an investment undertaken by individuals that results in future gain for the worker and productivity for the employing firm. The second is more characteristic of the sociological tradition in which jobs were seen as the contingent products of social forces (work organisation, hierarchy, job design) rather than objectively optimal, efficiency-driven mechanisms for deriving productivity from skill (Lowry et al 2008: 10; Spenner 1990: 400). Beyond this historical dimension, the distinction explains the rationale behind different approaches to deployment. One important example is the way different types of labour market affect skilling practices:

- Embodied skills are central to the functioning of *occupational* labour markets where a worker acquires, through a combination of training and on-the-job learning, a common set of skills which are useful across a range of employers, and might well utilise a different subset of them with each employer.
- A concentration on embedded skills can also lead to the career development of individual employees, but in this case through the mechanism of *internal* labour markets, represented at the most elaborate level by the traditional Japanese model where workers within a firm are not classified or paid according to fixed

occupational categories or levels, but start at a more or less common point and acquire skills progressively over an extended career with the same firm, in line with their emerging aptitudes and the firm's evolving skill requirements. An employee under such arrangements may well acquire a diverse and sophisticated skill set, but it will have little market value outside the home firm or its satellite companies (Lazonick and O'Sullivan 1994: 34) because the content and mix of skills is so precisely attuned to that firm's distinctive product lines, equipment, work practices and corporate culture.

- In less skill-intensive industries, however, a view of skills as being primarily embedded is more likely to encourage the development of what Buchanan et al (1994) describe as unstructured external labour markets, where there is little incentive to develop a lasting skills base in the workforce, but instead employers either train for specific skills opportunistically, or buy them in from outside providers of specialised labour as and when a need arises.

These market types are explained at a more fundamental level by the implications of each view. Embodied skills are a kind of potential which an employee brings to a firm. Because that potential is to some extent unique to each worker, it may represent an opportunity for the firm to do things it could not do before, or to do them in different ways. Thus there may be a benefit in the job adapting to the individual who is employed to do it – what Miner (1987) and Jovanovic (1979) describe as “idiosyncratic jobs”. Embedded skills, because they attach to a job rather than a person, are seen as lending themselves to substitution. They can be outsourced to specialist labour providers, or “insourced” to an in-house specialist who is available on call; they can be converted into a detailed step-by-step protocol or script to be applied by rote, removing the need for knowledge or discretion on the part of the worker; or most commonly, they can be built into production machinery or office technology. This makes it possible to “design the skill out of a job”, a concept that can be made to appear in a more favourable economic light than deskilling a worker, with its implications of investment gone to waste, as the embodied model of skill would picture it.

However, these two alternatives do not exhaust the locational possibilities. Some skills may be embodied in collectivities rather than individuals. An example is teamwork: a specific team that has worked together for a long time may have developed methods of interaction that work especially well for that specific team, but do not necessarily represent transferable teamwork skills for its individual members. A different kind of example would be traditional artisanal communities (the Oneida silversmiths, Shaker furniture makers, the northern Italian tile industry) where shared tacit knowledge of design and production methods is part of the community's distinctive competency profile.

Some theorists of organisational learning have posited a more central or even exclusive role for collective skill. Penrose (1959) saw it as the essence of an organisation that

People contribute labour services to the firm, not merely as individuals but as members of teams who engage in learning about how to make best use of the firm's resources – including their own... this learning endows the firm with experience that gives it productive opportunities unavailable to other firms...

(quoted in Lazonick 2005: 32).

Similarly Capper, representing the school of Cultural-Historical Activity Theory, argues that skilling and expertise occur

within an 'activity system' consisting of the individual, co-workers, the workplace community, the conceptual and practical tools available and the shared objects of the whole system... [W]ork, cognition and expertise are... socially distributed through groups... the consequence of participation in the activity system as much as... the result of individual effort... [C]ompetence in such settings... cannot be understood as an individual attribute.

(1999: 7)

He argues that this kind of collective skill is especially important in work environments characterised by uncertainty and complexity (in the technical sense of the word), whereas the traditional idea of individual skill or expertise, definable in isolation from its context, is appropriate to more traditional, routinised kinds of work undertaken in stable environments.

Skills of this kind could thus be seen not just as embodied in the collectivity, but equally as embedded in the activity system. They are more commonly assigned to a third category known as *situated* skills (Rogoff and Lave 1984; Lave and Wenger 1991). The main proponents of this concept are the organisational learning school which traces its roots back to the pedagogical theories of Dewey and Vygotsky (Bullard et al 1995; Brown and Duguid, 1991). With its emphasis on the collective nature of both workplace learning and the exercise of skill (or "expertise") in the work process, this school rejects the concept of skills as unitary, repeatable, or susceptible of being defined in abstract terms, subdivided into standard competencies, embodied sustainably in the person of the individual expert, or transferred from one person to another by training. It views expertise as a product of collective interaction – the learning that occurs in the work process, and feeds into more effective performance of work, is specific to the circumstances of the individual work process, the persons who participate in it, and the histories of both. Consequently, this current of thought tends to dismiss skill as a schematic or bureaucratic concept, treating the learning process as its real object of interest.

Thus the dimension splits into three options or perspectives:

- *Embedded*: the skill resides in and is definable with reference to a job or class of jobs. Any person with the necessary aptitude can be trained in the specific set of skills relevant to that job and will then be competent to perform it, irrespective of what other skills s/he might or might not possess. This concept of skill is implicit in Taylorism, in Just-in-Time training, in most kinds of emergency government intervention to address current skill shortages, and in the kind of highly structured approach to training commonly practised within the Strategic Management paradigm, where training is provided only if it is demonstrably relevant to an operational need identified in the current business plan;
- *Embodied*: the skill resides in the individual, as part of a unique and complex capability profile, is (or ought to be in an efficient labour market) developed as the individual moves from one job to the next, and forms part of the value that individual contributes to each successive employer. This concept underlies most

traditional long-cycle trade and professional training, but at the other end of the prestige scale it also underlies the definition of basic “employability skills”;

- *Situated*: skill is developed through the interactions of a particular group of workers facing a particular task in a particular environment. It builds on the capabilities and knowledge which each member of the team brings to the task, but in the process of its development new capabilities and new knowledge are created which adapt those prior endowments to the specific needs of the task and the environment, and in turn, as they evolve, may help to re-shape both the task and the environment. A set of skills developed by one team in one context cannot be precisely reproduced in a different context or with a different set of players; or if it is, the results are likely to be suboptimal or even dysfunctional. This concept is fundamental to learning organisation philosophies, but also an element in some models of regional economic competitiveness, notably the “learning regions” model.

These three modes are essentially different ways of looking at skill, rather than objective characteristics which attach invariably to a given set of skills<sup>1</sup>. From a measurement perspective, the most important implication is that any metric chosen to track the overall trajectory of the system must somehow capture all three of these types without privileging any one, since this dimension represents an essential focus for making sense of the resulting data. At the same time, it effectively poses the question of what to measure: the skill of the worker or the skill requirement of the job? This apparently insoluble problem is addressed in 3.4 below.

### **3.1.2. Boundary issues**

Boundary issues have different consequences for measurement. Multidimensionality implies that any common metric has to be inclusive and not deny any skill or skill set the status of skill simply because of where it stands on one of the dimensions of skill other than that chosen to provide the metric. It provides a pragmatic means of sidestepping the persistent controversies about the nature of skill in order to secure broad agreement on a common object of measurement. Boundary issues centrally concern the issue of what is and what is not skill, and hence determine what that metric should capture and what it should exclude. Distinguishing skill from non-skill is the most essential step towards reducing ambiguity over what is being measured, but for just that reason it is potentially more controversial than multidimensionality, since different schools of thought have views on the subject that are not easily reconciled.

The argument put forward below concerns four aspects of work-related competence which need to be distinguished from skill in the strict sense: aptitude, learning, knowledge and culturally or organisationally appropriate states of mind. The extent of disagreement among experts is such that there is little likelihood of any of these issues being conclusively resolved to everyone's satisfaction. So the purpose of this discussion is simply to map out

<sup>1</sup> This classification should be distinguished from “fit” models such as that of Boyatzis (1982, 2008) which defines competence in terms of three intersecting domains - individual abilities and characteristics, job demands and organisational environment - with a “sweet spot” where the three intersect which represents the ideal employee. This model resembles the embodied mode in that it sees the individual's competence as consisting in an amalgam of skill, life history, values and personality traits, while the “sweet spot” concept at first sight bears some resemblance to situated skill. However, this model differs radically from the one set out here in that it denies the agency of workers in shaping the nature of the job, instead seeing the second and third domains as givens with which the individual has no choice but to fit in as best he can. Thus it really represents an extreme version of the embedded mode.

the contours of disagreement before trying to find a working compromise that makes it possible to define a measurable object of study.

The first three are problematic because they are all acknowledged and possibly indispensable contributors to skill, so that the boundary problem lies in deciding how and at what point one moves beyond any one of these things and into the specific domain of skill. The fourth invites controversy because of the way such attitudinal characteristics have come to dominate public discourse on skill over the last decade under the guise of “soft” or “generic” skills. Once again, this question is one of degree, since a wide range of behavioural or interactional capabilities have long been regarded as legitimate aspects of skill, and the dispute simply concerns the extent to which it is admissible to extend the definition into what were previously regarded as matters of personality, organisational culture or even managerial effectiveness.

### 3.1.2.1. Skill or aptitude?

One common element is evident in the four definitions of skill cited at the start of this section: “complex mental and/or physical behaviors that *require practice* to be performed proficiently”; “an *acquired and practised* ability to carry out competently a task or job, usually of a manual nature<sup>2</sup>”; “the ability to perform a particular mental or physical activity which may be *developed by training or practice*”; and “*becoming adept* at doing something by the application of knowledge *refined through experience*”. Emphases have been added to show the common element: skill is viewed in all four definitions as different from an innate ability (e.g. dexterity, intelligence, perfect pitch), a physical characteristic (e.g. strength, beauty) or a personality trait (e.g. cheerfulness, liveliness, courage) in that it has to be *developed* before it can exist at all. The development can be a long or short process, it can consist of formal training, experience, self-directed reading, observation or practice, but some kind of learning process has to be involved.

By contrast, innate abilities and traits – *aptitudes* - can be further developed, but only on the base of a pre-existing characteristic. In such a case, that further development could legitimately be defined as skill, but the innate characteristic could not. Conversely, aptitudes may remain latent for many years or even a lifetime unless learning is applied to turn them into a useful skill.

A skill, in this definition, is an outcome of *learning*, even if that learning requires some of those unlearned characteristics as a foundation. Where a skill relies on an innate attribute, no amount of training will enable someone who lacks the necessary attribute to acquire that skill; but it is the learning that *constitutes* the skill. For example, a skilled musician generally requires perfect pitch and a high level of dexterity (manual or vocal, as the case may be), but she cannot be said to be a skilled musician until she has learned to relate her innate pitch to the musical scale and her dexterity to the fingering of her chosen instrument. It is difficult to become a skilled footballer without strength, balance and dexterity, but the

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<sup>2</sup> The association of skill with purely manual competencies is uncommon today, and this qualification may reflect past usage where the distinction between “skilled” and “unskilled” work was applied predominantly to the trades level and below. It may also reflect the most intense philosophical treatment of skill in the last sixty years, that of Michael Polanyi (Polanyi 1969), which focused almost exclusively on manipulatory skills. Since the ILO thesaurus, from which this quotation comes, is the only international source among those cited here, it may be relevant that many European languages have no word precisely corresponding to the English usage of “skill”.

skill comes from knowing how to apply those attributes to the rules and tactics of football, and from developing them to fit those specific purposes through a great deal of practice. Certain jobs, notably in customer service, negotiation and personal services, are done more effectively by someone with good looks or a pleasant personality, but the skill in doing them lies in having learned, for example, to express a friendly disposition in a manner consistent with the social norms of the workplace environment, or to exhibit one's physical attractiveness in ways that are perceived as appropriate by the people with whom one interacts in the workplace.

### 3.1.2.2. Skill or learning?

Learning and skill are inextricably entwined concepts: a skill can be acquired without training, but it can never be acquired without learning. It would be very difficult to talk about skills – or at any rate, about the creation or enhancement of skills - without some consideration of the associated learning process. Much of the current literature on skills, especially in Australia, could in fact be more accurately described as a literature on learning, since its concerns lie with pedagogical, political and organisational aspects of VET. Alongside this literature, and operating largely in isolation from it, is the more theoretically focused organisational learning tradition (Bullard et al 1995; Brown and Duguid 1991). The latter generally avoids using the word “skill”.

Both these traditions, but especially the latter, tend to concentrate on the process or mechanics of learning at the expense of its outputs or outcomes, often reflecting the authors' background in pedagogical theory or cognitive psychology. While the learning process is self-evidently important to the precise type of skill that emerges from it, the *current capability* resulting from that process at any given point in time is what matters when, for example, a firm is assessing its recruitment needs or its capacity to engage in some kind of process innovation. Even when learning is created jointly and seamlessly with the production outputs of a work process, it makes logical sense to talk of the skill, as opposed to the learning, as the critical *input* to that continuing work process: the operational characteristics of that input matter independently of the process by which it came into being. This characteristic of skill, as an independently definable output of one process and input to another, suggests one basis on which the concepts of skill and learning can be separated without defining away their interdependence.

That in turn implies that a metric which concentrated too exclusively on individual learning would be biased towards the embodied aspect of skill and fail to capture the extent to which skill, as exercised in real work situations, is determined by production requirements, work organisation and work practices rather than by individual workers' capabilities – i.e. the embedded aspect. In system terms, that would mean the bias towards the supply side which is in fact evident in the VET literature and much of the current public discourse on skill. On the other hand, the organisational learning school, with its tendency to concentrate on the situated nature of learning and the specificity of each individual learning process, can sometimes create the impression that all the learning which really matters is too situated to be transferable. While much more defensible in system terms, a metric built around the situated model of skill would not adequately capture another very important dimension of skill, the spectrum of transferability which runs from the wholly generic (literacy, “employability skills”) through the occupationally specific, the industry-specific, the firm-specific and the process-specific to the genuinely situated, highly specialised skills developed by a unique team working on a unique project.

### 3.1.2.3. Skill or knowledge?

Another area of the literature which commonly omits skill as an object of study is the organisational knowledge tradition which matured in the early 1990s. Focused on the role of knowledge as a specific factor of production both at the enterprise level and across the economy, this tradition (Blackler 1993; Lam 2000; Nonaka 1994) has developed sophisticated classifications of knowledge types as a prerequisite to modelling the ways in which knowledge is created and deployed in work environments and contributes to higher-order outcomes. In effect, it comes very close to being a theory of skill, except that it subsumes skill within the broader concept of work-relevant knowledge. Similarly, the extensive literature on tacit knowledge which originated in the work of Polanyi has developed a concept very close to skill, but refers to it in terms such as “practice knowledge”, “procedural knowledge” (Anderson 1983, quoted in Nonaka 1994) or the transition from “knowing what” to “knowing how”.

Both literatures have shown that a theory which is effectively one of skill – in fact, a more enlightening one in some respects than much of the theory that expressly relates to skill - can be successfully articulated by broadening the definition of knowledge. However, the price of this semantic creativity is that the definition has arguably been stretched beyond most people's understanding of what knowledge is. Two characteristics in particular appear to distinguish skill from knowledge, at any rate as the terms are commonly used:

1. A skill implies a person to exercise it. *Definitions* of particular skills can be expressed in abstract form, but the essence of a skill lies in its exercise. Thus, skill can be *substituted* by other means of achieving the same cognitive or manipulative inputs, e.g. a machine, an instruction manual or a protocol, and can be said in a *figurative* sense to have been “built into” those things; but it cannot be actually *incorporated* into or *embodied* in them in the same way as knowledge. Knowledge which is not actually documented and is intrinsically hard to document or incorporate in a machine can still, in some circumstances at least, be shared or embodied in such things as routines or stories (Brown and Duguid 1991), and hence separated from the individuals or groups of workers who create or exercise it. Even wholly tacit knowledge has an ontological status distinct from the knower and also from its application, and hence can be conceived of in abstract terms, even if it cannot be satisfactorily articulated. Thus, organisations can possess knowledge in their own right and can appropriate the knowledge held or generated by their employees, but they cannot ordinarily be said to possess skill in the same sense; transferring the skill held by individual employees to the organisation can only occur through person-to-person transfer, and through the agency of the persons who acquire it.
2. Knowledge is a *component* of skill, but skill necessarily implies something more than just knowledge – the added component of the ability to *transform* knowledge into useful work. Effectively it requires a second transition on the part of the individual, from “knowing how” to “being able”. That explains the emphasis in the definitions quoted earlier on the role of practice in acquiring a skill. The more explicit kind of knowledge can be transferred to or shared with individuals as yet unknown by putting it into an encyclopedia or a set of instruction materials, but transferring a skill, however well codified, always requires some kind of training or

learning mechanism beyond simple encoding, even if it is just learning-by-doing. That is why skill, rather than just knowledge, is the output that matters when organisations make decisions about building the capability of their workforces, or about their capacity to undertake new kinds of activity.

#### **3.1.2.4. Skill or attitudes?**

The fourth important set of boundaries are those between skill and certain other determinants of effectiveness in the workplace which are not normally associated with individual learning, e.g. aspects of personality and corporate culture. As Grugulis, Warhurst and Keep (2004: 6-7) argue:

One of the most fundamental changes that has [sic] taken place over the last two decades has been the growing tendency to label what in earlier times would have been seen by most as personal characteristics, attitudes, character traits, or predispositions as skills... It is not that employers in times past have not wanted such qualities... It is just that managers then would not have thought of these as skills per se... [B]y the early 1980s employers had moved to describing behavioural characteristics such as reliability, stability of work record, and responsibility... under the banner of skill, and a lack of job candidates possessing such qualities constituted, from an employers' perspective, a skill shortage. Today these qualities... are indeed believed to be skills (usually generic) and are increasingly treated as such by policy-makers.

Borghans, Green and Mayhew (2001: 376) write:

A generation ago, the 'unskilled' manual worker might have needed to possess strength, stamina and fortitude. These attributes were not described as skills. Today the junior salesperson or call centre employee needs a different set of attributes – for example those necessary to communicate effectively with customers and to work well in a team. These are now described as skills and are embedded in many governments' definitions of "core" skills... this particular development is capable of causing serious confusion, because it implies that the rhetoric of policy (the high skills vision, the knowledge economy) could turn out to mean very different things to different people.

Up to a point, this issue is the same as that raised earlier about the boundary between learned skills and innate attributes. The distinctive issue arises when the definition of "skills" is extended to include forms of behaviour which were once thought of as being *outcomes* of a well-managed, well-functioning organisation. This is most apparent in a growing view of commitment and motivation as aspects of skill (Grugulis et al 2004: 12). In a survey of Australian employers carried out by the NCVET in 2001, the "skill" most commonly reported as "extremely important" or "very important" was "positive attitude toward work" (92%), followed closely by "professional approach to work" (90%) (Allen Consulting 2006: 54). When asked about the skills they found hardest to recruit, 51% of Victorian employers who responded to a survey conducted in 2005 for the Australian Industry Group (Allen Consulting 2006: 53) nominated "having a positive attitude to work" and 38% "pride in one's own work" – though interestingly, these things were described in the actual questionnaire as *attributes*.

A positive explanation for this shift is that developments in industry and the labour market since the late 1970s have led to a broader redefinition of skills across the board, reflecting a less stable technological, organisational and market environment and a consequent rise in the importance of adaptive and interactive capabilities, which are more likely to provide a return on investments in skilling in an uncertain future than the technical skills which were traditionally the focus of the formal training system (Capper 1999: 9). Lowry et al, in their interviews with representative employers about future trends in industry requirements for skill, were told that “the ability to gain a skill set, and then shed that as and when necessary so as to learn a new skill set is a crucial part of being in the electrical trades” (2008: 28). It has become increasingly common for employers to argue in their formal representations to government that they are perfectly willing to spend their own money to train their employees in the technical skills their business requires, so long as someone else (i.e. the public education/training system) can provide them with recruits who have the “right” attitudes.

An alternative explanation is that of Grugulis et al (2004: 7) who suggest that this change may indicate a growing tendency for employers to redefine aspects of *organisational* health as skills brought to the workplace by *individual* recruits, and to see the remedy not in a review of their own work organisation and managerial style, but rather in an improvement in the “output” of the public training system. In other words, the demands for “employability” skills signal a shift of responsibility away from corporate management to the state. If this view is correct, the danger is that skilling as an input to the economy will be expected to meet needs which it cannot possibly satisfy, and which can ultimately be resolved only by business adjusting its human resources strategies to the distinctive strengths as well as the perceived failings of a new generation of workforce entrants. If governments try to satisfy such demands, increasing amounts of public expenditure will be directed into developing a supply of “skills” which would have developed anyway as a normal part of socialisation into the workforce, while more fundamental and potentially tractable problems remain neglected (Keep, Mayhew and Payne 2006: 552).

Like the other boundary issues covered here, this is one of degree rather than an either-or matter. At one level it will come down to the criterion mentioned above, namely which of these attitudes or behaviours are the kind of thing that can be learned. On a more practical level, the important issue for governments in particular may be which of them can be effectively and purposively *taught* through pre-employment training. However, this latter issue does not affect their inclusion in the definition of skill for the purposes of this research.

It should be recognised that the broader boundary issue is a matter of negotiation and adjustment which is still actively in progress. Given its importance to national skilling strategy, it matters to keep an open mind and not pre-empt the outcome by defining certain things as non-skill which will not be tracked. An inclusive and agnostic approach is needed to develop a metric which can capture at least the evolving consensus between contending parties – in particular, between employers and those who work for them. So long as the full picture can be captured and tracked through the full adjustment process, further analyses will be possible and appropriate to examine how this shifting definition of skill has affected the dynamic of the NSS.

### 3.1.2.5. Why boundary issues matter: a negative example

The reason the four issues of definition just discussed are classified as boundary issues, rather than simply another set of coexisting dimensions, is illustrated by a real example of the confusion that can arise from merging the categories. This example is found in a definition of “competency” that became popular among some American management consultants in the 1990s (McClelland 1973; Boyatzis 2008; Spencer and Spencer 1993). Strictly speaking, this approach lies outside the scope of this discussion because it is intended less as a theory of *skill* (seen as a generalisable attribute, an input to productivity or a potentially transferrable commodity) than as a theory of individual *performance*, relative to others, in the kind of highly competitive workplace environment favoured by the common American management practice of the time. However, it presents a good example of how blurring the boundaries of skill can lead to practical difficulties in real-world management, rather than just in the technical context of finding a metric.

This school of thought defines competency in behavioural terms as “a set of related but different sets of behaviors organized around an underlying construct” (Boyatzis 2008: 6) which effectively involves a combination of skill as normally understood, motivation, and what would normally be regarded as personality traits. In this model work-related knowledge, expertise and experience are regarded only as the “threshold level”, compared to which a second level of “below-the-waterline characteristics” (Hofrichter and Spencer 1996: 21) are critical to “distinguishing outstanding performance” (Boyatzis 2008: 7).

The problem here does not lie in the actual project of distinguishing between threshold competencies and those which constitute an outstanding performer. Such a distinction is intrinsically unexceptionable, corresponding in many ways to the distinctions made later in this chapter between ordinary skill and mastery, expertise or virtuosity, or that made in 2.3 between the threshold skills which a firm needs to enter a product market or adopt a process and those which give it its own distinctive, non-imitable competitive advantage. The problem comes rather from using the word “competency” in a somewhat unconventional meaning which conflates skill, behaviour, the individual’s life history and aspects of personality.

This introduces an ambiguity over whether a competency consists of behaviours which can be changed, actual skills which can be learned, or underlying characteristics of the individual which are effectively hard-wired – “related to biological and in particular neuro-endocrine functioning” (Boyatzis 2008: 8). The ambiguity in turn leads to a lack of clarity about the practical implications of this model as a tool of management (see for example Hofrichter and Spencer 1996). Is the implication that managers should be more meticulous in selecting only those recruits who match the company’s ideal “competency” profile? Is it a matter of paying more, presumably with some kind of incentive effect in mind, to those employees who come closest to fitting the mould – and if so, how would the incentive work if the less desired traits are hard-wired? Or is there some possible employee development strategy that would bring a greater proportion of employees into the “sweet spot”? The attempt to resolve the last of these questions has led Boyatzis in his more recent writings (e.g. Boyatzis 2006) into the even more hazardous waters of brain plasticity and brain-based learning to produce an approach to human resource development which at times looks uncomfortably close to personality modification.

By contrast, the resource-based strategic HRM tradition described in 2.3 also recognises that skills need to be realised as behaviours before they can contribute to firm

competitiveness, but uses a far more elegant model which keeps the two things conceptually separate, largely because it defines a competence as belonging to the firm, not the individual. The firm's stock of skills – its *human capital* - is embodied in its employees, but how well it is applied depends on those workers acting in ways that are essentially discretionary (MacDuffie 1995). To create the necessary motivation in its employees, a firm depends on its *organisational capital*, the set of HRM practices, culture, shared vision, etc., developed within the firm and enabling it both to utilise existing human capital optimally and to attract new human capital. As Wright, Dunford and Snell (2001: 706) put it, “without skills certain behaviours cannot be exhibited, and... the value of skills can only be realized through exhibited behaviour.”

## 3.2. Ranking skill

Section 3.1 examined the issue of what should be counted as skill, and hence of what should be included in a metric that can accurately capture quantitative variation in the skill content of different jobs. This section looks at the options for capturing qualitative variation, i.e. criteria by which one kind of skill can be ranked as “better” or “higher” than another.

### 3.2.1. The relevance of occupational hierarchy

The fundamental problem with the high/low opposition is that it can be interpreted in two fundamentally different senses. The basic ambiguity is illustrated by Allen Consulting (2006: 21) when they begin by arguing that:

Firms in developed countries are... operating in niche, higher value added markets and so are demanding *higher level skills*. This is true at all levels in the workforce – high value niche production requires very high level and specific technical skills, but the automation of basic processes also requires a higher level of skill at other levels of the workforce. [emphasis in original]

but go on, two paragraphs later, to write:

Those firms we surveyed who regard themselves as world class have a substantially lower proportion of labourers and process workers and a higher proportion of technicians and paraprofessionals in their workforce than other firms, resulting in a *higher level of skill* overall [emphasis added].

What these two quotes suggest, taken together, is that two alternative definitions of high skill are in play. On the one hand, we have the traditional view of a hierarchy of skill, corresponding to a hierarchy of qualifications, corresponding to a hierarchy of occupations – unskilled, semi-skilled, skilled, technician, professional. A professional is by definition more highly skilled than a technician, a technician than a tradesman, and so on down the scale. On the other, we have the proposition that it is possible to distinguish between high and low skill at any level in the occupational or qualifications hierarchy, and that increasing the level of skill is important regardless of where one stands on that ladder.

The first view implies that gradations of skill quality could be accurately measured if only the hierarchy of qualifications and/or occupational classifications were precisely aligned with the level of skill exercised, so that with sufficient attention to the match, the former

could be used with confidence as a proxy for the latter. This approach, referred to here as the *alignment model*, is the one generally followed in Australian occupational classifications. The latest version, the 2006 Australian and New Zealand Standard Classification of Occupations (ANZSCO), classifies occupations by level and specialisation of skill. Level is “defined as a function of the range and complexity of the set of tasks performed” (ABS 2005: 3). In practice, however, it is measured in terms of “the level or amount of formal education and training, the amount of previous experience in a related occupation and the amount of on-the-job training required to competently perform the set of tasks required”. The underlying assumption is that “the greater the range and complexity of the tasks involved, the greater the amount of formal education and training, previous experience and on-the-job training that are required to competently perform the set of tasks” (ABS 2005: 4). This approach to occupational skill classification contrasts fundamentally with that followed in the US to develop the O\*NET classification and its predecessor, the Dictionary of Occupational Titles, which are further discussed in section 3.3.

This version of the alignment model aims to align the hierarchy of occupations with an assumed “real” hierarchy of skill. Training and informal learning are used as avowed proxies; the latter in its turn is proxied by experience, but training is not explicitly proxied by level of qualification. A different version of the model sets out to align the hierarchy of formal qualifications with skill; this approach is favoured by educators and is embodied in the Australian Qualifications Framework (AQF).

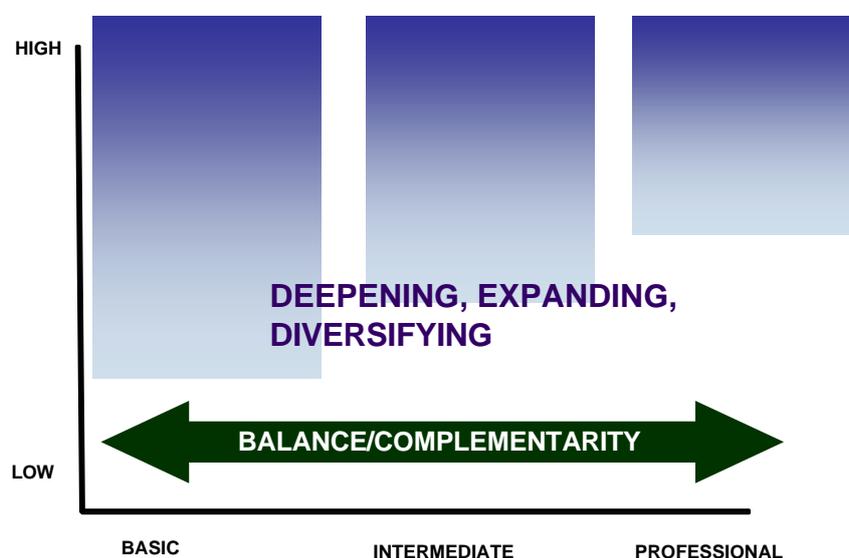
The second view implies an alternative approach of separating skill level and qualification level into two axes to form a kind of two-dimensional map. The terms chosen here to characterise the two axes are *qualification* and *skill deepening*. However, the X axis could equally well refer to level in the occupational hierarchy. The assumption underlying this model, referred to here as the *deepening model*, is that the two axes measure different things. The “qualifications” axis represents different kinds of work or skill content, reflecting different and complementary roles in the production process and work organisation. The “deepening” axis captures common elements of skill which are capable of continuous enhancement over the course of a career (and hence provide a rationale for career paths), regardless of where one stands in the qualifications hierarchy. The generic concept is represented by Figure 3.1.

The X axis in this diagram is labelled in deliberately ambiguous terms, since the words “basic”, “intermediate” and “professional” can be applied equally to qualification levels and to occupational levels. In any real application it would refer to either one or the other, since the implications are subtly different in each case:

- the occupational hierarchy is an institutional aspect of work organisation whereby the work of society is broken down into groups of generic tasks performed by different classes of worker (labourers, clerks, tradespeople, paraprofessionals, professionals) arranged in a conventionally recognised hierarchy of esteem. This hierarchy largely (though not always) determines how different jobs are valued socially and rewarded financially. The reasons particular tasks are handled at a given level in the hierarchy are often a matter of history and accepted practice (sometimes codified in industrial agreements), as is the grouping of tasks. There is a general assumption that jobs towards the top of the hierarchy involve more complex or difficult mixtures of skills than those towards the bottom, but the

association is loose and not always evidence-based: it is more common for the skill content of a job to be inferred from its position in the hierarchy than for a job to be located in the hierarchy based on an explicit analysis of its skill content;

- the qualifications hierarchy is part of the education system, another high-level institution, which determines that different kinds and combinations of skills will be learned in different settings (schools, university, long-cycle VET, ad-hoc short courses, workplaces), over different timescales, using different teaching and assessment strategies, with different knowledge prerequisites, and with different kinds of certification or sometimes none at all. The implicit skill-related hierarchy applies only to this last element of certification, which is used as a proxy for all the others, though it is arguably those other factors which constitute the (imperfect) predictors of skill content. Since higher-ranked qualifications generally require more formal and theoretically based learning, the hierarchy effectively ranks qualifications according to their codified knowledge content.



**Figure 3.1**  
**Qualifications vs. skill deepening – a core model**

The Y axis refers to the skill levels of individuals, i.e. the embodied element. It could be seen as crossing the X axis at the point where the individual has the minimum level of skill required to start work in a given occupation, or to gain the base qualification. Movement up this axis involves learning to do a set of tasks better, or perhaps to do a broader range of tasks than that normally encompassed by the core set required for initial classification or qualification at that level, but without in the process moving to a skill or task set more characteristic of a different occupation or qualification. Three terms used in the literature to describe forms of advanced skill illustrate the kind of process involved in deepening:

- **expertise:** Swap, Leonard, Shields and Abrams (2001: 97) describe the distinctive characteristic of expertise as being the ability, based on long experience across a wide range of contexts, to “recognise patterns... selectively retrieve relevant information and extrapolate from a given pattern to fluidly chart an appropriate

response". More precisely, they write that "experts can express rules of thumb, but these shorthand statements are deeply contextualized. An expert knows when the rule applies and when an unusual pattern of experiences requires an exception." They argue that expertise is "developed through learning-by-doing... almost always under the guidance of a more knowledgeable teacher," and further assert, based on research on chess masters, that it takes a minimum of ten years to acquire.

- **virtuosity:** Attewell (1990: 423) distinguishes between "skill as mundane accomplishment and skill as virtuosity". His definition of the latter posits that "human skills consist of effortlessly translating each unique instance into an example of routine... without thinking about it, in recognizing something new as something old... [A] virtuoso recognizes fewer exceptions than a learner: the maestro has been there before and has more (unconscious) routines to apply" (1990: 433). Virtuosity, he argues, is most valuable in circumstances where "an effective reproducible method has not yet been invented to deal with the particular problem" and that this in turn leads to "teaching methods notable for their lack of emphasis on substantive knowledge" such as the Socratic method (1990: 438).
- **mastery:** Braverman (1974: 443) defines mastery, in the context of a craft worker, as "the combination of knowledge of materials and processes with the practiced dexterities required to carry on a specific branch of production." This kind of mastery makes it possible for a craft worker to "decide how to accomplish a particular piece of work, choose the appropriate tools and procedures, and be self-directed in the work".

The ABS in its published rationale for the ANZSCO model acknowledges the existence of deepening when it notes that:

A person who spreads mortar and lays bricks for a living has the occupation Bricklayer, regardless of whether he or she is an exceptionally competent bricklayer with many years of experience and post-trade qualifications, or an inexperienced bricklayer with no formal qualifications and a low level of competence.

(2005:4)

The paper justifies excluding this criterion by specifying that "skill level" in the technical sense used in ANZSCO refers only to the skill level "typically required" to perform competently in an occupation, defined as "a set of jobs that require the performance of similar or identical sets of tasks". It explicitly does not apply to individual jobs (defined as "a set of tasks designed to be performed by one person for an employer") or to the skill level of individuals (ABS 2005: 4).

Thus the metric encapsulated in ANZSCO, irrespective of its strengths in other directions, is designed to capture variation between occupations but not between jobs. While occupational distinctions are very important to the analysis of data on skill trajectories, such a metric cannot capture the full picture of what is happening in the economy because it does not pick up variation between individual jobs. At the same time, the ANZSCO metric fails to capture variation between individuals. In this sense it privileges the embedded aspect of skill to the point where the embodied aspect is obscured. In the case of ANZSCO there is a further contradiction in that the actual assessment of skill level is based almost

entirely on representative individuals' learning time – i.e. a key element of embodied skill. However, even alternative approaches such as O\*NET which set out to assess the number and difficulty of the actual tasks in an occupation fail to capture the variety within occupations which functions as one of the main channels of evolution for skill utilisation across the economy in the NSS model.

Another argument against following an alignment model is that the conventional hierarchies are themselves institutions, and as such partly the result of historical accident. Many of the differences in the skilling institutions of different occupations can be credibly explained by the way clusters of occupations emerged at different times in history and each became attracted to its own common pattern, length and method of training. Those developmental arrangements owed as much to the state of pedagogy and the institutional structure of education (or indeed, of labour law) at the time each occupational cluster emerged and consolidated as they did to the objectively definable skill content of the respective occupations, even at the time. Some occupations became established over the period when apprenticeship was the only structure for achieving skilled status and were explicitly protected under apprenticeship legislation, and the continuity of that legislation has preserved both their status and their characteristic form of qualification into modern times. Others, notably many of what are now professions, fell outside the main scope of the apprenticeship laws and were free to move over time into arrangements, generally involving a higher proportion of full-time study, that better suited their evolving knowledge requirements. Others grew out of older occupations that had earlier been regarded as formally unskilled, or only emerged as occupations after the time when full-time vocational education was available.

The occupational hierarchy also reflects a past when the labour market was highly segmented, with few channels of mobility between, say, the semi-skilled and skilled or the technician and professional categories. Anyone who started their career within one classification usually had to advance within the confines of that stream, and consequently each stream created its own internal ladder of promotion and prestige, using criteria that were often developed without reference to other streams, and hence sometimes overlapped in terms of the actual competencies exercised. A commonly cited example is the German *Meisterbrief*, which is gained by progression through the trades stream, but indicates a level of competence closer to that of technicians in other systems – indeed, covering types of work that in corresponding British factories often need to be done by graduates (Steedman 1993: 287, 292). In many countries the distinctions between the qualification streams had more to do with social prestige or even social class than with the actual complexity of the work.

### **3.2.2. Social construction**

This consideration introduces the second key dimension of skill which was foreshadowed at the beginning of this chapter, social construction. This concept is associated with a school of thought that derives ultimately from Max Weber (Attewell 1990: 435-438). The basic argument behind social construction is that the definition of any given skill, or indeed of skill in general, is decided not by objective criteria but by socially accepted convention. Both the content and the status of individual skills, along with those of the occupations to which they attach, are determined, not by some objective common calculus of complexity and difficulty, but by a process of social negotiation, often over centuries. In this view, the perceived simplicity or complexity of a skill (especially a credentialled skill) is essentially a

status issue, and as such is shaped more by the prestige or bargaining power of occupational interest groups than by how difficult the skill is to acquire or practise.

Scholars disagree on how closely social construction is bound up with skill itself. At the more sceptical end of the spectrum, Attewell (1992: 49-50) suggests that the approach, which he prefers to call “social determinism”, is best understood in terms of a distinction between “skill” and “a skilled job”, with the latter representing the true object of social construction. He goes on to describe constructed skill as “an attribute of jobs... governed by complex political struggles in the workplace... for a social determinist, the (socially acknowledged) skill of a job may depend on control over its one or two most important (or socially most prestigious) tasks.” This parallels the view of Lazonick and O’Sullivan, who argue that the kind of autonomy on the shop floor which Braverman associated with the individual craft worker in the industrial-era British factory was in fact exercised collectively by what these authors call an “aristocracy of labour” made up of foremen and senior craft workers who constituted the effective managers of the production process (1994: 16).

A much more fundamental version of social construction as a direct attribute of skill is associated with a school of thought called ethnomethodology (Garfinkel, 1969; Schutz, 1970; Kusterer, 1978), which argues that virtually all human activities, even the most routine, turn out when analysed objectively to have most if not all of the characteristics of complexity conventionally associated with high skill. This includes such mundane activities as driving, walking, carrying on a conversation and operating a simple tool. While there may be a margin of difficulty between these “basic” competencies and those conventionally viewed as “advanced” or “sophisticated”, that margin is trivial compared to the distance between “basic” competencies and no competence at all. The difference is that the “basic” or “simple” skills become invisible once one has been practising them long enough, or once there is an expectation that everyone should be able to do them. In fact, some of these authors argue, the sign of fully completed learning is that a task becomes so familiar that the skill can be exercised automatically and without conscious attention – it becomes almost like a bodily routine, or to use a term which the ethnomethodologists borrow from phenomenology, *somaticised* (Attewell 1990: 433).

It follows that the skills required to perform operations with which one is familiar – whether performed by oneself or by someone else – are more likely to appear “simple”, and those with which one is unfamiliar to appear “complex” or “difficult”. Consequently, society’s, and the economy’s, perception of the complexity of a skill will be a product primarily if its *novelty* or *scarcity*, and not specifically of how easy it is to acquire that skill, or of how much effort or aptitude is needed to develop it (Attewell 1990: 431).

In the broad social-constructionist view the hierarchy of qualifications, like that of occupations, is based on an uncertain and shifting amalgam of objective and ascriptive characteristics of the work and the practitioner - difficulty, responsibility, scarcity, remuneration, social recognition – which can be summarised under the umbrella term *esteem*. The more extreme social-constructionists go further and argue that the “esteem” dimension is in fact the *only* consideration that has historically shaped the high/low skill distinction. In their view, the definition of high or professional skill was originally imposed by guilds and professions which wished to limit entry to their occupational domain in order to safeguard their income or social standing. They did so by creating an often exaggerated public impression of the difficulty of their work, reinforced by such devices as

the use of Latin or highly technical jargon, or by imposing unnecessarily long or demanding apprenticeships or other qualification requirements, often backed up in earlier times by explicitly status-related controls on entry to apprenticeship. Collins (1976), recalling an argument originally put forward by Adam Smith (1950: 107) with regard to wage determination, has suggested that the power of the classical professions like law, medicine and the clergy to impose such barriers was founded partly on the centrality of their functions to the physical, financial or spiritual well-being of the individual citizen.

Social-constructionist explanations account convincingly for much observed behaviour that seems otherwise irrational. However, the fact that socially constructed skill reflects factors other than objective content does not make it irrelevant to analyses of the NSS. The different hierarchical ranks attached to occupational clusters may well have reinforced distinctions between them in terms of expectations, for example about the kinds of work employees at each level feel entitled or confident to take on, or about the level of autonomy or direction exercised in the workplace. In turn, those expectations could be partly the product of aspects of the training environment, such as the authority structure or the methods of assessment, which are or once were considered appropriate for the knowledge required at different levels in the workforce. Thus, pedagogical choices which originated in historical accident can still objectively determine the way a skill is exercised and deployed in real workplaces, and hence shape the pattern of industry demand for each type of skill.

The important understanding that emerges from a social-constructionist account is that *neither* the “qualifications” nor the “esteem” criterion directly captures skill. Either can serve as a *proxy* for skill, but in an unconventional fashion, in that each objectively determines the range of competencies included in a credentialled skill, or the way that skill is deployed in the work context. In a sense, therefore, they can be treated more like predictors. In any case, a systems approach to skilling recognises these institutional factors as real characteristics of the work environment which cannot be wished away, are part of the durable culture of different occupational groups and often important to their self-definition and self-esteem, and genuinely influence the way organisations work and the ways people within them can best work together. The NIESR case studies showed how in some cases enterprise competitiveness could be critically affected by whether a particular work role, and hence the skills required to exercise it, were located on one side or the other of a divide between, say, trades and professional employees (Steedman 1993).

### 3.3. Measuring skill

This section moves on from the partly philosophical issue of what skill means – a discussion, as was explained at the beginning of this chapter, that serves partly to clarify a central aspect of the NSS model – to the practical issue of how skill can best be measured. This issue needs to be resolved before a research strategy can be defined for the empirical section of the thesis.

Spenner (1990: 399), in what is still the classic treatment of the subject, lists three major approaches to measuring skill in a generic sense: non-measures, indirect measures and direct measures. By the first he means approaches that simply assert the skilfulness of a job or occupation, or take it as unproblematic. He includes in this category the use of occupational level as a proxy for skill. He notes that this approach was very common in both economic and labour-process studies up to the 1980s.

By “indirect measures” he means the use of proxies. One set of common proxies equates level of skill either with level of formal qualification or with years of schooling. The former is commonly practised by VET and workforce planners, while the latter is favoured by many economists, especially those in the human capital tradition. Another is the use of individuals’ wage rates as indicators of the contribution of a job, and hence of the skill exercised in that job, to firm productivity. This proxy is still regularly used today in econometric modelling.

### 3.3.1. Proxy indicators

While good data have been available for many years to support the former kind of proxy, it begs many of the questions that need to be addressed when analysing patterns of skills demand and deployment. The most important of these concern issues of credentialism - whether some employers are imposing unnecessarily high qualifications requirements as a screening device – and overskilling, i.e. whether employees are required or enabled by their work to use all the skills they have been trained to exercise. On the supply side, a simple equation of skill with qualification also obscures the extent to which some employees develop the skills required to do their job without recourse to the formal qualifications system, or need to do substantial additional learning on top of their formal qualification in order to develop skills that can be practically applied in the workplace. Consequently, it sheds no light on the role of organisational learning or the generation of new knowledge in the production process. Perhaps most importantly for the present analysis, reliance on this proxy effectively locks the researcher into an alignment model and excludes any evidence on the contribution of skill deepening.

International comparisons on this basis may also be misleading because of significant inter-country differences in the skill content of qualifications at the same ostensible level in the same field. This applies with equal force to years of education, given such factors as different national structures of education and different national approaches to the allocation of formal learning between classroom-based and work-based components (e.g. apprenticeship vs. secondary vocational schools).

A related approach which has been commonly taken since the 1990s – more often by implication than as a basis for formal analysis – is to associate training activity with skill: industries and firms which do a lot of formal training are assumed to be high-skill, and low-training ones to have low skill requirements. This implicit proxy has been common in discussion about skill ever since reliable data on training activity began to appear in the late 1980s and early 90s. It is intuitively credible as an *argument*, and indeed has lain at the core of the Low Skill Equilibrium argument since the original Finegold/Soskice article in 1988. As a *proxy* for skill, however, it is inappropriate even for that type of analysis, since the function of such analysis is precisely to *establish* whether low skill requirements are in fact the reason behind low training activity, meaning that a different indicator is needed for skills exercised. More generally, a different indicator is needed to permit analysis of any question of match between the level of training provision and the amount of skill required, most obviously in the case of skill shortages.

The practical difficulty with using this kind of proxy is that it is far easier to quantify formal, structured training than informal training. Very few official surveys of firm training activity even try to capture the second element. The 1993 run of Australian *Survey*

of *Training and Education* (ABS 1993) was one of the few that did try to gather data about “on-the-job training”, albeit with the question worded in a way that picked up kinds of informal learning (e.g. teaching self, asking questions, watching other workers) which do not fall within the intuitive definition of training. However, even it could only ask reliable questions about *whether* a respondent had received such “training” and if so, which of four categories had been “most important” (Fraser 1996: 48). Since the proportion of employed respondents to the three surveys so far conducted in this series who reported such “on-the-job training” ranged from 65.5% to 70.7%, as opposed to between 29.8% and 44.6% who reported and could quantify their formal training, it is clear that omitting this category substantially understates the incidence of skilling activity in the workplace.

While some researchers in recent years have endeavoured to quantify and/or cost this missing element (Richardson 2004; Freyens 2006), they have only been able to reach an estimate by working backwards from firm-level data on turnover and labour costs. This equates broadly to the second type of proxy identified by Spenner in his 1990 article.

The problem with the wage-effect proxy is that it involves arbitrarily ascribing a residual (usually in the guise of “unobserved heterogeneity”) whose causes are unknown and unidentifiable by econometric analysis to individual productive potential, which the researchers equate just as arbitrarily to skill. It also involves making many assumptions about the mechanism linking wage rates to individual productivity which cannot be empirically grounded and are often contradicted by common observation, e.g. about the speed with which wage rates adjust to changes in individual worker productivity and the degree of variation that exists between the wages of individual workers carrying out the same kind of job in the same firm. Above all, this proxy requires adjustment to compensate for variations in supply and demand; otherwise, as Form points out, horse teamsters and file clerks would need to be treated as unskilled simply because there is no longer any demand for their skills (1987: 31).

Felstead et al (2007: 3) identify three other kinds of proxy: proportion of the workforce in occupations classified reputationally as high-skilled, scores on literacy and numeracy tests, and workers' self-assessment of their own skill levels. As noted earlier, Spenner treats the first as “non-measurement”. The earlier discussion on social construction illustrates why this sort of proxy creates almost identical problems of validity to those created by the qualifications proxy; but even if the initial ranking is empirically based, the skill content of occupations evolves over time, so that the equivalence needs to be constantly reviewed, resulting in an unstable metric (Felstead et al 2007: 7). International literacy surveys such as PISA and IALS are progressively expanding their scope to cover generic work-related cognitive competencies which provide an increasingly rich picture of some aspects of the capability of each nation's workforce. However, such measures refer only to the embodied and potential aspects of skill and cast no direct light on how much of this capability is actually deployed for productive purposes. Self-report is perhaps better seen as a research method than a metric in its own right, and will be further discussed in that context below.

In practice it is often difficult to avoid the use of such proxies altogether if there is a need to provide a full picture of, say, the skilfulness of an industry at a point in time, simply because the data available in most countries are insufficient to cover all the dimensions of interest. The important things when it becomes necessary to resort to any such proxy are to use it in ways and for purposes which minimise its known potential to bring about measurement error; to triangulate it wherever possible with different proxies which may

cancel out the error or at the least, make it more transparent; and if at all possible, to use proxies only as a supplement to a direct measure of at least one key dimension of skill which has been designed to capture the real construct of interest. This is the approach which has been taken in Chapter 8 of this thesis.

### **3.3.2. Direct measurement strategies**

Efforts to develop a direct measurement scale generally focus on aspects of the content of skill which are potentially measurable or at any rate describable using a common and objective set of descriptors. Most of these follow what Spenner calls the job requirements approach, which effectively captures the embedded dimension of skill by analysing jobs or occupations in terms of the kinds and level of generic skill they require. Thus, the second edition of the Australian Standard Classification of Occupations (ASCO), which foreshadowed the approach of its successor ANZSCO in classifying occupation levels in the first instance by the level of formal education or training and the amount of prior experience normally required at the point of entry, nevertheless resorted in some cases to “a secondary set of criteria:

- breadth/depth of knowledge required
- range of skills required
- variability of operating environment
- level of autonomy as determined by the degree of discretion and choice which may be required to perform the set of tasks.”

(ABS 1996)

Similar multiple criteria – knowledge content, job complexity, routineness/ unpredictability and autonomy – form the basis of many comparable rankings used in other countries or by academic researchers, though the choice and definitions vary widely.

The one known example of such a framework that covers the embodied as well as the embedded dimension, and the most comprehensive public-domain exercise of its kind so far, is the US Dictionary of Occupational titles (DOT) and its web-based successor O\*NET (<http://www.onetcenter.org/content.html>; Felstead, Gallie, Green and Zhou 2007: 9-13). Primarily intended as an occupational classification, the latter currently (September 2008) analyses 812 occupations in terms of six sets of generic criteria. Three of these sets are worker-oriented (worker characteristics, worker requirements, experience requirements) and three job-oriented (occupational requirements, workforce characteristics, occupation-specific information). Each of these domains is divided into 2-5 major categories and a large number of subcategories or elements, making up a total of 277 descriptors. Each descriptor is assessed on a descending 5-point scale of difficulty, anchored with examples of the kind of performance, activity or characteristic that might be expected at the relevant level.

While the DOT was scored by professional assessors, this practice was eventually discontinued, partly because of the limited range of occupations that could be sampled with the resources available and the virtual impossibility of keeping the register up to date, but also because of widely reported instances of rater bias (Attewell 1990: 427-8) and poor inter-rater reliability (Spenner 1990: 411). O\*NET is based on data from a sample survey repeated approximately every 3-4 years for each occupation, and the occupation scores are derived from mean scores for the individuals whose jobs are sampled in each occupation.

O\*NET, keeping in mind its scope and sample size, is almost certainly the richest data source of this kind available anywhere. It represents an invaluable source for researchers of the US labour market, but cannot be applied to Australian research except perhaps for the purposes of approximation and at the very broad occupation level, partly because of differences in the occupational titles used in the US and Australia, but primarily because of the imperfect correspondence between the actual content of jobs with similar titles in each nation. The burden of gathering the data means that nothing of this sophistication is likely to be available for Australia in the foreseeable future, especially now that the national statistical agencies here and in New Zealand have committed themselves to a different approach to occupational classification.

Lowry et al use one subset of the earlier DOT criteria for their analysis of future generic skill requirements in Australia (2008: 16-18), but do not specify in their paper how they have approached the equivalence problem. For the purposes of this thesis, it seems undesirable to follow the same approach, since the measurement error that would result from assuming equivalence of job content is likely to be unacceptable in proportion to the fine-scale movements in job skill requirements that need to be picked up over the small period of time covered by the research. A further problem with the O\*NET model for present purposes, even if comparable data were available for Australia, is that the published profiles apply at the occupation level, and hence would be slow to pick up any movement in the skill content of individual jobs, especially if this occurred in small pockets of the economy which might be under-represented or not included at all in the sample.

The UK Skills Surveys have followed a much simplified version of the O\*NET model, but have also sought to capture other dimensions of skill through triangulation. Their research strategy has four main elements:

- a simplified form of job content analysis, whereby respondents are asked to report whether their job includes a number of generic functions (e.g. writing reports, supervising other staff, giving presentations) and the relative importance of each to their job performance. The 2006 survey extended this set of variables to include some aesthetic and emotional skills (Felstead et al 2007: 13). These data provide a semi-objective basis for at least a rough index of relative job complexity which can be tracked longitudinally over short intervals;
- a composite measure of learning requirement involving three questions:
  - If they were applying today, what qualifications, if any, would someone need to get the kind of job you have now?
  - Since completing full-time education, have you ever had, or are you currently undertaking, training for the type of work you currently do? If so, how long, in total, did (or will) that training last?
  - How long did it take after you first started doing this type of job to learn to do it well?
- indicators of the degree of independence and control which workers experience in the way they do their job (Felstead, Gallie and Green 2004: 162). This set of proxies reflects the common observation that the more skilled a job is, the less it lends itself to being carried out under close supervision or rigid protocols.

Discretion was measured by asking respondents how much choice they individually had over the way they did their job, with supplementary questions on how much personal influence they had over:

- how hard they worked;
  - what tasks to do;
  - how the task was done; and
  - the quality standard to which they worked;
- parallel employer surveys providing matched data by firm or industry sub-classification (Green, Mayhew and Molloy 2003). These provide an alternative perspective at the firm or industry level which may clarify how far any reported mismatches reflect the actual skill content of jobs, and how far they result from contingent underskilling of the workforce; they are also useful for investigating links between firm strategy or work organisation and skill content.

Like O\*NET, the Skills Surveys collect data by self-report from a sample survey of employees. The validity issues raised by this method are addressed in 3.3.4 below.

### **3.3.3. Spenner's simplified model**

Spenner (1983, 1988, 1990), reviewing an already considerable body of literature, suggested that there were two dimensions of skill that could be regarded as “fundamental and underlying” (1985: 135):

- *substantive complexity*: the level, scope and integration of mental, manipulative and interpersonal tasks in a job;
- *autonomy/control*: the discretion or leeway available in a job to control the content, manner and speed with which tasks are done (1985: 135; 1990: 402-3).

Spenner himself derives this dimensionalisation from several earlier simplified models, notably that of Field (1980: 153) which divided skill in four components: span of job (number of discrete tasks); difficulty of each task (time required to become proficient); expected standard of proficiency; and the extent to which the job requires judgements and actions in response to changing environmental conditions (Spenner 1983: 829). Another acknowledged precedent was the model developed by Kohn and Schooler and their followers which was based on three “organising dimensions” of personality – intellectual flexibility, self-directedness and sense of well-being or distress – and four corresponding “structural imperatives” of jobs: occupational self-direction (including substantive complexity, closeness of supervision and routinisation), job pressures, extrinsic risks and rewards (including personal accountability) and position in the organisational structure (Spenner 1988: 72-3).

While not suggesting that this pair of dimensions captures all the significant variation, Spenner notes that they have the advantage of being “two primary dimensions of skill that have applicability across all jobs in the economy” (1985: 136) and recommends that “multidimensional conceptualisations of skill should *at least* include dimensions for subjective complexity and autonomy-control” (1990: 403, emphasis in original). Although he puts this simplified classification forward only as “hypothesis and a pragmatic

approach" (1990: 402), it has since been found to be a convenient basis for a metric for new research where it is possible to construct relevant indicators from scratch, most notably in the design of the UK Skills Surveys where the autonomy-control dimension is referred to as task discretion (Felstead et al 2002: 67).

The exact relation between the two dimensions remains controversial. Spenner describes them as "conceptually distinct but empirically correlated" (1985: 135), but the extent and nature of that correlation is somewhat uncertain. His 1990 article suggests that various empirical studies in the literature had produced correlation coefficients in the range of .5 to .7 (1990: 403), but the only detailed account of this research appears to be in an unpublished paper (1986, cited by Form 1987: 31) which the present author has been unable to locate. His earlier writing shows a more complicated picture, with his 1985 article actually suggesting "the possibility of divergent trends" (1985: 141), specifically a slow increase in complexity alongside a slow decrease in autonomy/control within an overall stability when averaged out across all industries and occupations. He himself suggests that comparison may be difficult because most of the quantitative research focuses on complexity while the research on autonomy/control at the time he was writing consisted mainly of case studies, which makes the reported statistical correlation even more puzzling. The UK Skills Surveys, as explained in section 5.2 below, suggest that the correlation, insofar as it exists, is quite unstable, varying widely over time and across occupations. Similarly, the analysis undertaken for this thesis, detailed in Chapter 7, indicates that the correlation between task discretion and a different type of skill indicator is generally strongest at lower levels in the occupational hierarchy.

The inclusion of autonomy/control as a dimension of skill is partly historical. The loss of individual workers' control over their work was seen by Marx as central to his theory of alienation, and remained at the centre of Marxist-oriented research into the effects of industrialisation and technological change over the next century and a half (Form 1987: 30). At the time when Spenner was writing, this debate had been revived by the deskilling controversy, summarised in 5.1 below, and much of the research which he was reviewing was undertaken in the context of that debate. Different authors' positions on the relation between autonomy/control and skill tended to be determined by where each author stood on the overall deskilling issue. Thus, Form (1987: 30), in an article generally sceptical about deskilling, describes autonomy/control as one of four conceptions that "obscure the centrality of job complexity" and later as a "pitfall", suggesting that any observed correlation between the two dimensions is simply evidence that autonomy/discretion is another manifestation of complexity (1987: 32). Lowry et al explicitly follow his lead, dismissing autonomy/ discretion as "not a dimension of skill, rather... a function of the broader contextual and hierarchical dimension of jobs" (2008: 17).

Spenner's reaction to Form suggests a certain ambiguity in his own view. While taking care to distinguish autonomy/control (within a role) from authority (a relationship between roles), he limits his response to reaffirming the analytical separability of the two constructs and ultimately concedes that it is immaterial whether autonomy/control is defined as part of skill, so long as it is treated as a relevant issue (1990: 405). This may be understandable given the different ways in which his acknowledged predecessors viewed the two dimensions; for example, Kohn and Schooler, as has been seen, treated substantive complexity as part of the self-direction imperative.

This is a question that probably needs to be resolved empirically on a case-by-case basis, as different populations may see the relationship in different terms. It is simply important, as Spenner points out, to ensure that the association, however defined, is theoretically grounded and not simply allowed to fall out of factor analysis (Spenner 1990: 403). In practice, the success with which Spenner's model has since been applied in the UK Skills Surveys is ample evidence of its usefulness, and provides sufficient justification for following it in the present research, if only for the sake of being able to use the British data for comparison. There are in any case strong substantive arguments for treating autonomy/control as a dimension or at the very least an indicator of skill; these are further discussed in 3.4.2 below.

### **3.3.4. Validity issues in self-reporting**

An ideal approach to skill measurement would use objectively verifiable and measurable indicators of skill, i.e. things whose presence or prevalence can be determined by tangible, unequivocal evidence without any requirement for subjective judgement. Such is the case for proxies such as qualifications, which either exist or do not in each case. So do scores on psychometric and ability tests, though the design and assessment of these tests is a formal expression of past judgements that were subjective, or intersubjective to the extent that the questions were validated by analysis of the responses to earlier instruments or pilot questionnaires.

Such indicators can shed light on embodied skill, in that they describe relevant characteristics of individuals, but fail to capture skill actually exercised. On the demand side, lists of tasks or operations involved in different jobs provide some indication of the level and type of skill typically required to perform them, but deciding whether tasks found in different jobs are sufficiently similar to be classed as equivalent, or ranking the skill level of tasks exercised in different technical fields, is impossible without some subjective judgement. In practice no direct means has yet been found of measuring skill as exercised without the need for someone to exercise qualitative judgement.

Two options exist for this subjective element of measurement, external rating and self-report (Spenner 1990: 408). External rating, of the type carried out for the DOT or by workplace assessors involved in determining questions of work equivalence for pay purposes, can be effective in limited-scale applications, but is generally too time-intensive, and too dependent on the availability of sufficient suitably skilled raters, to be practicable on a population scale, even for sample surveys. Even where skilled raters are used, problems can still arise over the accuracy and consistency of their ratings. As noted above, the US statisticians moved from independent rating to self-report with the changeover from DOT to O\*NET, partly in the interests of achieving satisfactory coverage and currency, but partly also in response to public concerns about the validity of the independent raters' assessments.

In principle the use of self-report might appear to lend itself to bias because respondents would have a tendency to over-report either their own competence or the difficulty of their job. In practice, to quote Spenner's conclusion (1990: 416), "most of the evidence suggests that people, by and large, are fairly accurate perceivers and reporters of their immediate job situation". Reviewing a large body of research and review articles over the previous twenty years, he found evidence of good correlation between self-reported and objective measures of complexity for the same job in cases where both were available. The only apparent sign

of systematic bias was some inconclusive evidence that in cases of either very high or very low complexity, respondents were likely to err in the direction of central scores.

The designers of the UK Skills Surveys also carried out some limited validation of the 1997 survey and found no reason to depart from this method of data collection; they also note that “individuals are the best placed informants about their own jobs”, but caution that questions should ideally be grounded in tangible activities and carefully worded to reduce social esteem bias (Felstead et al 2007: 9).

### 3.4. A metric for generic skill change

The various attempts to construct a metric which have been described in this chapter were devised to suit different purposes, and the criteria of good design were related in some degree to the purpose for which each was developed. To move from these precedents to a suitable model for use in the present thesis, it is necessary at this point to return to three core points developed in Chapter 2 about the kind of metric required to support this research:

- the primary need is to measure skill *at the point of deployment*, i.e. the amount and type of skill that is actually converted into productivity. This is a different exercise from identifying the amount of *potential* productivity that is present in the economy in the form of skill, or from modelling the demand (present or future) for different kinds of skill;
- it is more important to track change over time than to support accurate cross-sectional comparisons at any one point in time. The latter are obviously needed for making sense of the findings, but the actual measurement needs to capture flows rather than stocks, and hence must be sensitive to small variations over short intervals of time;
- it is important that the raw data capture as much as possible of the variety which actually exists in the system. This rules out approaches, such as are needed for occupational classification, which suppress variation by averaging out individual observations or reducing them to broad categories, though the data generated should make it possible to carry out such analyses.

Thus the review of the literature so far has made it possible to refine the list of characteristics set out at the beginning of this chapter as desirable in a generic metric of skill. The new and more operationally focused list of criteria requires that such a metric:

- must be indifferent to dimensions of skill other than the specific one that provides the basis for the metric, i.e. should not privilege or overestimate or underestimate the prevalence or intensity of any skill because of its location along an irrelevant dimension; specifically:
  - it must capture skill in its embodied, embedded and situated aspects;
  - it must measure something other or more than just the socially constructed dimension of skill;

- must capture the element of learning that distinguishes skill from aptitude, disposition and state of mind; but equally
  - must go beyond simple knowledge (however practical) to the ability to do useful work, and
  - must go beyond the process of learning to the capability which is its outcome at any point in time;
- must provide a means of assessing variation along some qualitative dimension in a way that applies irrespective of technical field or level in the workforce hierarchy;
- must be capable of being assessed by worker self-report without creating undue opportunities for socially approved response bias or boasting responses.

The approach outlined below meets most of these requirements, at least in some degree, bearing in mind that it is not feasible at this stage to generate new data for the purposes of this research. That is, it has been designed to draw the maximum relevant information out of the data that already exist in the public domain, while still providing a basis for the future development of more specialised instruments (survey-based or qualitative) for follow-up research.

Before clarifying the concepts that make up the model, it is necessary to clarify what is meant here by the basic concept of “a job”. The term is used here in a particularistic sense to mean the set of tasks and work arrangements in which an individual worker is employed in an individual work context. That is, each job corresponds to a single employee, even if other employees working on similar functions in the same workplace have more or less identical jobs. The term used for this construct in the UK Skills Surveys is “person-job” (Felstead et al 2007: 11). This definition is intended to capture the full complexity of real workplaces and the full diversity of individuals’ workplace experience. It needs to be distinguished from the more generic sense of “an occupation in an industry” in which the term is used in occupational classifications and by researchers such as Ian Watson (2008). Such usages assume that the differences between closely comparable jobs are sufficiently unimportant to be treated as noise, allowing broadly defined job descriptions to be applied over time and across firms. The present approach still allows such job categories to be constructed, at any level of generality, from the raw data, but leaves the latter representative of the actual diversity of workplace experiences, recognising that even identically classified positions within the same department of the same firm may embrace a variety of demands on the skill of their incumbents depending on local management style, complementarity between the skills of fellow-workers and interaction with specific customers, and that those demands are liable to change over time with changes in product line, production processes, markets and work organisation.

The measurement approach starts from Spenner’s model but adds a third dimension, skill-intensity, which is specifically designed to track movement over time. Skill-intensity is the degree to which a job “stretches” the skill base of those who exercise it, independently of whether that skill base is high or low in its own right. The inclusion of this new dimension is also intended to compensate for the current lack of good data for tracking changes in the substantive complexity of individual jobs in Australia, since the one variable in HILDA directly and explicitly relating to job complexity is ambiguous in its wording and poses

some problems of interpretation, as further outlined in the next chapter. This is necessary above all for comparison with the British data, so that some net or raw measurement of skill (even if it is a different measurement) will be available to track against movements in task discretion in order to examine relationships between the two.

The full model still requires information on substantive complexity to provide a complete picture, even though it has not been possible to include that dimension in the present research. For that reason, the rationales underlying all three dimensions are set out below.

### **3.4.1. The substantive complexity criterion**

As noted in 3.3.3 above, both Spenner and Form agree that complexity is a central unifying theme in the various attempts they document to measure the content of skill across occupations and time. Some kind of complexity is a key element for designating one skill as “more” (difficult, advanced, sophisticated, demanding, knowledge-intensive) than another, i.e. a key dimension of qualitative variation. In this sense a job involving many tasks of different types exercised in coordination, or else a small number of task types that are less straightforward to carry out, is generally regarded as more skilful than one that comprehends only a few simple tasks.

Spenner's definition of substantive complexity has three components, level, scope and integration. They can be conceptualised for working purposes as follows:

- **Level** refers to the element of difficulty involved in carrying out a task. This could include such things as knowledge content, required aptitudes, need for prior experience, responsibility and unpredictability. A job that simply requires performance of a large number of different tasks is not necessarily complex in this sense if each of them is very straightforward and requires little knowledge, thought or dexterity to get right. Given two jobs that involve the same number and range of tasks, the one in which it is harder to do the individual tasks effectively will rate as the more complex on this criterion.
- **Scope** refers not just to the number of different tasks to be done, but to the range of qualitative variation among them. A job that involves carrying out a great many separate tasks of the same kind (e.g. using a highly automated machine on a speeded-up assembly line, or handling heavy traffic in a call centre where the inquiries are routine and the interactions rigidly scripted) may be intensive or demanding simply because of the volume of work to be done in the time, but does not necessarily pass the test of complexity by this definition.
- **Integration** is the need and capacity to carry out tasks of different kinds, each requiring its own distinctive knowledge and having its own distinctive success criteria, in a coordinated fashion so that they work synergistically towards a given end. Complexity thus implies not just doing many things, or doing many things of different kinds, but doing them together to produce an outcome or output which is broader or sometimes different in scope from any one of them.

The element of integration distinguishes this definition of complexity from the model of competency-based training (CBT) and certification which has dominated Australian VET policy since the 1980s. The CBT approach implies that a person who has demonstrated proficiency in each of a specified number of task-related competencies is qualified to

exercise an occupation or complex skill of which those competencies are elements. A view of complexity based on integration suggests that the skill lies in the coordination rather than in the individual elements. Nelson and Winter, developing an argument originally put forward by Michael Polanyi, define skill as:

A capability for a smooth sequence of coordinated behavior that is ordinarily effective relative to its objectives, given the context in which it normally occurs.

(1982: 73)

They go on to describe three interdependent characteristics of skill: it involves a sequence of steps; a performer is not normally aware of the details of his performance; and the options at each stage are selected automatically and without awareness that a choice is being made. They compare skill first to organisational routines, and then to computer programs in that their "execution is ordinarily a highly complex performance relative to the actions required to initiate the performance" (1982: 75). This concept of skill bears more resemblance to the models of advanced skill outlined in 3.2, e.g. Attewell's concept of virtuosity, than to Spenner's more generic model, but sheds a useful light on the implications and significance of the complexity dimension in the latter.

Defined in this way, substantive complexity is conceptually distinct from simple work-intensification. Consider for example an organisation where most of the lower-skilled support positions have been eliminated in the interests of economy, as occurred in most Commonwealth agencies in the last decade of the 20th century following the merger of the Third and Fourth Divisions into a single clerical-administrative stream. This change left non-managerial professional employees with many of the tasks previously handled by clerical support staff, alongside their continuing substantive responsibilities. Their jobs might be said in a colloquial sense to have become more complex as a result (indeed, the process was sometimes characterised as multitasking), but equally commonsense usage might suggest that they had been partly deskilled. Under Spenner's definition of complexity this contradiction no longer applies. Firstly, the *average* "level" (i.e. difficulty or knowledge requirement) of their tasks fell even as their number and diversity ("scope") increased. Secondly, the clerical support functions were often not closely integrated with their professional work but rather a separate set of tasks fulfilling a different function and competing with the professional work for the available time. Consequently, substantive complexity can be said to have declined even where the jobs became more technically diverse and more demanding in terms of output per hour worked.

Precisely because of the stringent test involved, i.e. the need for evidence on all three sub-dimensions, substantive complexity poses measurement problems which might not initially be evident. If integration of tasks is an essential criterion, then simple counting of the distinct tasks involved in a job provides only part of the answer; it is also necessary to measure integration, and it is difficult to think of even a theoretical basis on which a uniform objective metric could be developed for integration in the sense of task synergy or complementarity. Introducing task difficulty into the equation, under the heading of "level", effectively begs the very question which the model sets out to resolve, since it means finding a neutral metric to rank tasks on their difficulty across the full range of technical specialisations. These complications effectively throw the researcher back into the domain of subjective judgements and rankings.

The UK Skills Surveys, as already noted, take a triangulation approach to this dilemma. The main element is still simple enumeration of job components, but with generic activities or capabilities abstracted from the job-specific tasks at a level of generality that makes ranking them by “level”, at least potentially, a more intuitive and consensual exercise. Even so, they complement these data with others on learning time and typically required qualifications which provide some kind of proxy for the knowledge and coordination elements of complexity.

One of the more compelling proxies for both level and integration is the time it takes to learn to do a job properly. This includes not only the amount of formal education and training, which captures an important aspect of the difficulty element, but just as importantly the amount of informal learning on the job and simple practice, which probably comes closest of any proxy to indicating the level of integration required. Unfortunately few data exist on the latter, except where they have been intentionally collected by purpose-designed surveys, so that attempts to quantify learning time risk over-weighting the formal element and privileging those jobs which incorporate high levels of codified knowledge or rely heavily on structured pre-employment training. Similarly, the knowledge requirement of a job represents a credible proxy or even indicator of its difficulty, but because a high proportion of the knowledge required to do any job is tacit, and no valid means has yet been found of measuring tacit knowledge directly, there is little hope of finding a metric that captures both elements accurately.

A further distinction needs to be made between learning time (i.e. prior learning which is necessary before a job can be done well) and learning requirement (the need to continue learning new things in order to keep up with the evolving requirements of the job). The latter is treated here as an element of skill-intensity, and will be discussed below under that heading.

Another common set of proxies for complexity involves predictability, routinisation and repetitiveness at one end of the scale and variety, adaptiveness and initiative at the other. It makes intuitive sense to suppose that a job where nothing is given, one needs to think on one's feet and the range of challenges is unpredictable is more complicated and harder to get right than one where all the roles, tasks and responsibilities are mapped out beforehand in strict protocols, few surprises can be expected, and those which do occur must be left to someone further up the line to sort out.

Initiative is the element where substantive complexity and task discretion most obviously intersect, and will be treated under the latter heading. Unpredictability has equally obvious links to skill-intensity, in that it is one of the common ways a job can “stretch” those who work in it. At this point in the argument it is most appropriate to focus on the aspects of routine, repetitiveness and variety which belong most clearly in the complexity dimension.

It is common to view routine/repetitiveness and variety as lying at opposite ends of the same spectrum. Yet in many jobs which are acknowledged to be highly skilled, the skill lies precisely in being able to repeat the same set of tasks over and over again with great precision and a minimum of variation. An example is the specialist cataract surgeon who has learned to carry out the same operation dozens of times a day, every week, for years on end, with no room for mistakes and only a limited range of known circumstances requiring a change of approach. And when the retiring Chief Justice of the High Court of Australia

can say “There is much that is repetitive about what I do in the law”<sup>3</sup>, it is clear that not all jobs requiring repetition can be low-skilled. This need for accurate repetition would seem to be most relevant in heavily regulated occupations such as law and accountancy where individual responsibility is high, due or correct process is a key element in satisfying the customer's or the public interest, individual cases must be handled without discrimination and “creativity” is colloquially seen as a vice. As in the cases of both the judge and the surgeon, the level of skill needed to repeat a complex standard operation with total accuracy is typically reflected in very extended learning times.

The opposition can also be criticised in the light of organisational learning theory. Routines are now generally viewed as one of the most powerful tools by which an organisation can harness its collective knowledge to solve complex problems (Cohen, Burkhart, Dosi, Egidi, Marengo, Warglien and Winter 1996). The skill required to follow a routine can be considerable in types of work organisation where highly complex tasks are handled by subdividing them into routines where each member of a team has a prescribed function to fulfil and the success of the overall operation depends on each member of the team working precisely as expected and in precise coordination with the others. Such routines, being at least partly tacit, are often very difficult for a newcomer to learn.

As seen above, Nelson and Winter see skills as performing the same function for an individual as routines do for an organisation, suggesting that the two concepts have much in common. Indeed, the model of skill derived from Polanyi and elaborated by Nelson and Winter sees routinisation as an inevitable consequence of fully developed skill:

Skills are deep channels in which behavior normally runs smoothly and effectively... suppression of choice is certainly associated with, and is probably a *condition* for, the smoothness and effectiveness that skilled behavior confers.

(Nelson and Winter 1982: 84-5, emphasis in original)

At the other end of the presumed scale, task variety is a direct indicator of the scope sub-dimension and connected to integration: in principle, the more disparate the set of competencies that need to be exercised synergistically, the more difficult the integration task. In this sense it is probably the closest thing available in most circumstances to a direct indicator of integration. However, such variety can coexist with complex routines, in that the routine represents the only way such a diverse task set can be coordinated. To confuse the matter further, many of the most difficult jobs in society (e.g. policing) require a judicious interplay of creative sensitivity to the circumstances of the individual case and a commitment to impartiality and due process. In such cases the *coexistence* of repetitiveness and novelty is what determines the difficulty of the integration task.

An additional complication is that a job which requires the practitioner to make many choices under conditions of uncertainty may well be taken as objectively complex, but for those who follow in the tradition of Polanyi and in that of the ethnomethodologists, *awareness* of these choices is evidence of an imperfectly skilled practitioner. In Attewell's words, “All events are unique cases; human skills consist of effortlessly translating each unique instance into an example of routine... Skill inheres in the ability to do this without recognizing it, in acquired or trained ‘blindness’ to uncertainty and uniqueness” (Attewell

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<sup>3</sup> Chief Justice Murray Gleeson, *The Law Report*, ABC Radio National, 19 August 2008

1990: 433). This paradox has implications for what constitutes good evidence: in this context at least, self-report could be seen as unreliable because it would tend to understate the skilfulness of the most skilled individuals, and of the jobs in which they work.

The picture that emerges from these considerations is profoundly ambiguous. The best that can be concluded is that routine, repetition and variety are all relevant to the substantive complexity dimension, but none of them is a uniform, unequivocal or monotonic indicator of complexity. Their significance will vary according to the circumstances and the other characteristics of the job, and hence their implications need to be analysed case by case<sup>4</sup>. In any event, it seems preferable to see the three sub-dimensions as conceptually distinct rather than as opposite points of the one scale.

### **3.4.2. The task discretion dimension**

Spenner's autonomy/control dimension is referred to in this thesis as task discretion. This is the term used in the UK Skills Surveys, but with one very important difference. The British authors apply the term specifically to the control exercised by an individual worker over her own work, and are careful to distinguish this aspect of control from collective decision-making or consultation, which they see as different and possibly rival forms of work organisation (Gallie, Felstead and Green 2004). In this thesis it includes any mechanism which enables the worker to feel that she has some control over the decisions affecting her immediate work, whether that mechanism consists of autonomous decision-making at the level of the individual, collective decision-making at the team or work-group level, or input to decision-making through some kind of formal or informal consultative process. Thus, task discretion in the sense used here is a broader dimension of which individual autonomy represents one manifestation or sub-dimension.

Part of the reason for taking this different approach is that in an increasingly interconnected world and workplace, it is becoming harder to find jobs that involve a lot of genuine autonomy, and hence that this disappearing characteristic of work may have been overtaken as the most important issue by the ability to exercise some kind of control in a work setting characterised by high levels of interdependence. More generally, and given that this metric is based on worker self-report, a judgement has been made that what really matters is the *sense* of being in control rather than the mechanism by which it is brought about. The British authors appear to suggest that consultative input to decision-making should be approached with caution because in practice it often involves deliberate strategies to create the illusion of control when none in fact exists. However, it is arguable, and will be argued later in this subsection, that there are equally common circumstances where the appearance of individual autonomy exists on paper, but in circumstances where the individual's decision-making latitude is so circumscribed that there is less real discretion than might exist under explicitly hierarchical arrangements.

Task discretion is historically significant to the whole discussion of deskilling, and of skill trajectories in general, since the main element in all accounts of the deskilling impacts of industrialisation from Braverman, and indeed from Adam Smith, through to more recent critiques of managerialism has been the loss of the individual workers' discretion over the way they do their job. Closer to the present and from a very different perspective, the

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<sup>4</sup> When this issue was tested on the HILDA findings, it became clear that the respondents associated initiative positively and repetitiveness negatively with skill-intensity (Section 6.4).

ability and willingness to exercise initiative, on the surface one of the key concomitants of discretion, has become one of the capabilities most insistently sought by employers as a “new economy” skill. In the 2001 NCVER survey of employers’ views on VET (NCVER 2001, quoted in Allen Consulting Group 2006), over 75% of respondents who employed recent VET graduates rated as “extremely important” or “very important” the skills of “ability to use initiative” (88%), “problem solving skills” (81%), and “ability to work with minimal supervision” (80%). The highest identified priority for improvement in VET graduates was the ability to use initiative.

Sceptics on the subject of deskilling have often been inclined to dismiss Spenner’s autonomy/control dimension as an element of personal fulfilment, work organisation or social power distinct from the actual skilfulness of the work (Form 1987:30; Lowry et al 2008: 17). However, there is a strong argument in principle for seeing task discretion as a distinguishing characteristic of high-skilled jobs. Increasing job complexity logically creates more situations where there is a range of choices for action, the consequences of a wrong choice are more critical and harder to reverse, and the number of factors influencing the correct choice is such that only someone on the spot has the full knowledge of the circumstantial factors that is required to make a correct decision. The more such occasions can be expected to arise, the harder it becomes to codify the correct choices beforehand in a protocol or to reach them through micromanagement from a distance; consequently such jobs cannot be exercised effectively unless the jobholders, individually or collectively, have a high level of input to the relevant decisions.

Another way in which task discretion interacts with complexity is through the integration element of the latter. The skilfulness of a job depends to a large extent on whether the integration function is internal or external to the job. Where the worker is responsible for coordinating multiple tasks to produce a higher-order output, this in itself makes the job more complex and more skilful, and also implies greater task discretion. But where task discretion in a job is low, it is more likely that coordination will be handled externally: that is, the worker will be expected to carry out a pre-specified set of tasks in a prescribed manner at prescribed times without regard to how they interact, and someone further up the line will take on the responsibility for integrating the outputs into a higher-level outcome.

From this perspective it could perhaps be argued that task discretion is not in itself a characteristic that makes a job high-skilled, but rather evidence of its complexity, since highly complex jobs would not be sustainable unless they incorporated high levels of task discretion. It could thus be regarded simply as a sub-dimension of complexity rather than a dimension in its own right. Even in that case, it would still qualify as distinct in an evidentiary sense, since workers themselves are likely to perceive the amount of freedom and control they have in their job as something different from its complexity or difficulty. Thus, given the kinds of gap in the evidentiary base that currently exist in Australia, data on task discretion could serve (perhaps in conjunction with other variables) as indirect indicators of substantive complexity, compensating to some extent for the absence of quality data on the latter.

A second set of arguments from the supply side is that job-related learning (formal or informal) contributes to productivity precisely because it equips the worker with the knowledge and experience to make detail decisions affecting her work with greater accuracy than someone further up the hierarchy could achieve. In the process it also creates expectations of greater autonomy as an indicator of the respect and value which the

organisation accords to the individual worker. If this is seen to be withheld, the worker will lose motivation and commitment to the job, and may even experience stress which reduces her productivity (Karasek 1979, cited in Spenner 1988: 86). On both these grounds, the productivity benefits of any new learning can be expected to stop at the point where task discretion ceases to rise in line with the increase in workers' job-related knowledge. (Conversely, too much task discretion may reduce productivity if the workers are insufficiently knowledgeable about the matters on which they have discretion to make their own decisions.) From this point of view task discretion is a logical concomitant of complex or knowledge-intensive work but conceptually distinct: it functions as an indicator of effective deployment, influencing the extent to which the productivity potential created by workforce learning is converted into actual productivity.

Task discretion is itself a multidimensional construct. Spenner's definition has three elements: content, manner and speed. The first suggests that the worker has some choice in the selection and definition of the tasks which go together to make up the job. The second implies that even where the tasks themselves are predetermined, the worker has discretion to perform them in ways that are sensitive to the immediate situation or appropriate to her capabilities or knowledge. The third relates to control over the timing of the tasks.

It is questionable whether Spenner's definition captures the full complexity of this timing sub-dimension. It would seem logical to expect that besides the actual speed with which each task is done, there must equally be scope for variation in the sequencing and scheduling of tasks. The former is clearly relevant to the central role played by sequence in Nelson and Winter's definition of skill: skill lies precisely in being able to "choose" (albeit unconsciously) the order in which component tasks are performed. Scheduling could refer either to the initiation of tasks at times that are most appropriate to the circumstances, or to the individual's freedom to organise his work over the working day or week in accordance with fluctuations in the workload and his most effective working style. Spenner in his 1993 article effectively acknowledges these elements in an additional criterion which appears in his 1993 article but not subsequently: "room for the worker to initiate and conclude action" (1993: 829). The factor analysis of the HILDA data which is described in Chapter 6 shows that this time sub-dimension is important in this own right and contributes far more to the variance than the other elements of task discretion, or for that matter than skill-intensity, suggesting that it deserves closer study than it has received in earlier research on this dimension of skill.

In addition to these aspects of job content, task discretion varies along another axis which can be seen as orthogonal to the first: the degree to which task discretion is experienced individually or collectively. As noted earlier, this is a major difference between the way the term is used here and in the UK Skills Survey reports. Early specifications of task discretion, notably Braverman's, saw the traditional craftsman's job before the onset of deskilling as having been characterised by high levels of personal autonomy. In practice, such autonomy is possible only in a limited range of jobs: even a sole practitioner or jobbing tradesman is usually time-constrained, perhaps to a greater extent than someone working in an organisation, by the demands of his customers or by the event-driven nature of his work. Working in an organisation generally requires a fairly high degree of coordination with other workers which limits the scope for personal autonomy, and this type of interpersonal coordination can itself be viewed as a manifestation of the integration problem which is directly associated in Spenner's model with high skill. But even where true individual autonomy is impracticable or inappropriate, high levels of task discretion

can still be achieved on the collective scale: for example, teams may have discretion in how the members share out and schedule tasks among themselves, workers may have input into the design of their jobs even if there is little scope for discretion in their implementation, or forms of industrial democracy may provide workers in different areas of a firm with some say over how the work of their division or team is coordinated with that of other areas with which they interact. Any instrument which sets out to measure task discretion must be capable of capturing this collective element, in its various manifestations, along with individual autonomy.

Spenner is at pains to distinguish autonomy/control, which occurs within a role, from authority or supervision, which he sees as part of the structural relationship between roles in a workplace (1993: 829, 1990: 403). In practice this distinction may be hard to sustain, since close supervision is one of the most obvious constraints on task discretion, and few of the earlier authors on whom his model is based seem to have recognised the distinction. However, it does draw attention to the possibility of dissonances occurring between the level of task discretion assigned to a role and the authority or accountability structure within which that role operates.

A case in point is precisely the common expectation that employees should be able to “work without supervision”. What this often implies in practice is that the employee is expected, without oversight or guidance, to produce a result which has been pre-defined by someone else and which she has no latitude to tailor to the needs of the situation in which she finds herself, or to what is actually possible. In such a case low levels of supervision can indeed coexist with low levels of task discretion. Similarly the requirement to “show initiative” sometimes means simply an expectation (perhaps a perfectly legitimate one) that employees will do exactly what is expected of them, but without having to wait to be told. Such dissonances are most likely to become problematic under structures of “accountability” or “empowerment” where individuals or teams are left to their own devices to deliver a predefined “outcome” which has been designated without informed consideration of its feasibility or appropriateness, with no opportunity to provide feedback or renegotiate the target. In such cases task discretion can become a very ambiguous construct.

It is precisely in such cases that self-report shows its strengths as a means of assessment, since the people who work in a job are generally the best placed to sort out the level of freedom they actually experience from the level of “empowerment” set down in the job description. In other respects, however, self-report may raise possibilities of bias, since people’s perception of how much discretion they have is related to their expectations, and these may vary according to their assessment of their own capability and the value of their job. It seems intuitively logical to expect that workers who regard their job as high-status and themselves as high-skilled will tend to see a high level of discretion (in one form or another) as their entitlement and be sensitive to any encroachment on it. Conversely, one might expect those accustomed to thinking of their job as low-value and themselves as low-skilled to feel more relaxed about working under direction and to overestimate the value of small concessions to personal autonomy. Thus social construction can easily bias the estimates, especially at the intermediate levels where it includes status factors which are not directly skill-related, e.g. traditions of strong unionism, traditions of self-employment, or white- vs. blue-collar status.

### 3.4.3. The skill-intensity criterion

The construct of skill-intensity is used in this research partly on the pragmatic grounds that the data exist in HILDA to track it, whereas there are no good indicators of substantive complexity in the dataset. However, it also appears to represent a dimension of skill that is genuinely complementary to substantive complexity and task discretion and covers different aspects. One particular strength of skill-intensity as a measure of skill trajectories at the level of the full economy is that it does not treat the skill content of a job or the skills of an individual as a fixed quantity existing in its own right. Instead, it relates to the match between the skill brought to the job by the worker and the skill demanded by the job – in other words, how far the job “stretches” the worker’s skill. The elements of “stretch” include the extent to which the worker uses all his existing skills in his work, the gap between his existing skills and the demands of the job, and the extent to which he wants, and is able, to learn new skills or refine his existing ones in order to do it properly, or better.

Skill-intensity effectively captures the embodied, embedded and situated dimensions of skill because it lies at the point where the three intersect:

- The worker brings a quantum and mix of embodied skills to the job, deriving from a mixture of aptitude, education and past work experience unique to that worker. This base of embodied skill evolves as the worker matures in the job. Skills that are used in the job develop because of the need to practise, refine and extend them, adapt them to new productive knowledge and processes, and apply them in a new context of work organisation or in interaction with different colleagues, managers and customers. Skills that are not used in the job eventually decay, to a greater or lesser extent, and hence cease to be available to the worker, the employing firm or the broader economy.
- Jobs, viewed as complex productive functions designed to work together to generate higher-order outputs, impose a requirement for a mix of skills in the worker which is more or less unique to that job, i.e. embedded in it. Even if the job description appears highly standardised, its detailed skill requirements will always be determined to some extent by highly local factors such as the type and performance of the technology in use, the personalities of the manager and workmates in the same team, the culture and organisational routines of the individual firm and the precise nature of the product and its current market.
- However, the determination is not necessarily one-way or wholly preordained: the individual capabilities of those employed in a job necessarily have some influence, however marginal, on how the tasks are assigned and how feasible it is to achieve the specified task performance. In this way, even if indirectly and imperceptibly, the capabilities of each individual in the workforce affect the capability of the organisation as a whole. Because measurement takes place at the level of the individual job, it captures this element of situated skill that arises out of localised and possibly unique interactions between the work requirement, the characteristics of the workers and the other elements of the activity system.

Skill-intensity thus embodies the ideas of reciprocity, fluidity and constant mutual adjustment which are central to the NSS model. In a more specific way, it captures all three of the core processes which shape the dynamic of the model. Supply in the form of

embodied skill (the set of capabilities, however acquired, which each worker brings to the task) interacts with demand in the form of embedded skill (the predefined capability requirements of the productive function which the job must satisfy) through the mediating process of deployment. Deployment, at the macro- and meso-level, includes the strategies and arrangements by which decisions to serve a particular social need or market demand are translated into products, then into production processes, and those processes in turn are subdivided into functions and jobs with characteristic patterns of interaction (hierarchical and cooperative) and a division of responsibilities requiring a certain distribution of skills. At the micro-level it includes the organisational culture and routines and the work and management practices that influence the effectiveness with which these assigned functions can be carried out.

Where a good match does not exist between embedded and embodied skill, the manifestations fall into the two conventionally recognised categories of over- and underskilling. Overskilling describes the situation where workers come to a job with skills which the job does not require, or where the job exercises all their skills, but at a lower level of complexity, sophistication or performance than they are capable of achieving (McGuinness and Wooden 2007; Mavromaras, McGuinness and Fok 2007; Mavromaras, McGuinness, O'Leary, Sloane and Fok 2007). Overskilling in most cases is dysfunctional because the skills that are not used eventually decay and are lost, but also because a worker who is unable to exercise her full package of skills may feel undervalued, lose motivation and eventually become less productive than another worker with lesser skills which are fully exercised by the same job. Yet a certain measure of skill and knowledge that goes beyond the normal repertoire demanded by current jobs can be very valuable to a firm by giving it the latitude to do new things and creating the absorptive capacity (Cohen and Levinthal 1990) that allows it quickly to assimilate the new knowledge required to move into unfamiliar areas of activity.

The same paradox applies to underskilling. If the skills of the workforce fall well short of the demands of the job and there is no means of bringing them up to that level, the firm will experience suboptimal productivity of the kind normally associated with skill shortages. But at the same time, the basic concept of "stretch" implies an awareness on the part of the worker that her current skill base is close to or marginally below the demands of her job, so that she needs to learn continuously in the course of doing the job in order to keep up. There is also the arguably ideal situation of a virtuous circle where the skills of workers are up to the demands of their job at any given point in time, but the workers are able and motivated to keep learning as they go, and the jobs are free to grow with their developing capability.

This last situation could be described as dynamic match, as opposed to a static match (the equilibrium envisaged by traditional economic models) which has connotations of stagnation. Similarly in the case of mismatch, there can be static mismatch which rigidifies into permanent failure to achieve the potential productivity, but there can also be dynamic mismatch which results in creative tension and/or positive feedback loops. To be consistent with the underlying NSS model, the metric used for skill-intensity needs somehow to capture this presence or absence of dynamic effects.

A different way of looking at this paradox is that skill-intensity is not a monotonic function: it does not increase indefinitely with the growth of some input, neither does it peak at a single point and then drop off again. A theoretical curve of skill-intensity plotted against

embodied-embedded skills match, assuming the data existed to plot it, would have two peaks located close on either side of the point of perfect match. On the side of marginal underskilling, the skill-intensity is greatest where the worker's skills are close enough to the demands of the job to avoid regular or sustained negative impacts on productivity from mistakes and incompetence, but tested by those demands to the point where workers experience a challenge in their work and a sense of achievement when they do it well. On the side of marginal overskilling, a skill-intensive job is one which can accommodate types and levels of skill not previously associated with work in the area concerned and put them to productive use before they decay.

Equally, the paradox could be explained by arguing that skill-intensity, like the other dimensions that make up the metric and like skill itself, is multidimensional. The account so far has uncovered three complementary dimensions that go together to make up skill-intensity: match, stretch and learning. It is the combination rather than their individual presence that makes a job skill-intensive. A good match between embedded and embodied skills, without the dynamic element of stretch, can lead to complacency, path-dependence and ultimately competence traps. Stretch is productive only if the workforce has the capacity and opportunity for learning to close up the skill gaps as they emerge. Learning, understood as both the perceived need to learn and the resources to fulfil that need, is worthwhile only to the extent that the job takes productive advantage of it within a reasonable time. Thus, an adequate indicator of skill-intensity needs to be a composite one, made up from multiple variables that capture the different aspects.

The most useful characteristic of skill-intensity as an indicator of trends over time and across industries is that it is conceptually distinct from the actual technical content of the skill. It is one of the few metrics that can support valid comparisons across the full range of technical content, across manual, cognitive and behavioural/interactional skills, and across levels in the skill hierarchy. This last characteristic reduces, though it does not entirely eliminate, the influence of social construction, since it requires workers to compare their capability with what their own job requires, rather than with someone else's abilities. For the same reason, it minimises the risk in relying on self-report data, since informants may conceivably have an incentive to over-report the extent of their own skilfulness or the skilfulness of their job, but are much less likely to see advantage in misreporting the degree of match between the two. The only caution raised in the literature is that in some cases, workers who are used to regarding themselves or their work as unskilled may under-report the skill-intensity of their job because they do not recognise what is required of them as being skill. In such cases it may be necessary to collect data using questions that do not refer explicitly to skill (Felstead, Gallie and Green 2002: 23).

On the other hand, precisely because of this feature, skill-intensity needs to be distinguished from the actual skill content of a job in the absolute sense discussed elsewhere in this chapter. A skill-intensive job or occupation is not necessarily the same as a high-skilled one. A job may be quite low-skilled but still skill-intensive in the sense just described, e.g. if the workers feel continually stretched because they are inadequately trained even for the relatively simple tasks they need to perform, or if they do learn as they go, but the things they learn do not add significantly to their productivity or the substantive complexity of their work. (This would apply, for example, in shop-floor retail work where there was a rapid turnover in product lines without any increase in their specification.) At the other extreme, a surgeon who is highly specialised in a single type of operation – as in the earlier example of the cataract surgeon – can only be described as very highly skilled in

terms of the quantity of both codified and tacit knowledge involved, the learning time required to reach that level of proficiency, the level of responsibility exercised and the requirements for dexterity, alertness and diagnostic skills, but may well be so thoroughly on top of his job that he no longer feels cognitively stretched by it or needs anything more than intermittent learning as new products and techniques are developed. Skill-intensity is a dimension of high skill that is commonly strongly evident in high-skilled jobs, but not enough on its own to characterise a job as high-skilled. Hence in this thesis, when occupations need to be classified into high, medium and low skill categories, as in Chapter 8, it will still be necessary to use a composite metric that includes some of the traditional, flawed proxies alongside skill-intensity.

More generally, skill-intensity has only limited value as an indicator of the amount of skill being exercised in the economy, or in any part of it, at a single point of time. At best, it hints at the prevalence of skill, but it tells very little about the nature or quality of the skill. Hence the construct can be used only with caution as the basis for cross-sectional comparisons either between industries or between nations. At best, some estimate of the comparative skill-intensity of different industries at a given point in time can be gained from workers who have moved between industries over time and thus have a basis of experience on which to make like-with-like comparisons. By contrast, data on perceived skill-intensity permit *changes* in the skill profiles of firms or industries to be tracked in a very fine-grained way and refreshed as frequently as new data can be collected. This kind of analysis can show strikingly different results from analyses based on static or point-in-time measures of skill, especially for inter-industry comparison, where the prevalence of change (though not the degree of change) can be compared more reliably than current skill-intensity. Changes in the relative skill-intensity of industries and occupations in turn provide a direct indicator of the compositional element of the national skills trajectory.

The purpose of tracking skill-intensity, as distinct from some more comprehensive metric of skill, is best understood in the light of the argument put forward in Chapter 2 that from a systems perspective, the supply of skills in the economy is better viewed as a flow than as a stock. This distinction by itself is sufficient to justify the difference in measurement strategy between this thesis and the UK Skills Surveys. The latter, as their authors take some trouble to point out, are primarily intended to provide an accurate estimate of the stock of skills in the economy and how this changes over time (Felstead, Gallie and Green 2002: 18). They justify the spacing of their survey runs by the argument that the stock is unlikely to change rapidly, and hence that much of the year-on-year variation revealed by more frequently refreshed data would probably need to be dismissed as noise. Given that their object of interest is a relatively invariant commodity, it obviously becomes important to know as much as possible about the characteristics of this commodity. But where the interest lies in flow, the situation at any point in time is less critical, because it is assumed for these purposes to be ephemeral. The important thing is to capture the dynamic, which is presumed by the underlying theory of the NSS to be non-linear and non-incremental, such that significant developments emerge almost imperceptibly but may accelerate rapidly at some stage in the evolution of the relevant process. To pick up these trends it is necessary to have data points closely spaced in time, even if most of the data generated will represent noise just as inevitably as if the purpose were to estimate the stock.

All three dimensions which make up the proposed metric have been fleshed out here, and their implications teased out, in far more detail than would be necessary if the intent were simply to provide the basis of an ad-hoc methodology for the empirical research in the

present thesis. The reason for this detailed exposition has already been given in Chapter 1: this metric and the model of skill it reflects, just like the NSS concept itself, have been put forward not just as tools for a single research project, but as part of a paradigm that can usefully shape both academic research and strategic analysis in the future. The empirical component of the thesis is there only to provide a first, illustrative implementation of some aspects of the paradigm. Hence it is unlikely that many of the implications just discussed would emerge from this single piece of research. However, they need to be foreshadowed as considerations which will have to be faced by other researchers deciding whether to adopt, or adapt, this model, or which they will sooner or later confront through practical experience.

### 3.5. Summary and conclusions

This chapter has served two purposes. One is to create awareness of the multiple meanings that attach to the apparently straightforward concept of skill, and their respective implications. This was demonstrated through the single example of the locational dimension of skill. The other is to draw out the requirements that need to be satisfied by a generic metric for skill for the purposes of the research in this thesis, and to propose a model that will meet as many as possible of these, initially from currently available data sources, but also as a structuring principle for the future development of more comprehensive and targeted data collections.

To satisfy the purposes set out at the end of Chapter 2, a metric needs to meet the following requirements:

- it must measure skill actually exercised at the point of deployment;
- it must be capable of capturing flows rather than, or in addition to, stocks of skill;
- it must capture as much as possible of the variety that actually exists in the NSS by undertaking measurement at the level of the individual job;
- it must indiscriminately capture the embodied, embedded and situated aspects of skill;
- it must minimise the bias resulting from social construction;
- it must capture the learning element that distinguishes skills from aptitudes;
- it must provide a generic basis for assessing qualitative variation; and
- it must be capable of generating accurate data from employee self-report.

The main message which emerges from a necessarily lengthy review of the literature is that no single indicator can adequately capture a picture of the prevalence and distribution of skill, or of its trajectory over time. A composite metric is required. Such a metric has the further advantage of permitting some of the gaps in the data on one indicator to be filled provisionally by deduction from the other chosen indicators.

The proposed model is based on one which was derived empirically by Spenner in the 1980s from a comprehensive analysis of the literature up to that time, notably in the context of the deskilling debate. While this work is now quite old, it can still be regarded as the state of the art, since no more recent writing has been identified which covers the subject so thoroughly or introduces any substantially new concepts. The basic Spenner model has proved its value over the last twenty years by serving as the structuring principle behind the

UK Skills Surveys, which have provided the richest and most reliable data yet collected on the skill trajectory of any economy.

For the purposes of the present research, the Spenner model has been enhanced by the addition of a supplementary dimension, skill-intensity, to the original two dimensions of substantive complexity and autonomy/control (task discretion). In part, this was a matter of practical necessity because no satisfactory longitudinal data yet exist on the substantive complexity of Australian jobs. However, the new dimension adds useful new information not provided by the other two when the purpose is to track system effects over time.

The three elements of the proposed model are:

- (i) **Substantive complexity:** the number, diversity and difficulty of the tasks that make up a job. Includes learning time, knowledge content and coordination requirement.
- (ii) **Task discretion:** the degree of latitude or influence which is experienced by workers, individually or collectively, in making or shaping decisions about the content of their job, the way they do their job, and the timing, sequence and scheduling of the individual tasks that make it up.
- (iii) **Skill-intensity:** the degree to which a job “stretches” the skill base of the person who does it. Its sub-elements are the match between the worker’s capability and the operational requirements of the work, the degree to which the worker’s existing skill base is utilised and developed, and the need (and opportunity) to keep learning new things as the job evolves.

The three dimensions are complementary. A full and accurate picture of the state of the NSS at any point of time cannot be achieved if any one is excluded from the analysis. However, it is argued that an informative if incomplete trace of the skill trajectory can be taken by tracking skill-intensity and task discretion conjointly. Chapter 4 demonstrates how adequate indicators for these two dimensions can be derived from the HILDA database, while Chapter 6 sets out the logic by which the underlying model has been developed into a research methodology.

## Chapter 4

### The data source

The kind of research carried out in this thesis has been possible in Australia only since the release of the initial waves of data from HILDA, which is Australia's first multi-purpose longitudinal panel survey based on a large, nationally representative sample. This chapter briefly describes the background and general outlines of the survey before focusing on the particular variables in the dataset which support the analyses in this thesis and relating them to the metrics that were identified in Chapter 3. The final part of the chapter examines the limitations of the HILDA data and what these have meant for the type and extent of research that could be undertaken for the thesis.

#### 4.1. HILDA: the survey and dataset

Household, Income and Labour Dynamics in Australia (HILDA) was commissioned by the Commonwealth department currently known as Families, Housing, Community Services and Indigenous Affairs (FaHCSIA, the Department), previously known under earlier administrative arrangements and perhaps still better recognised as the Department of Social Security. FaHCSIA owns the data and licenses their use by outside researchers. The survey itself is managed by the Melbourne University Institute for Applied Economic and Social Research (the Melbourne Institute). A team of expert researchers from the Melbourne Institute designs the questionnaire for each annual wave in consultation with the Department, which must approve all questions, and an advisory panel representing key government and academic users. The field research for the first seven waves was carried out by the social research firm AC Nielsen Ltd.

HILDA was developed to address a gap in Australia's infrastructure of social statistics. While the ABS has built up a thoroughly comprehensive repertory of time-series survey data based on cross-sectional samples, the only longitudinal surveys previously available with a panel sample were restricted in their coverage to fairly specialised populations or ran for only a few years. Panel surveys use the same sample for each run and consequently make it possible to track the experiences of individuals rather than just net change within populations over time. Such individual-level data are of particular interest to FaHCSIA because they make it possible to map the dynamics of the social processes leading to or resulting from the kinds of life event that trigger, or are affected by, its activity, e.g. marriage, family formation, separation, job loss, labour force entry and exit, and episodes of ill-health (Wooden and Watson 2007: 209). In this respect they assist the Department in forecasting its future workload, evaluating its programs and identifying emerging policy challenges.

The scope of the survey is very broad, reflecting the range of life events and social developments to which FaHCSIA's programs need to respond. Aside from the Department's own needs, the dataset was designed from the start to meet the requirements of other social researchers working in related areas of interest, and as such overlaps the compass of more specialised existing surveys. The three main designated subject areas are

household and family dynamics; income and welfare dynamics; and labour market dynamics (Wooden and Watson 2007: 210). A large part of the dataset consists of extensive and detailed information on household and individual income and expenditure. The core set of questions which are asked in unchanged format from year to year covers nine key areas:

- (i) education;
- (ii) employment status;
- (iii) current employment (location, type, working conditions and job satisfaction);
- (iv) labour market experience of persons not currently employed at the time of interview;
- (v) detailed calendar of labour market and educational activity over last 12 months;
- (vi) income;
- (vii) family situation (including non-resident children);
- (viii) partnering and relationships;
- (ix) living in Australia (miscellaneous topics, e.g. disability, life satisfaction, housing, caring responsibilities).

(Wooden and Watson 2007: 211)

This core questionnaire has been progressively expanded to cover new issues which are intended to be permanent features of the survey: for example, employed respondents have been asked about their work-based training experience since Wave 3, and the set of questions on job quality and characteristics has been substantially extended from Wave 5 onwards, as further discussed in section 3.2 below. In addition, special modules have been inserted in individual years to gather more detailed data on issues of current interest; so far they have included retirement intentions and income, personality traits, obesity, health insurance, household wealth, youth and fertility. Some of these are unique to a single wave, while others are scheduled to be repeated every few waves. The scope of the questionnaire is intended to evolve in line with policy interests: for example, future waves are expected to contain an increasing emphasis on health issues (Wooden and Watson 2007: 228).

HILDA forms part of a growing body of international panel data collections covering similar topics, of which the most important are the British Household Panel Survey and the German SOEP. The questionnaire has been purposely designed to provide compatible data with these surveys (Haisken-deNew and Hahn 2006).

The original panel was set up in 2001. The primary sampling unit is the household, defined as “a group of people who usually reside and eat together”, following the standard ABS definition (Watson N 2008: 110). The sampling method can best be described as a geographic cluster sample. A sample of 488 census collection districts was drawn out of a total of some 38,000 across Australia, stratified by population, State and metropolitan/ non-metro region. Within each of these districts a sample of between 22 and 34 dwellings was selected. Where a dwelling was occupied by multiple households, a maximum of three households were sampled. The resulting initial sample included 11,693 in-scope households, of which 6,872 provided full responses and a further 810 part responses. In this first wave 19,914 persons were enumerated and 13,969 provided interviews (Watson N 2008: 117).

In principle members of the panel, once recruited, remain continuing sample members (CSMs) indefinitely. Children who are born to or adopted by a CSM, and anyone who has a child with a CSM, are recruited with the same status. Other ways of being recruited are to move into a household that forms part of the sample, or to be a member of a household to which a CSM moves, but recruits in this category are counted only as temporary sample members (TSMs) and not tracked if they subsequently leave the household. The only ways a CSM can pass out of scope are to die or to move permanently outside Australia. In practice, the composition of the panel has been far more significantly affected by attrition, a matter that is addressed in more detail in 4.3.2 below. However, considerable trouble is taken to track members who are initially uncontactable, and even if a member eventually cannot be contacted or refuses to participate in one wave, efforts will continue to include him/her in subsequent rounds of data collection.

The survey is conducted annually, generally between August and December, though the fieldwork can be extended into the following March for hard-to-track sample members (Wooden and Watson 2007: 212). This means that the gap between surveys can extend in some cases to as much as 18 months; several of the variables have alternative items in the dataset which have a reference period limited to the 12 months preceding interview.

The questionnaire is made up of three parts. A household questionnaire, administered to one member of the household, includes questions covering all members of the household ("enumerated persons"). This is followed by an individual questionnaire for each household member over the age of 15 ("responding person"). The latter has separate versions for new and continuing sample members. These modules are administered face-to-face by an interviewer, though in practice a small but growing proportion of interviews in the later waves has needed to be carried out by telephone because of difficulties in making face-to-face contact (Wooden and Watson 2007: 212). The interviewer survey is supplemented by a self-completion questionnaire (SCQ) which is left with each responding person to be returned by mail or subsequently collected by the interviewer. The SCQ contains some questions which are difficult to administer in real time, e.g. because of the need to consult financial records, and some which are considered so sensitive that respondents would be reluctant to answer them frankly face-to-face or in the hearing of other household members. Data items in the published dataset are classified under the questionnaire on which they originated, but in many cases are also merged to form composite derived variables for each responding person.

Six waves of data have so far been made available for analysis, running from 2001 to 2006. New waves of data are generally released in the November following the year in which the fieldwork was undertaken. Although initially funded only for four waves, the survey has so far received new appropriations each time its existing one has run out, and new funding announced in the 2007 Budget has ensured that a minimum of twelve waves will be conducted (HILDA Annual Report, 2007).

FAHCSIA permits other Commonwealth and State agencies and academic researchers to use the dataset on application, under an individual or institutional Deed of Licence. The Deed is issued only for a limited period and permits use of the data only for the purposes specified in the application, and subject to stringent controls on the dissemination of unit record data. These controls are considered necessary to protect respondent privacy, in view of the extremely sensitive nature of some of the questions asked (e.g. on individual and household finances, health matters and respondents' perceptions of the quality and

durability of their personal relationships). All but the most secure users are given access only to a public release file which contains some confidentialised items and limits disaggregation in order to minimise the risk of identifying individuals. One aspect of the latter which is particularly relevant to the research carried out for this thesis is that data on respondents' occupation and industry of employment are available only down to the 2-digit level.

## 4.2. The skill-related variables

The HILDA survey, as should be clear from section 4.1, was not primarily intended as a data source for the analysis of skill or other qualitative job characteristics. In the overall instrument design, skill represents only a very subsidiary element of the "labour market dynamics" topic. The small group of relevant indicators appears in the SCQ and has been largely overlooked by researchers so far. (Exceptions are covered in Section 5.3.)

These questions are asked only of respondents employed at the time of survey, and refer to the respondent's current main job. The core set, asked over all six waves, consists of six variables which break into two logical subsets, one referring to the skill demands of the job, the other to the degree of control or discretion which the respondent exercises over how s/he goes about the work. Each variable is listed below under three elements. The first element is an intuitively meaningful variable name that has been coined for the purposes of this thesis. The second is the variable name in the HILDA dataset, with the underscore standing for a letter identifying the item to a particular wave (a for Wave 1, b for Wave 2, etc). The third is the corresponding question in the self-completion questionnaire

COMPLEX (\_jomcd) - My job is complex and difficult  
 NUSKILLS (\_jomns) - My job often requires me to learn new skills  
 USESKILL (\_jomus) - I use many of my skills and abilities in my current job  
 OWNTASK (\_jomfd) - I have a lot of freedom to decide how I do my job  
 HAVESAY (\_jomls) - I have a lot of say about what happens in my job  
 WORKFLOW (\_jomfw) - I have a lot of freedom to decide when I do my work

These questions form part of a sequence of twelve in which respondents are asked to rate their agreement with statements about aspects of their main job on a 7-point response scale. The other items in the sequence, which precede the skill-related set, relate to the stressfulness of the job, whether it pays fairly, the security of the respondent's employment, the security of the job itself and the likelihood that the employing business will still be trading in five years' time. In each case the scale is presented on the questionnaire form as a set of tick boxes, with verbal anchors only at the extreme points ("strongly disagree", "strongly agree"). This format is common in several sections of the SCQ, and respondents would have answered five similarly structured sequences using unanchored scales (some with a different number of response options) before reaching this point in the questionnaire.

From Wave 5 onwards, a supplementary set of nine variables was added to this sequence:

- I have a lot of choice in deciding what to do at work
- My working times can be flexible
- I can decide when to take a break
- My job requires me to do the same things over and over again

- My job provides me with a variety of interesting things to do
- My job requires me to take initiative
- I have to work fast in my job
- I have to work very intensely in my job
- I don't have enough time to do everything in my job.

These additional data items have both broadened the scope of the data available for analysis and helped to clarify the meanings placed by respondents on the individual core variables, while also making it possible to construct more reliable and sensitive composite scales for the different dimensions of both skill and job stress. Their contribution will be outlined below, after the core variables have been discussed in more detail.

The six core variables correspond closely to two out of the three generic dimensions of skill identified in Chapter 3. The first subset can be regarded as more or less direct and complementary indicators of the extent to which a job requires skill in a generic sense, i.e. independently of the level or field of competence. COMPLEX, at least on first sight, comes closest to capturing the substantive complexity criterion, while NUSKILLS and USESKILL cover different aspects of the skill-intensity criterion. OWNTASK and HAVESAY respectively capture the individual and collective aspects of task discretion, while WORKFLOW corresponds to a qualitatively different aspect of the same dimension relating to the timing of tasks and the sequence in which they are done.

This close correspondence opens up the potential for the individual variables to be combined into scales which could be used to measure the key dimensions of skill in the model developed in Chapter 3. This process, and the tests applied to validate the resulting scales, are described in detail in Chapter 6. The preliminary assessments set out immediately below refer only to the face and construct validity of each indicator.

#### **4.2.1. COMPLEX**

COMPLEX stands out as the most problematic and ambiguous of the six. To the extent that it does capture the substantive complexity dimension, it suffers more than the others from the core problem with self-report that was identified in Chapter 3, namely that it effectively assesses the match between the respondent's skills and the demands of the job. Thus there is a potential ambiguity over whether the item score reflects the nature of the job or the adequacy of the respondent's skill base. This is acceptable so long as COMPLEX is treated as an element of skill-intensity, since the latter construct as defined in Chapter 3 is specifically concerned with the issue of match. However, it detracts from the face validity of this variable as a measure of substantive complexity, seen as an objective characteristic of jobs.

A second ambiguity goes to the more fundamental issue of whether increasing complexity in the colloquial sense can always be treated as an indicator of higher skill. In foreseeable circumstances a rising score on this variable over time could result from work intensification rather than a growth in task complexity as understood by Spenner or an increased coordination requirement in the sense used by Nelson and Winter. In other words, a job could become more "complex" simply because more, perhaps unrelated tasks now need to be done in the same time, even though each of those tasks is individually straightforward. This would be the case, for example, in the situation described in 3.4.1 above in where an organisation has

been downsized and the surviving employees are required to fill in for lower-skilled support staff who no longer exist. In such cases, COMPLEX might more logically be associated with job stress than with any absolute or relative measure of the skill required.

The third potential ambiguity stems from the wording of the question. Read literally, the question asks about two things, complexity and difficulty. This could be seen as an advantage if one accepts the argument in 3.4.1 that difficulty is one aspect of the “level” of tasks in Spenner’s original definition of substantive complexity, since combining the two terms in the same question should help the respondent to identify the kind of complexity that is intended. But difficulty could just as legitimately be seen as the key indicator of the “stretch” dimension of skill-intensity, in which case the question can be seen as straddling the two constructs. If this is not clear to the analyst, there can be little certainty about how the average respondent will interpret it.

#### **4.2.2. NUSKILLS**

NUSKILLS refers directly to the learning element of skill-intensity. Specifically, it describes the extent to which the job itself requires the employee to keep learning. It is indirectly informative about the extent to which the workplace provides opportunities or support for learning, but only insofar as a respondent would logically be unable to give a positive score if it were altogether impossible to do the learning required. Taken at its face value, it says nothing about whether the worker is encouraged or facilitated to engage in learning beyond the immediate requirements of the job. However, a positive trend can be taken as fairly unambiguous evidence of growth or change in the skill requirement of a job<sup>1</sup>.

The implications of a negative or declining score on this variable are less straightforward. It could mean that the firm in which the job is located is not innovating, and consequently that product lines and production processes have remained stable over several years, though those processes might still require considerable skill. Conversely, it could mean that after decades of learning, the respondent has at last fully mastered a highly skilled occupation where the needs and techniques change relatively little over three or four years, e.g. some kinds of surgery. Indeed, if one accepts Attewell’s proposition that “a virtuoso recognises fewer exceptions than a novice”, it is reasonable to expect that someone who has achieved virtuosity in her job will do less conscious learning than a normally competent practitioner would over the same time. The important thing to remember is that in such cases, perceived stability in the skill requirement could well be reflected in a declining score for this variable over the time a worker remains in the same job. In this respect NUSKILLS can be expected to behave differently from the other indicators in the set, and this needs to be taken into account when interpreting any trends that emerge. Of course, the intuitively obvious conclusion – that the job is getting less skilful over time – may just as well be true in other cases, but it would require different evidence to determine whether that is happening.

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<sup>1</sup> One obvious qualification is that individual scores will be more reliable when averaged out over several years, as the initial period of transition into a new job is bound to involve some amount of learning for the recruit even if the actual skill profile of the job is static.

### 4.2.3. USESKILL

This variable captures the third element of skill-intensity, the utilisation of available skills. Like the others, it is strictly an indicator of skill match, specifically whether the respondent considers herself to be overskilled or appropriately skilled for her present job. It is thus more likely to capture either underutilisation of skills or substantive mismatch (i.e. the worker has good skills, but the wrong ones for the job) than skill gaps or deficits.

The one obvious problem with this variable lies in its wording: "I use *many* of my skills and abilities." Just how many is "many"? Since respondents are given no guidance on how to make this assessment, it is unrealistic to expect much consistency in the response. Some may quite reasonably interpret it as meaning "more than normal", in which case they will need to guess what is a "normal" amount to use; in other words, their response may be determined by guesses as to how others have answered the same question, rather than just by the respondent's assessment of her own skills and her own job.

Another caution that needs to be voiced about this variable is that over the first six waves it has been consistently scored much higher, and with less wave-on-wave variation in the mean, than the other two core skill variables. One might reasonably take this at its face value, except that comparisons with UK evidence (Mavromaras et al 2007b, discussed in detail in section 5.3) show a prevalence of reported overskilling in that country so much higher than the level revealed by HILDA that it cannot credibly be explained by known differences between the two labour markets. USESKILL also shows the weakest inter-item correlation with the other two core skill indicators and loads in a counter-intuitive way in the factor analysis discussed in Chapter 6. These are possibly indications that the item is insufficiently "difficult" in the terminology of Item Response Theory, i.e. that the level of actual positive perception required for the average respondent to record a high score is too low for the item to discriminate effectively between respondents.

The discussion of these first three variables reinforces the warning that has already been given several times about the distinction between skill-intensity and skilfulness. What is being measured here is not depth or quality of skill, but rather skill-related aspects of the job-worker match. These indicators tell nothing about the actual amount of skill required in each job, either in an absolute sense or relative to other jobs. "Learning new skills" should logically demand on average a great deal more application, prior knowledge and underlying aptitude for a surgeon than it does for a low-level clerk. A worker with low overall skills is more likely to have to use most of them in order to repay the cost of employing her than one with a diversity of highly advanced skills (who could still be employed profitably on a wage far lower than the full potential value added by his skills). These problems emphasise that without adequate indicators of substantive complexity, the other two dimensions can provide at best an impressionistic picture of the actual skill content of a given job at any point in time.

The next three indicators correspond in general intent, but not precisely, to a set of five used in the UK Skills Surveys. Whether fortuitously or by design, the three variables provide complementary perspectives on the autonomy-control dimension. As was argued in Chapter 3, this is an advantage given that jobs in which some aspects of this dimension

are highly evident may be less strong on other aspects because of the nature of the work itself.

#### **4.2.4. OWNTASK**

This variable refers specifically to individual worker autonomy, the least definitionally problematic aspect of task discretion. This is the aspect which has been most prominent in the labour process debate, being the one that comes closest to Braverman's concept of mastery. It was argued in 3.4.2 above that individual task autonomy is often associated with a high-skilled job, since it implies that there are different ways of going about a given set of tasks, the choice will make a significant difference to the efficiency or effectiveness with which the job is performed, and the most appropriate choice is dependent on the individual circumstances in which the operation is performed, so that it cannot be codified into a protocol. If one accepts the argument put forward there that the choice of means is a matter of coordination, individual task autonomy arguably comes closest of any among the six core indicators to capturing at least a part of the substantive complexity dimension.

However, individual autonomy is also a form of work organisation, and only some kinds of job lend themselves to this form. Where the coordination involved is coordination among persons – that is, in any environment where work takes place in a closely coupled team, or where there is tight interdependence between supplier and customer or members of a supply chain – it may be simply inappropriate for individuals to act wholly on their own initiative and judgement. This interpersonal coordination may be a major element of the skill required by the job, and jobs characterised by highly interdependent working can be more skilful than ones that require little cooperation. Despite this, when an individual's job is redesigned to fit into a more cooperative work arrangement, the worker may see the loss of autonomy as deskilling. This is especially so if the job in its previous form was a specialist or supervisory one.

#### **4.2.5. HAVESAY**

This variable provides some compensation for the limited applicability of OWNTASK. Even if a worker cannot decide independently for himself how the work is done, he can still have a degree of control over its organisation through collective decision or input to job design. Indeed, the need to negotiate mutually optimal arrangements may increase the skill demands of the job over a comparable one where individuals are free to find the way that best suits themselves. However, HAVESAY incorporates its own kind of ambiguity because it can accommodate a large range of possibilities including individual autonomy, devolved decisionmaking and inclusive hierarchical decisionmaking. A job can be quite rigidly prescribed and controlled in the exercise, but involve workers regularly in the process of job definition and review on which the controls are based. This participatory-bureaucratic style of work organisation contrasts in practice and ethos with one where individuals work with high levels of autonomy but in circumscribed roles which are defined without any input from them. Both differ just as much from the situation where a work team has latitude to structure its own tasks but little say on how those tasks are defined. The three forms of work organisation require different skills, and perhaps different levels of skill. Yet all three could attract an equally high score on this variable.

#### 4.2.6. WORKFLOW

Control over workflow, as already argued in Chapter 3, is a central aspect of substantive complexity in the kind of job where a large number of tasks with conflicting or uncertain priority have to be handled in tight timeframes. However, the name assigned to this variable is not wholly accurate. As the only variable in the core set that refers to the time control dimension, it also needs to accommodate responses that refer to things other than actual control over the sequencing of tasks; indeed, this is not the most literal reading of the question as asked. Some respondents could interpret it as referring either to flexibility in their overall hours of work, or to flexibility in the way they schedule their working time over a standard working day or week. Until supplementary variables were introduced in Wave 5 to expand the coverage of time control, it was difficult to interpret the response or read any skilling implications into it.

The time control dimension in general suffers from the same limitation as the personal autonomy dimension, namely that it is not an option for many kinds of otherwise skilled work. A style of work organisation based on intensive, highly collegial teamwork could well attract a low score on this question. So would the type of work which is highly demand- or event-driven, e.g. in a hospital emergency ward, even though many of the highest-skilled jobs fall into that category.

These three variables are theoretically complementary, in that each captures different elements of a common construct ( in this case task discretion), but in a slightly different way from the first three. To be really skill-intensive, a job needs to score well on all three of the skill-intensity variables, i.e. the construct approximates to the sum of the three constituent variables. However, because the individual task discretion variables each capture aspects of autonomy/control that apply only to some kinds of work, regardless of its overall skilfulness, these three function to some extent as alternative approximations to the construct. Hence the degree of autonomy/control consistent with a high-skilled job is more likely to show up as a high rating on one or two of the three, offsetting a lower rating on the others.

Each of these possible settings has its distinctive potential for ambiguity, and even where the task discretion requirement is logically associated with higher skill, each implies that a different kind of skills should be at a premium. A worker exercising high individual discretion (high score on OWNTASK) in a complex organisation needs to develop a capacity for self-reliance and thinking on his feet and be prepared to accept high individual accountability both to the organisation and to his immediate clients, but might not have much need for strategic awareness of the organisation as a whole or the needs of the end customer. A self-organising work team (high score on HAVESAY) would need to develop strong interactive skills including communication, knowledge sharing and collective learning, a comprehensive knowledge of their work specialisation, and an awareness of the interactions between their work and the parts of the production process immediately upstream and downstream of it. Workers in a participatory bureaucracy (high score on HAVESAY) would ideally need, as a condition of their effective participation in strategic decisionmaking, to develop at least some awareness of the organisation as a whole, its competitive strategy, its value chain, the interactions between its different parts, and the needs of the end customer. Workers with high control over the sequence in which they perform their tasks (high score on WORKFLOW) would have to develop not only good

time management skills but reasonably advanced skills in negotiating deadlines with competing clients.

Given these uncertainties, the best chance of using these three variables as reliable proxies for skill lies in a finding from the actual response data that they interact positively with one another in situations where other evidence makes it possible to reach a reasonably accurate estimate of the skill content of the job. An example of this from the UK Skills Surveys is the analysis of data for 1992 and 2001 by Gallie et al (2004: 249-250, 255-6) showing that a move from hierarchical to team-based work organisation led to a decline in perceived individual discretion, but only where the resulting teams had little devolved collective decisionmaking power.

Another way in which the task discretion variables appear to differ from those on skill-intensity is that the match they effectively measure is one between experience and expectations. This is partly a result of their wording, as the inclusion of the phrase “a lot of” in all three effectively requires respondents to assess their job against some assumed average or standard. This is the same problem identified earlier with USESKILL, but exacerbated by the nature of discretion as a concept. In answering the skill-intensity questions, the respondent needs to compare two referents which are tangible and, in theory, quantifiable using a common metric: the respondent's own skills, and the skills required by the job. Either you have a skill that is needed to do the job, or you do not. Autonomy and discretion, on the other hand, are relative things even in their own right. What constitutes “a lot of freedom” or “a lot of say” for any given respondent depends entirely on that respondent's own past experience of exercising freedom and discretion, or else on her subjective assessment of the amount that she is capable of handling and/or the amount that is appropriate to the task. Thus, a rising trend in the indicator could indicate a fall in expectations as easily as a genuine growth in task discretion. This characteristic also suggests that these indicators are more vulnerable to the confounding influence of social construction, since employees who are accustomed to viewing their work as professional or otherwise high-skilled will be more likely to see themselves as able and entitled to exercise high levels of autonomy or influence than workers who think of their jobs as low-skilled.

#### **4.2.7. The supplementary variables**

The new variables added to the sequence in Wave 5 have clarified some of the uncertainties raised by the individual core variables. They do so in five ways:

- The variables on task variety and repetitiveness cover two of the factors most commonly associated in the literature with substantive job complexity (negatively in the latter case). The wording of both questions suggests a more objective external reference than that of COMPLEX;
- The initiative variable could theoretically relate to either the skill-intensity or the task discretion dimension. In the latter case it should represent a second indicator of individual discretion, whereas in the first it can be taken as an additional indicator of task difficulty, and indeed of complexity;
- The three new variables relating to work-intensification make it possible to determine how far COMPLEX is associated with this construct or the broader one of job stressfulness, as opposed to either substantive complexity or task discretion.

Both are potentially more useful than the two indicators of job stress in the original set (“My job is more stressful than I had ever expected” and “I fear the amount of stress in my job will make me physically sick”), since both these latter items are so strongly worded that they must be regarded as excessively “difficult” in item response theory terms, and hence score so consistently low in practice that they have little discriminatory power;

- The two more specific variables relating to time use make it possible for respondents to distinguish between the aspects of time control that relate to working times and those that relate to the sequencing of tasks;
- The new question “I have a lot of choice over what I do at work” might seem at first sight hard to distinguish from OWNTASK. In practice, the analysis of the results in Chapter 6 shows that respondents distinguish quite strongly between the two questions, suggesting that they measure different constructs. To the extent that individuals have a choice of tasks, as well as choice in how to perform them, this question can also be treated as an indicator of collective discretion, in that the team can vary the way it shares out the tasks between its members.

It is not yet possible to detect any trends in the individual variables because only two waves of data are available, and a minimum of three is needed to establish a trend. In addition, any changes in the response over the first two years could be partly artefacts of panel conditioning (see 4.3.5 below). However, their impact is already recognisable when they are combined with or analysed against the core set. In particular, the relatively weak inter-item correlations between COMPLEX and the variables on task variety and repetition (<.4) are further evidence that the former does not adequately capture substantive complexity. Their presence on the questionnaire also appears to have affected the response to some of the core variables, implying that trends in those variables before and after Wave 5 may need to be treated with caution. Further details of these analyses appear in Chapters 6 and 7.

To summarise, the six core variables provide balanced though incomplete coverage of the two constructs of skill-intensity and task discretion, and can be combined into composite scales to measure each construct which are technically acceptable, at least for the first six waves. On the other hand, they do not appear to capture substantive complexity except very indirectly and with doubtful reliability. The additional variables provided from Wave 5 onwards allow the higher-level constructs to be defined and measured with much more confidence.

### **4.3. Limitations of the data**

While HILDA remains the best data source yet in Australia, and in some respects the only one available, to support this kind of analysis, its limitations need to be recognised as constraints on the extent and accuracy of the research that can be done. These limitations are understandable when it is remembered that skill analysis is only a very minor subsidiary focus of the survey, and do not undermine the basic value of the data. A brief discussion of some of the key problems is necessary at this point in the exposition in order to present a balanced picture of the scope and potential usefulness of the data for the benefit of other researchers who may be considering HILDA as a research source. This discussion will also

help to explain some of the decisions which were made on the choice of a research problem and methodology. However, a full account of the sources of error and the measures taken to control for them will be left to Chapter 6.

As a general observation, the very complexity and comprehensiveness of the dataset makes it difficult to work with. Each wave contains over 3,000 variables, most of them of no or peripheral relevance to the research being undertaken here. The formatting of the questions and data items reflects both the interests and the data standards of different agencies which have commissioned sections of the survey. Variables in different subsets of the dataset differ in their specificity, with whole variables in some subject areas corresponding to single response categories in others. Almost a third of the variables relate to the one set of questions, a detailed month-by-month calendar of educational, training and labour-market related activities undertaken by the individual respondent since the last wave. Questions – at any rate those of primary interest to the present research – are relatively seldom grouped or sequenced into meaningful thematic clusters; while this has the incidental virtue of minimising the risk of sequence bias in the response, it adds to the task of drawing together a comprehensive set of data on the one subject across a full wave. Many of the variables have been processed, e.g. to aggregate responses across questionnaires and waves, weight for various factors or adjust for missing data; often there will be a choice of three or four variables on a single topic (especially in the case of financial variables relating to income), and even with the very comprehensive documentation supplied, it can be a challenge to work out which is the most reliable or relevant, which are raw data and which processed, which refer to the full response and which only to subsections (e.g. new vs. continuing respondents).

Time-series analysis is further complicated by the absence from the data as supplied of any longitudinal or pooled cross-wave files. For the sake of accuracy and convenience, the longitudinal research in this thesis uses a specially created short longitudinal file made up of between 85 and 135 variables selected by the author from each wave as the most relevant and reliable. This has left the full variable set in each wave available for cross-sectional analyses where required, though most of those which have been undertaken using data items outside the core longitudinal set have been exploratory only, and as such are not reproduced in the thesis. Where it was impossible to determine which among a set of alternative variables was the most appropriate or reliable, those variables have been excluded from analysis at this stage; fortunately it has been possible to do this so far without compromising the research.

Aside from the practical challenges of extracting meaningful information from such a large and heterogeneous dataset, some of the data items themselves suffer from problems (mostly unavoidable) that limit their validity, reliability and/or informativeness. Those problems are summarised below under eight types of error:

- (i) *Selection bias*, i.e. the extent to which the composition of the sample fails to reflect the true composition of the population;
- (ii) error due to *attrition bias* which progressively erodes the representativeness of the original sample and undermines the basic assumption in panel data that longitudinal analyses will capture the same population over successive waves;

- (iii) error due to *inadequate time series*, making it difficult or impossible to pick up longer-term or lagged impacts;
- (iv) *sampling error* due to inadequate sample size, which affects the reliability of any inference made to the population once the data are disaggregated beyond a certain point;
- (v) *response biases*, i.e. forms of systematic bias which have been shown by past research to affect the accuracy with which responses to certain types of questions will reflect the respondent's true opinion or perception;
- (vi) *questionnaire and scale effects*, where the way a question is phrased or the number of points provided on the rating scale makes it difficult for the respondent to give an answer which accurately reflects his opinion, or for the analyst to work out exactly what the respondent meant by the answer;
- (vii) issues of *inter-rater reliability*, in the sense that different respondents do not necessarily mean the same thing (e.g. the same intensity of preference) by the same score on a rating scale;
- (viii) *random error*, i.e. variations in an individual's response to the same question from wave to wave which do not reflect a genuine change in her views and do not follow any identifiable pattern or result from any known systematic bias, but are simply the result of chance variability.

The first four of these involve design problems or data issues peculiar to HILDA, and as such are detailed in this chapter. The remainder are common to all surveys of this type and are no more pronounced in HILDA than they would be in any other survey constructed along similar lines, except for the points raised in the previous section. They are mentioned at this point simply for the sake of giving a complete picture of the challenges that had to be faced in constructing the analyses which appear in later chapters. Chapter 6 will give further consideration to these more generic sources of bias.

#### **4.3.1. Sample selection bias**

The HILDA sample is not a particularly accurate representation of the balance of occupations and industries in the employed workforce, and can be expected to become progressively less so with each wave. The original sample was designed to provide a representative panel of households, not of the employed workforce. The geographically clustered sample creates a risk that industries may be over-represented if census districts are sampled where the local labour market is dominated by a single industry or employer, and both occupations and industries may be under-represented if they involve low overall numbers and high local concentrations which fall outside the census districts sampled. An obvious example among industries would be Defence, where not only employment but in many cases the residence of workers in the industry tends to be highly concentrated in particular locations (bases, barracks, etc) which are themselves highly dispersed and hence easily missed by the kind of sampling technique used in HILDA.

The problems of representativeness are best seen by comparing the original HILDA sample for 2001 with the Census data for the same year. HILDA over-represented professionals by

more than 18% compared with the Census population (i.e. as a percentage of their proportional representation in the Census – not in actual percentage points). Managers & Administrators were less markedly over-represented (3.1%) and Labourers & Related workers marginally so (1.8%), while Advanced Clerical & Service Workers, Tradespersons and intermediate-level workers were under-represented by 6.3%, 5.5% and 3.5% respectively. The discrepancies are more marked in the case of industry groups, with Agriculture over-represented by 45%, Mining by 43% and Education by 27%, and Wholesale Trade and Manufacturing under-represented by 28% and 14% respectively. While most of these sampling errors affect relatively small populations, some of the most striking involve numbers which could significantly affect analyses involving cross-industry or cross-occupation aggregates – for example, Professionals made up nearly 22% of the sample and the Education industry 9%. In general, the bias appears to favour higher-skilled occupations and industries.

A different and unavoidable source of mismatch between the HILDA data and those drawn from the Census is that HILDA asks questions on job characteristics only with respect to the respondent's main job over the last 12 months. Given that around 9% of employed respondents in each wave reported having more than one job at the time of survey, the information lost on those other jobs could represent a small but not trivial part of the complete profile of Australian jobs. It is reasonable to expect that jobs which are casual, part-time, contract or ephemeral will be underrepresented in the findings as a result. In the case of the casual jobs at least, which represent about two thirds of the non-standard employment among HILDA respondents, research by Ian Watson (2008) which is described in 5.3 finds that these are likely to be less skilled than permanent ones, though the same is not the case for contract jobs.

### **4.3.2. Attrition bias**

These problems with the initial sample are only compounded by the absence of any effective mechanism to rebalance the panel as members are lost to non-response in later waves or by passing out of scope. So far the only proposal for a new refresher sample has related to securing a higher representation of newly arrived migrants, and even this remains only a suggestion (Watson and Wooden 2007: 228). It is possible that some of the more mobile sub-populations may be less affected over time by the geographic bias in the original sample because CSMs who leave an originally sampled household are tracked to their successive households, thereby including in the sample the other members of their new households. Some reduction in geographic bias may also be expected if sampled households themselves move to new locations. However, it seems doubtful whether these mechanisms alone will be sufficient to bring about any worthwhile adjustment over the short period for which data are so far available.

For the purposes of the present research, the main interest lies in those members of the panel who are currently in the active labour force and employed, and who complete the relevant sections of the SCQ. These effectively “leave” the sample for these purposes when they retire. At the other end, they are replaced by household members who pass the age of 15 and thus become eligible to respond to the individual and self-completion questionnaires (i.e. pass from being simply “enumerated persons” to “responding persons”). Given that this threshold is at least one year below the minimum legal school leaving age in all Australian States, a lag of some kind can be expected before these “recruits” become employed in the primary labour market, and that lag is likely to be considerably greater

before any of them settle into jobs requiring substantial entry-level qualifications; to the extent that they are employed in between, it is likely to be in casual or part-time student jobs which are not representative of their longer-term career paths. In any event, their jobs in these initial years will almost certainly be very different from those left by retiring panel members, and logic suggests that the differences will be especially marked in respect of skill content, learning and task discretion. There is no reason to expect that these changes in the occupational balance of the panel, affecting only the extreme points in the age spectrum of the active labour force, will be representative of those experienced by the employed workforce in general.

To this “natural” attrition must be added the impact of attrition proper, i.e. loss of sample through members becoming untraceable or unwilling to participate in later waves. The HILDA attrition rate is considered acceptable or even creditable by the standards of comparable household panel surveys in other countries (Watson and Wooden 2004: 345), but it has certainly been more than trivial. In particular, between the first and second waves some 13% of households in the original panel dropped out, though many of them returned in later waves. Even accepting that the rate of repeat response (both between adjacent waves and from members who were non-respondents in earlier waves) has grown steadily (Wooden and Watson 2007: 215), by 2006 the panel had lost almost 28% of its original members, while only 63% have responded in all six waves (Watson N 2008: 118). The managers of the survey acknowledge that attrition bias has not been random; in particular, so far as the purposes of this research are concerned, it has meant a declining proportion of respondents who have lower levels of education or work in lower-skilled jobs (Watson N 2008: 123).

These losses were offset by the recruitment of some 1429 new entrants, equivalent to 11% of the 2006 sample, over Waves 2-6 (Watson N 2008: 122). However, the only ways of being recruited to the panel are to join a sampled household, either as a new member from the outside population through marriage, partnering, joining a group house, etc., or by being born or adopted into it, or else to be part of a household which a continuing sample member joins. Given that births are unlikely to affect the relevant variables for at least another fifteen waves, any “natural” rebalancing must occur through the other mechanisms, or else through non-sampling mechanisms such as children passing the age of 15 or individual members moving to different jobs.

The limited impact of such mechanisms is apparent when the 2006 Census data are used to compare changes since 2001 in the composition of the working population with those that occurred in the composition of the HILDA sample. More detail on this aspect is provided in Chapter 9. Indeed, given the amount of attrition and its non-random distribution, it is surprising to find that the representativeness of the panel in 2006 has not notably deteriorated. Neither is it significantly better than in 2001; it is simply different. The over-representation of workers in Education has increased to 29%, while that of Professionals and Agriculture remains strong though somewhat diminished (17% and 34% respectively) and that of Accommodation, Cafes & Restaurants has increased from 3% to 9%. Managers, Labourers, Electricity, Gas & Water Supply and Construction have moved from over- to under-representation, while Intermediate Clerical, Sales & Service workers have moved in the opposite direction. With those exceptions, it is generally the trades and the lower-skilled occupations that remain under-represented. Substantial growth in the proportion of the population engaged in Mining has not been captured in the sample, nor has a substantial decline in Cultural & Recreational Services. Thus, even apart from the representativeness

of the sample in each individual Census year, the changes in the composition of the sample between 2001 and 2006 do not accurately reflect those that occurred in the composition of employment as measured by the Census.

To the extent that it is possible to generalise, these considerations taken together suggest that the HILDA data for both years probably overstate the average amount of skill demanded across all Australian jobs. The discrepancies reflect both the selection bias in the original sample and attrition bias working against lower-skilled occupations, and together would suggest that the stable or gently declining trend which appears in the main indicators of skill-intensity and task discretion across the first six waves cannot be simply an artefact of the sample. This question is examined fully in Chapter 9.

More generally, the evidence on these first two sources of error indicates a need for caution in taking changes in the overall occupational composition of the panel over successive waves as indicative of changes in the composition of employment. The evidence also dictates some caution in assuming that findings from the same analyses undertaken on the full panel in successive years accurately mirror change in the same population.

At first sight it might appear that many of these problems have been offset by the inclusion in recent HILDA releases of longitudinal population weights to compensate for changes in sample composition on a number of key parameters that include occupation (Watson N 2008: 86). However, their usefulness appears, so far as can be deduced from this and other documentation (Watson 2004), to be limited by the fact that they are derived from a single model in which occupation is only one among a number of benchmarks, the others being sex by broad age, State by part of State, State by labour force status, and marital status. Most of these are demographic, and the priority given by the sample designers to demographic representativeness may itself be one reason for the errors in occupational balance in the original sample. In any event, even if it is assumed that application of these weights would produce a balanced panel that accurately mirrored the industry/occupational composition of the base-year sample, such a panel would self-evidently be useless for tracking the incidence or impact of changes that actually occurred across the six waves in any of these parameters.

### **4.3.3. Inadequate run of data**

Much of this error could be safely overlooked if only its expected impact on data reliability were small in comparison with the change that occurred across waves in the key variables. However, as will be shown in later chapters, the amount of year-to-year change that appears in most of the key variables of interest (at least in the broad aggregate) is generally small and in many cases statistically insignificant. Hence, extreme care is needed in interpreting those longitudinal data to eliminate any possible artefacts. This is where the third source of error – an inadequate run of time-series data – becomes a problem.

The UK Skills Surveys, which will be covered in more detail in Chapter 5, now have the advantage of five runs spread out over twenty years. Any changes that are evident over such a period, especially if they are sustained over several runs, can reasonably be expected to damp out most of the chance annual fluctuation, whereas the latter will have a much greater impact on a short run of annually refreshed data. The offsetting advantage of a finer-grained time-series such as HILDA in detecting system changes depends on clear trends in fact becoming visible over such a short timeframe.

Those apparently interesting changes that have emerged so far from the HILDA evidence are very hard to interpret without internal or contextual data indicating how they fit into longer-term patterns. To anticipate the evidence which will be set out in Chapter 7, it is possible that the relatively flat trendline in the key indicators from 2002 to 2006 represents a period of stability coming at the end of a longer period of steady decline, much as occurred with task discretion in the UK. It was preceded by a sharp and so far unrepeated fall in most of key skill-related indicators between 2001 and 2002, but there is no easy way of telling whether this represents the tail end of a longer-term trend of decline, a return to the long-term trendline from an earlier peak, the result of a one-off event, or an artefact brought about by attrition in the sample or repeat administration of the questionnaire.

The above arguments point to a risk of Type 1 errors, i.e. finding effects that do not in fact exist. However, an inadequate time-series can lead to an even greater risk of Type 2 errors – failure to recognise effects that are actually taking place, especially in their early stages. Without a longer run of back data to show up the contrast, a movement in the data that represents the beginning of a sustained and important change in a long-term trendline can easily be dismissed as statistically but not ecologically significant. Such errors are particularly damaging in a systems paradigm where much of the interest lies in non-linear processes of growth and decline.

The only real answer to such problems is patience. Each new wave of HILDA adds significantly to the value of the existing data: in particular, without the Wave 6 data it would have been impossible to tell whether the upward movement in several key skill indicators in Wave 5 represented a shift from the flat trend of the last four years or a one-off. In the meantime, it has to be accepted that a degree of inevitable uncertainty will attach to any finding of change over time, and the only safeguard against Type 1 errors lies in triangulation with other sources that shed light on the same issues, even if they are not sufficiently comparable to support rigorous statistical comparative analyses.

#### **4.3.4 Sampling error**

The fourth source of error may not appear to be a problem at first sight. With a designed sample of almost 12,000 in-scope households, and with approximately 20,000 individuals enumerated and 14,000 interviewed in Wave 1, HILDA offers an expertly constructed sample almost half as large as the benchmark ABS Labour Force Survey, comparable in size to major ABS household series such as the *Survey of Education and Training Experience* (Cat 6278.0), well beyond the coverage of any private Australian workforce survey, and with an employed component roughly double the size of the achieved sample for the latest of the UK Skills Surveys (Felstead et al 2007: 15). However, this number declines sharply when the focus shifts to the set of respondents who are able to provide data on the variables of primary interest. Of the 13,969 individuals interviewed in Wave 1, 8,525 were employed at the time of survey. In addition, around 9% of interviewed respondents in all waves failed to return the SCQ where these questions occur, and of those who did, not all completed the relevant questions. Hence, the number of valid responses to each individual question ranged between around 6,800 and 8,250 depending on the wave. Once the analysis shifts to those respondents who answered all the relevant questions in different waves, the available pool of respondents roughly halves again.

These figures are still large enough to support most types of inferential analysis with a high degree of confidence, subject only to the aforementioned concerns about how randomly the non-response is distributed. However, difficulties still arise when the response is highly disaggregated, notably by industry and occupation, especially at the 2-digit level. Taking as an example the Wave 6 data, when the response is broken down by industry at the 2-digit level and occupation at the ASCO major level, only 90 cells out of 454 in the matrix contain twenty or more observations, and only twelve contain a hundred or more. When the disaggregation on both variables is extended to 2-digit (the highest level of disaggregation provided in the publicly available file), only 810 cells out of 1880 are populated at all; the number of cells containing 100 or more observations falls to nine, while of the remainder, all but 163 are populated in single figures, many of these being single observations. Similar problems can arise when comparing relatively small subsets of respondents, e.g. those who changed jobs in the last year, against the remainder of the sample.

#### 4.4. Summary

HILDA is Australia's first and only large-scale panel survey designed to provide a broad range of data on social and economic issues affecting the welfare of households. Originally designed, and still primarily intended, to serve the research needs of the Commonwealth department responsible for social security, it has been expanded to meet the needs of other social and economic research and made available to outside researchers, including the present author, under licence and subject to strict privacy controls on the use and dissemination of the data.

So far six annual waves of data have been released, running from 2001 to 2006. The sample is a panel, that is, the same respondents are intended to remain in the sample permanently once selected. It covers around 12-13,000 households and 20,000 individuals, of whom between 12,000 and 14,000 have provided individual-level data in each wave. Of these, around 7-8,000 are employed at the time of each survey and hence eligible to answer the skill-related questions. Attrition has been substantial at times, peaking at 13% between the first and second waves, but is improving over time and is considered acceptable by the standards of comparable overseas panel surveys. The sample is designed primarily to be representative of households, and as such is not a fully accurate representation of the structure of employment, tending on the whole to over-sample higher-skilled jobs.

The questions relating to skill requirements are a very subsidiary element, consisting of six core questions which run across all six waves and a further nine which have been added since 2005. They provide a reasonable balance of coverage of the dimensions of skill-intensity and task discretion, but do not shed any significant light on the subjective complexity dimension. Individual questions pose problems to do with clarity of definition, ambiguity and measuring multiple constructs, but together they complement one another sufficiently to provide usable data on both dimensions. The dataset as a whole, through its very breadth, provides the compensating advantage of offering a large range of variables that can be tested as possible influences on skill deployment.

## **Chapter 5**

### **Findings of precedent research**

This chapter provides a selective coverage of earlier attempts to track skill trajectories over time. It does not set out to provide a comprehensive review of the considerable literature on changes in the skill requirements of individual occupations or industries, but focuses on the specific proposition that trends can be identified which apply across all sections of an economy and can be characterised as improvement or deterioration in some common element of skill.

While debates over the growth or loss of skill have been taking place as far back as Adam Smith, serious empirical research on the subject has been sporadic. This chapter summarises the findings from two of the most active phases: the combination of statistical and case study research that took place in the 1970s and 1980s in response to widespread interest in the deskilling hypothesis, and the more sustained program of survey research undertaken in the UK since the late 1980s under the auspices of the Economic and Social Research Council. The third section of the chapter looks at the limited amount of research that has so far been carried out using the skill-related variables in HILDA.

The choice of these three episodes in the literature is not arbitrary. The deskilling debate effectively represents the prehistory of the present research, in that it was the period when the issues and their implications were framed and the research requirements mapped out, but the data were not yet available which would allow the research to proceed to any satisfactory resolution. The Skills Surveys mark the first comprehensive exercise in mapping the skills trajectory of a single national economy using quantitative data specially designed to capture multiple dimensions of skill as actually exercised in the workplace. The early research based on HILDA, though not directly overlapping with the research in this thesis, represents a first indication of the potential of that kind of data to support similar studies of the Australian NSS.

It should be stressed that the discussion which follows goes nowhere near exhausting what has been written on the changing demand for different skills, in Australia or internationally, and does not set out to do so. In the Australian context, particular attention must be drawn to the careful work of Maglen, Hopkins and their successors at the Monash University Centre for the Economics of Education and Training (CEET) since the 1990s in forecasting future trends in the occupational composition of the Australian workforce (Maglen 1995, 2001; Maglen and Hopkins 2000; Maglen and Shah 1999; Shah and Burke 2003), and to the efforts of the Commonwealth employment department in its various guises to answer similar questions over the same period (DEET 1991, 1995). This body of work, and comparable work done in other countries, will not be covered here because its focus lies more on changes in the types of skill in demand than on the generic question of whether the skill content of jobs has risen or fallen with changes in the pattern and character of employment.

## 5.1. The deskilling debate

Much of the writing on the nature of skill which featured so extensively in Chapter 3 dates from the 1980s and appeared in the context of a debate generally referred to as the deskilling controversy (Attewell 1987), or from the Marxist end of the discussion as the proletarianisation debate (Wright and Singelmann 1982), which is generally accepted to have originated with the publication in 1974 of Harry Braverman's *Labor and Monopoly Capital*. Since many of the original sources are no longer accessible, the summary account which follows is drawn in part from contemporary review articles by Form (1987), Attewell (1987, 1992) and Spenner (1979, 1983, 1985), all of whom, it should be noted, were sceptical of Braverman's core hypothesis.

The main focus of Braverman's book was a drive by capitalism to increase control over the workforce, and thereby its appropriation of the surplus value created by workers, through conscious strategies to eliminate the bargaining power of skilled workers by deskilling their jobs through fragmentation and routinisation. His work was situated within a much longer tradition of debate over the impact of technological change on the amount and character of work going back at least as far as Adam Smith, as well as representing an argument for the continuing relevance of the century-old Marxist expectation that the future of work under capitalism would be characterised by a steady expansion of the proletariat into previously skilled and middle-class occupations.

Braverman's work had an impact on public and especially academic opinion which caused some surprise to researchers who were familiar with the already large literature on the same general topic (Form 1987: 30). This impact seems to have occurred partly because of the relative accessibility of the book, the empirical core of which consisted of a series of highly persuasive case studies that extended beyond the traditional Marxist domain of the factory floor to include areas of white-collar work. Part of its impact was probably due to its appearance at a time when Marxism was going through its last big resurgence in English-speaking countries, and when concern about a "crisis of work" was already widespread in the US (Form 1987: 30). The work was a conscious response to Daniel Bell's recently published *The Coming of Post-Industrial Society* (Bell 1973), generally seen as the most influential advocate at the time for the competing hypothesis of a general upgrading of skill as a result of technological change and the resulting changes in work practice.

According to Form (1987: 33), one of Braverman's main contributions was to shift the terms of the debate away from what Form calls an "efficiency theory" to a "power theory" which presupposed that the capitalist's compulsion to increase his control over the skilled workforce was a driving force which outweighed strict efficiency considerations arising out of technological determinism. In other words, for Braverman technological change was not a driver of new work practices or requirements in its own right, but rather a source of new opportunities which capitalists could take up, at their discretion, to assert new kinds of power over the Working Class. Even in this respect Braverman's work was far from original. Form attributes the origin of the power theory to Marglin (1971), but traces its antecedents as far back as Veblen. It also owes much to French labour sociology, notably the earlier work of Friedman.

Braverman's argument also had a number of important weaknesses which have since been acknowledged by many of his own followers, notably its idealised view of the level of control exercised by the 19<sup>th</sup>-century craftsman over his work by virtue of his skill and

embodied knowledge, its overestimation of the prevalence of that kind of autonomous work in earlier centuries, and its reliance on a very classical model of Taylorism as a paradigm of management strategies to control the workforce. Nevertheless *Labor and Monopoly Capital* left a legacy of at least three ideas which have remained prominent in the public mind, and to a lesser extent in scholarship even from quite different ideological and disciplinary perspectives.

The first and most obvious was the basic concept of deskilling, even though by around 1990 there was fairly general agreement that this proposition had no real empirical support in its original guise as a ruling trend in the labour market. The second was Braverman's companion or possibly fallback hypothesis of a polarisation of skill and status within the workforce, echoed over the intervening years from varying perspectives in such concepts as the "disappearing middle" and most recently the two-track economy, and linked to continuing concerns about labour market segmentation. The third was the association between deskilling and erosion of worker autonomy. None of these, as has been noted, was original to Braverman, but his book appears somehow to have crystallised all three concepts in the public imagination.

The work also gave rise to a sub-discipline of industrial relations and industrial sociology and a school of thought within those disciplines both known as Labour Process, a term used in traditional Marxist language to describe "the totality of technical and social aspects of the activity of work" (Spenner 1993: 824, footnote). In his 1985 article Spenner expands this definition to include "the nature of work and implicit skill levels but also larger considerations of authority relations between positions, the class structure in which jobs are embedded, and strategic uses of technology beyond the logics of efficiency and productivity" (1985: 127). Both the discipline and the school of thought have survived the general post-1990 loss of faith in the practicality or indeed desirability of the "socialist transformation" (Wright and Singelmann 1982: S179) which was their original *raison d'être* and remain active, albeit much diminished in the English-speaking countries at least. In more recent years the discipline has become much less uniformly Marxist and less bound to Braverman's original view of the labour process, while the Marxist component remains predictably riven by splits between "pure" and revisionist Marxists, with much dissension over who belongs in which camp (Adler 2004; Kitay 1997; Sawchuk 2004; Burawoy 2008).

The main relevance of this controversy to the present thesis lies in the fact that it marked a new prominence and a surge of academic interest in a tradition of research and argument which had been running quietly in the background for many years, and has provided a direction for that debate right up to quite recent times. The Labour Process movement, and the deskilling debate in general, produced a very large body of literature, much of it peripheral to the topic of this thesis and much of it, as already noted, now difficult to access. No attempt will be made to cover it comprehensively here, even in summary form. The only purpose of this section is to describe how that debate set a context for the present research, and indeed prefigured much of its empirical focus at a time when insufficient reliable or relevant data existed to test the competing hypotheses rigorously. Beyond that initial context-setting, the discussion will be confined to summarising the issues on which consensus, or rather competing consensuses, had emerged by the time the first really good time-series data allowing direct measurement of skill as exercised became available through the second round of the UK Skills Surveys.

In Form's view, Braverman was responsible for "framing deskilling as an evidentiary debate between Marxists and non-Marxists" which could in principle be resolved by producing better evidence (1987: 30). Thus the publication of *Labor and Monopoly Capital* marked the beginning of a search for more accurate evidence of trends in skill use – specifically including a search for direct measurement rather than proxies - which continued through to the early 1990s. While Form saw this challenge as "opening up a long-needed channel of communication" between Marxists and non-Marxists, an evidentiary divide continued to exist between the two sides of the debate for some years. For one thing, the early Labour Process researchers concentrated heavily on the autonomy/control dimension as opposed to more content-related aspects of skill quality, which many of them were inclined to dismiss as partly or even wholly artefacts of social construction. For another, the two sides continued for some time to use incompatible methodologies. As late as 1985 Spenner was noting that evidence in favour of deskilling almost invariably took the form of case studies while critics of the position were more likely to rely on statistical evidence, with each side getting better results for its case from its preferred method.

One reason for the conflicting findings was that the quantitative studies tended to show that skill growth or decline, where it occurred at all, was not a *generic* process driven by the logic of capitalism, as the Labour Process school had originally argued, but the result of a shift in the balance of employment between industry sectors with different skill requirements, i.e. *compositional* skill change (Spenner 1983, 1985). Case studies were obviously incapable of refuting such findings, so that advocates of the deskilling argument were eventually motivated to seek out their own quantitative evidence.

Spenner reviewed ten out of over a hundred case studies published up to 1985, finding that none of them shed any light on the compositional aspects of change. On the other hand, he saw it as an advantage of the case study method that it was better able than aggregate studies to pick up change over short periods, especially change in job content. The case studies also appeared to be picking up regional variations that did not appear in the aggregate evidence. His overall judgement was that it was difficult to compare the findings of individual studies because of the range of methodologies, large variations in scope, timeframe and context, and lack of clarity about precisely what each author meant by "skill". However, the very diversity of methods led him to conclude that these studies had proven the existence of deskilling, though nothing about its prevalence or distribution, since "there are too many downgrading illustrations to have all been artifacts". Perhaps the most important understanding to be gained from the case studies was that "the impacts of technology on skill levels are *not* simple, *not* constant across settings and firms, and *cannot* be considered in isolation" (Spenner 1985: 141-146, emphases in original).

While the earliest statistical studies used occupation, sector, wages or educational level as proxies for skill level (Field 1980), the preferred source for American researchers by the mid-1980s was the Dictionary of Occupational Titles (see 3.3.2), which represented the best available data on substantive complexity despite its significant weaknesses (Spenner 1983: 830-831). Rumberger (1981) devised an interesting compromise approach by using occupation as his primary skill-related variable, but cross-referencing each occupation to the educational proxy in the DOT to reach an estimate of its substantive as opposed to reputational skill content. This control produced surprising results, revealing for example that 20% of professional and over half of all managerial jobs did not require the highest

levels of skill, while the modal skill level for farm labourers, long regarded as standing at the bottom of the skill ladder, was higher than for service workers.

Rumberger's paper was also significant as one of the first (along with that of Wright and Singelmann, described below) to recognise that compositional change had different components or dimensions and try to isolate the specific contribution of each causal process to aggregate change. He identified three components: a changing balance of employment between broad occupational groups; a changing balance of skill requirements within each occupation, caused by higher-skilled jobs displacing lower-skilled ones or vice-versa; and rises or falls in the skill requirements of individual jobs (defined here as categories of job rather than the specific jobs held by each individual in the workforce). Of the three he found that inter-occupational shift had made the most important contribution to overall change over the period 1940-1976, with the largest influence being an increase in employment in occupations requiring the highest two educational levels and a decrease in those requiring the lowest two (1981: 586). However, the aggregate result was a narrowing of the skill distribution of jobs across the economy, since the percentage requiring the highest skill levels actually declined between 1960 and 1976 (1981: 587). The largest gains in this analysis were recorded in the upper-middle skill level. Overall, however, he found an unequivocal rise in the average skill requirement of jobs since 1940.

Spenner (1985) carried out a meta-analysis of eleven quantitative studies published up to that date, including that of Rumberger. Of these, eight analysed changes in skill as substantive complexity, two focused on changes in autonomy/control, and only one included indicators relevant to both. All but four relied on DOT indicators, though the choice varied, with some using the job content indicators and some the educational proxy. In general those using the educational proxy identified more upgrading. The most common finding was a small compositional upgrading or no aggregate change. Only local evidence of deskilling was found, and then only on the basis of somewhat eccentric indicators (e.g. proportions of workers classed as supervisors). The overwhelming impression was one of aggregate stability over quite long periods, though Spenner suggests that this was partly an artefact of the infrequent and inconsistent updating of the DOT. All studies were rated by Spenner as having serious weaknesses, either in the research design or in the data (Spenner 1985: 136-141).

Before moving on to more recent studies using better data, it is useful to look at two pieces of research that fall clearly within the deskilling debate, one undertaken in the very early days and one at the latter end of the tradition, which use data in some ways similar to HILDA. Unfortunately a third and apparently the most interesting, that of Karasek, Schwartz and Pieper (1982), was never published and is no longer accessible; earlier work by Karasek (1979) suggests that it may have employed a metric for task discretion well in advance of anything else developed at the time.

One of the earliest and most interesting pieces of research on the Labour Process side to use quantitative evidence was that of Wright and Singelmann (1982), which also stands out as one of the first to examine the impact of different kinds of compositional change. It used Census data on shifts of employment between industry sectors and compared these against change in the composition of individual sectors by quasi-Marxian class categories (employers, petty bourgeoisie, managers, semi-autonomous workers and workers) corresponding very broadly to levels of task discretion, in order to calculate their combined impact on the overall class structure of the US economy. The purpose of their analysis was

to confirm Braverman's general prediction by finding a growth in the proportion of (proletarianised) "workers" to other classes.

Their methodology is difficult to follow or duplicate because neither their occupational/class categories (referred to as "locations") nor their industry sectors correspond to those in any standard industry or occupational classification, and the exact composition of each is not made clear in the article. The former was calculated by analysing the responses to a set of four questions in the Survey of Working Conditions, carried out in 1969 by the University of Michigan, asking whether the respondent was an employer; whether she was self-employed; whether she had subordinates; and whether she had freedom in deciding how to do her work and freedom to make decisions about what she did. The frequency of responses to each question across sector/occupation cells was calculated and each cell assigned to a "class" according to its average score. These "locations" were then applied to the employment data in the 1960 and 1970 Census to estimate compositional change over the decade.

While the methodology was open to criticism, as the authors themselves admitted, the results are interesting in that they showed offsetting effects of the two processes of compositional change. An overall stability in the proportions of each class across the workforce was found to be the result of a strong growth of employment in higher-skilled sectors like health and education which had large numbers of "semiautonomous workers", i.e. employees enjoying high task discretion. Across all individual sectors, however, the proportion of "workers", i.e. employees with low task discretion, was rising while managers, semiautonomous workers, small employers and the petty bourgeoisie (i.e. the self-employed) were generally in decline. Hence, the authors argued, deskilling was the ruling generic trend but was masked by compositional shift between industry sectors.

They pointed out that the growth in semiautonomous workers had occurred almost wholly within the public sector, and forecast that with a halt or reversal of the growth in public employment likely over the 1980s, the underlying trend towards proletarianisation could be expected to emerge once again in the aggregate figures for the workforce as a whole (S201). However, Singelmann and Tienda (1984) later repeated the analysis with data running through to 1980 and found that the shift towards jobs with higher task discretion had continued across the economy even after 1975 when the growth in public employment did in fact tail off, because shifts of class within industries had become the more important factor (Attewell 1992: 59).

A much more recent work which examines the same question for Sweden, using the same kind of evidence, is that of Jonsson (1998). Although explicitly focused on questions of class homogeneity and convergence, this work takes a multidimensional approach to skill extending well beyond Wright and Singelmann's exclusive focus on task discretion. The study uses high-quality data from the Swedish Level of Living Survey, a longitudinal survey of around 6,000 employed persons with cross-sectional samples but a small adventitious panel component (around 800 respondents) which was run over four waves in 1968, 1974, 1981 and 1991. The dataset permitted the construction of indicators for occupational level, required qualifications, learning requirement, work monotony, physical demands, hazardousness of work, autonomy (confined to the time control dimension), wage level and type of employment contract. Additional variables in the 1991 run provided data on the work-based learning, influence over decision-making and fringe benefits.

The long period covered by the data and the spacing of the individual runs makes it possible to identify much clearer trends than is currently possible using HILDA. Jonsson finds unequivocal evidence that the average skill requirement rose across the full period on all indicators, with the main component of skill growth concentrated in occupations which correspond broadly to the two Australian classifications of Labourers & Related Workers and Elementary Clerical, Sales & Service Workers (1998: 613). Looking at gender effect, he finds that the average skill level of women's jobs dropped between the earlier waves because of increasing participation, but by 1991 women were rapidly catching up with men except at the managerial and professional levels. Generally there appeared to have been a convergence of skill requirement between levels in both white-collar and blue-collar work, but no sign of skill convergence between the two, though the lowest-classified occupational groups in each category showed strong similarities in working conditions (1998: 614). Some rise in monotony was observable at the lower end of the occupational scale even in the presence of higher educational requirements, possibly indicating a rise in expectations (1998: 617), but autonomy as measured increased except for women in manual jobs, where it remained stable. Following the individuals in the panel component of the sample, Jonsson finds that skill upgrading was much more common than downgrading and continued throughout an individual's career, whereas deskilling did not (1998: 618).

As noted at the beginning, this is a very summary account of the research carried out by both sides in the deskilling controversy, with detailed treatment of individual studies confined to the two which most clearly prefigure the present study. Generally speaking, the statistical research failed to find evidence of deskilling as an overall trend, though there was occasional evidence of slight and localised upgrading. The surprise was, if anything, how little change appeared to have taken place at the aggregate level even over quite extended periods. The large body of good case studies, on the other hand, demonstrated how much detail, critical to the nature of change at the workplace level, was overlooked by the available quantitative data, leading to a search for better population-level data on the exercise of skill in the workplace.

The controversy is much less lively today than it was a quarter of a century ago, with the upgrading hypothesis having once more become the dominant assumption in the public mind and in policy, if not necessarily academic, discourse. While the belief in a general and inevitable rise in skill across the labour market continues to be contested, the case against it has largely been taken over by a less millenarian tradition dating from Keep and Mayhew's 1988 article on the low-skill equilibrium, which views deficits in the demand for skill as the contingent result of systemic policy failure rather than an inherent imperative of the dominant economic system.

Perhaps the main contribution of the deskilling debate was that it kept the issue of change over time in skill requirements an open question for another twenty years when the inevitability of upgrading might otherwise have been taken for granted. In academic terms its important contributions seem to be five. The first, paradoxically, was to popularise the idea of skill polarisation as a more sophisticated alternative to universal deskilling, and hence to focus greater research attention on changes in the distribution of skill across occupational levels. The second was to create better awareness of task discretion as a possible key dimension of skill. The third was to highlight the need for data on aggregate trends and the limited generalisability of case study evidence in this area. The fourth, conversely, was to drive a new search for direct indicators of skill utilisation in the workplace which could duplicate some of the strengths of qualitative research by capturing

more of the effective drivers of change than the proxies that were normally used as indicators up to that point. The fifth, arising out of that need, was a more rigorous focus on the nature and definition of skill, including a recognition of its inherent multidimensionality.

## 5.2. The British skills surveys

Building on the groundwork laid by Spenner, and initially overlapping with that work, researchers in the UK have collected twenty years of data specifically focused on self-report by employees on how skill is used in the workplace. The data come from five surveys conducted between 1986 and 2006:

- Social Change and Economic Life Initiative (SCELI) (1986)
- Employment in Britain (1992)
- 1997 Skills Survey
- 2001 Skills Survey
- 2006 Skills Survey.

All five surveys have been carried out by independent academics and funded by different combinations of national and regional government and industry bodies. They are cross-sectional household surveys of employed adults, with an achieved sample of around 4,800 individuals in the 2006 round. They were not originally planned as a coherent series, vary in their primary purpose and focus and draw a new sample for each run. However, successive surveys have intentionally built on the previous ones to preserve data continuity while progressively increasing the breadth and depth of the dataset (Felstead, Gallie, Green and Zhou, 2007: 2).

Following Spenner's model set out in Chapter 3, all five surveys have collected data on aspects of job complexity, and those conducted since 1992 have also contained questions on task discretion. The data they record on job complexity are considerably more extensive than those in HILDA, and do not contain any directly comparable questions except for one in the 1992, 2001 and 2006 runs which is virtually identical to NUSKILLS. A second question addresses another component of work-based learning by asking respondents whether they need to help their colleagues learn. To capture the preparatory learning requirement ("broad skills") questions are asked on:

- required qualifications;
- duration of the on-the-job training required to be come fully proficient;
- time needed in a job to learn to do it properly.

A second major component of the surveys gathers direct evidence on both substantive complexity and technical job content by asking respondents to rate the importance for their job of 35 generic types of skill, increased to 40 for 2006. This is an attempt to cover the job analysis element of DOT and O\*Net in a simplified form. Principal component analysis was used to convert these individual items into composite scores on ten kinds of generic skill: literacy, physical, number, technical know-how, influence, planning, client communication, horizontal communication, problem-solving, checking, aesthetic and emotional. The last two of these broader categories were used only in the 2006 survey.

Additional questions were asked about more specific skills in computing, foreign languages and where relevant, management (Felstead et al 2007: 26-35, 95-119).

The third key component, the questions on task discretion, is sufficiently similar to permit fairly reliable comparison with HILDA. However, it must be borne in mind that the task discretion questions in the UK surveys relate only to individual discretion (Gallie, Felstead and Green 2004: 249), whereas those in HILDA include other forms of influence, including collective or consultative input to decision-making.

The indicators in each of these areas have been combined into an index, based on principal component analysis, and these indices rather than the constituent variables are used as the dependent or analysis variables, as required, in most of the published analyses.

Over the period 1986-2006 these surveys have tracked a steady rise in the requirement for skill across most jobs, though growth slowed after 2001. This was primarily apparent in a growing requirement for formal qualifications at all levels, though this is counterbalanced by evidence of possible credentialism (Felstead, Gallie and Green 2002: 11), especially at lower levels in the qualifications framework where the policies of successive governments have favoured a rapid expansion of formal certification, mostly through recognition of prior learning, in jobs previously treated as unskilled (Keep, Mayhew and Payne 2006). However, the trend has been apparent in more robust indicators such as training time and the amount of time required in a job to learn to do it properly. A different kind of skill growth is evident in the need to keep learning new skills on the job, which has shown fairly uniform growth over the two decades and is the only key indicator not to have plateaued since 2001. These latter trends are seen as marking a growing role for learning in the workplace as opposed to formal training (Felstead et al 2007: x).

In general, the rise in skill requirement has remained broadly in line with the occupational hierarchy, meaning that the relativities between different levels have changed little. In particular, there is little evidence of progress in meeting the need for a major expansion of middle-level skills that was identified by the NIESR matched case-study research in the 1980s and 90s (Steedman, Mason and Wagner 1991). While most generic skills appear to be increasingly required, the only ones to carry a significant wage premium across the board are computer skills and the category of higher-level communication and planning skills characterised as “influencing skills”.

On the negative side, despite growing indications that workers expect to use skill and initiative in their jobs, the task discretion index showed a strong decline up to 2001, with the mean score on the variables which correspond broadly to WHATDO and OWNTASK dropping by 25% and 28% respectively between 1992 and 2001, though the decline has since levelled off. It was most pronounced for professionals, and considerably more pronounced for part-time workers. Unlike HILDA, these surveys provide some insight into the sources of declining task discretion, and show that much of the decline was due to an increase in the constraints imposed on individual decision-making latitude by fellow-workers (Felstead, Gallie and Green 2002: 13). In other words, a significant part of the decline is due to factors that would be attributed in the analysis framework for this thesis to a more interactive style of work, and hence to a need for stronger cooperation skills.

With such a relatively long run of data it is easier to identify the periods of faster and slower change over the twenty years. The pattern on the broad skill indices differs

according to the aspect of learning involved. The learning time index shows the steadiest growth, an almost linear if gentle rise from 1986 to 2006. The required qualifications index rose between 1986 and 1992, plateaued in 1997, rose again in 2001 and levelled out thereafter, 2006 being the first year in the series which actually saw a growth in the number of jobs requiring no formal qualifications. Training time peaked in 1997, dropped sharply in 2001 and rose back to just above its 1997 level. Generally speaking growth seems to have been strongest in the early and mid-1990s, and virtually all indicators, including task discretion, level off between 2001 and 2006. By contrast, as already noted, the indicator of work-based learning, equivalent to NUSKILLS, shows strong and relatively even growth across the three waves for which data exist, the percentage who strongly agreed or agreed rising from 76.2 in 1992 to 81.3 in 2001, and again to 82.5 in 2006.

The UK skills surveys are an exceptionally rich resource, and this very summary account of their findings, which covers only those aspects in which they provide data directly comparable with HILDA, does nothing like justice to the range and usefulness of the information they provide. This account is intended only to set the context for the research in this thesis by summarising the sources which represent direct precedents for the analyses carried out here. However, they serve to illustrate the inadequacy of the data currently available on the dynamic and outputs of Australia's NSS, and Chapter 10 will return to the question of what parts of them could usefully be duplicated for Australia, either in future waves of HILDA or in some other source.

### 5.3. Research using HILDA

As noted in Chapter 4, HILDA was not primarily designed to collect data on skilling, and most of the research done so far which uses its data has focused on other aspects such as wealth and poverty, family formation, women's career patterns and flows between employment and unemployment. However, five recent studies use the key skilling variables to examine issues of relevance to this thesis.

Carroll and Poehl (2007) apply logit modelling techniques to data from the first five waves to examine job mobility and the factors that drive it. They note that HILDA provides the first reliable large-scale data source for mapping flows within employment (as opposed to flows between employment and unemployment) in the Australian economy. Their specific interest lies in the relative importance of individual preferences or characteristics and objective considerations of job-person match in driving voluntary job change. Their findings are ultimately somewhat inconclusive, since the authors suggest that several of the observable factors that are found to reduce the odds of job separation (firm-specific human capital, tenure in present and previous jobs, marital status, union membership, public sector employment) could simply reflect unobserved heterogeneity, in that individuals with an inherent preference for stable employment may self-select into kinds of job or life situation that promise or demand greater stability. Their research is largely peripheral to the issues covered in this thesis, except in that it emphasises both the statistical importance of labour mobility as a potential source of allocative efficiency (an important element in the supply mechanism as set out in the model in Chapter 2) and the importance of job satisfaction as a determinant of mobility or worker-firm attachment.

McGuinness and Wooden (2007), in research that appears to have been conducted independently of the Carroll/Poehl paper, use data from the first four waves to examine the

specific relationships between overskilling and job mobility. Their measure of overskilling is derived from USESKILL, with those scoring the item 1-3 classified as “severely overskilled” (15-28% of sample in each year), those scoring 4-5 as “moderately overskilled” (25-28%) and those scoring 6-7 as “well matched”. Their variables of interest relating to job mobility are intention to leave current job, perceived probability of losing current job, and expectations of finding an equally satisfactory replacement job. These three dependent variables were regressed in a fractional logit model against the overskilling variable, a range of demographic variables, employment type and duration, and indicators of underskilling and upskilling derived from COMPLEX and NUSKILLS respectively, though the precise nature of these indicators is not described in the paper.

The results of this first analysis indicated that overskilled workers believe themselves to be more likely to quit their present job voluntarily within the next 12 months than well-matched ones, by 10% in the case of the severely overskilled and 3% for the moderately overskilled, once other potential causal factors have been taken into account. This far the results are consistent with expectations. However, overskilled workers also proved to be more apprehensive of losing their job involuntarily, and in the case of moderately overskilled workers, marginally less optimistic about finding a comparable replacement job. When actual job changes between waves were regressed in a random effects probit model against overskilling and the same demographic variables, overskilling proved as expected to be a significant predictor of voluntary job change (8.2% increased odds for the severely overskilled and 4.4% for the moderately overskilled), but also marginally increased the odds of involuntary job loss.

As a final test, descriptive statistics were used to compare the USESKILL scores of voluntary job changers between Waves 3 and 4. Only 38% of those previously classified as overskilled reported an increased score on this variable as a result of their change of job. On the basis of these analyses, the authors argue that overskilling in Australia cannot be regarded as a purely transitory or frictional phenomenon which is resolved by natural labour mobility, a conclusion which suggests that it may be symptomatic of a more durable dysfunction in the labour market.

Mavromaras, McGuinness and Fok (2007a) extend this analysis to examine the wage penalties that attach to overskilling, as evidence of lost productivity resulting from the failure to deploy workforce skills effectively. Their data are drawn from the first five waves, using a combined sample and the same definitions of overskilling as the McGuinness/Wooden paper. Inclusion of Wave 5 alters the proportions of severely overskilled, moderately overskilled and well matched to 11%, 31% and 58% respectively of the combined sample ( $n = 5,843$ ).

Their analysis uses ordinary least squares (OLS) regression to estimate the wage penalty for severe underskilling. Measured against the wages of otherwise comparable workers who are well matched, this penalty averages out at 13.3% across the sample, but is especially pronounced for graduates (23.8%). These findings proved robust when subjected to further testing based on propensity score matching (PSM) to control for the possibility of unobserved heterogeneity (e.g. rises in participation and retention rates at the higher levels of education leading to a broader spread of ability in each qualification group). Averaging out the OLS and PSM results produced estimates of the wage penalty ranging from 20% for graduates down to 8% for employees holding vocational certificates or diplomas (a category which includes the skilled trades). The penalty for moderate overskilling revealed

by the OLS estimates is more modest at 4.9% and 5.1% respectively, and lost most of its significance after PSM testing.

Basing their calculations on the severely underskilled only, the authors estimate the annual wage penalty at \$3,979 for a vocationally qualified employee, \$6,257 for one with 10 to 12 years of schooling and \$13,723 for a graduate. Extrapolating from the sample to the Australian population, and assuming that the wage penalty is equivalent to the value of forgone productivity, they tentatively suggest a total annual productivity loss to the Australian economy of just under \$6 billion, or around 2.6% of GDP, resulting from inadequate deployment of the skills of the full-time employed labour force. They argue that this is likely, if anything, to be an underestimate of the true productivity cost, citing evidence adduced in the UK by Dearden, Reed and van Reenen (2006: 414) of a “wedge” between the productivity and wage effects of training which suggests that the actual productivity differential could be as much as twice the wage differential. It should also be borne in mind that this estimate excludes productivity lost as a result of underemployment of part-time workers (i.e. persons working fewer hours than they would prefer), underutilisation of the skills of part-time workers who are working their preferred hours, and skilled unemployment.

Mavromaras, McGuinness, O’Leary, Sloane and Fok (2007b) add an international comparative dimension to the analysis by including data from the 2004 UK Workplace Employment Relations Survey (WERS). The latter, though containing a broadly comparable question on skills-job match, differs significantly from HILDA in sampling method (random selection of employees from a cross-sectional sample of workplaces, as opposed to a longitudinal panel sample of households), the way the question is asked (“How well do the skills you personally have match the skills you need to do your present job?”) and the scaling method (5-point scale with the individual points anchored by verbal tags i.e. much higher, a bit higher, etc.). Differences in findings between the two surveys may well be due at least in part to sensitivity of the response to the last two matters in particular. In this paper the HILDA data are drawn only from the first four waves.

Despite the differences, the overall incidence of moderate overskilling in both countries emerges as surprisingly similar at 33.41% for Australia and 33.36% for the UK. However, severe overskilling appears to be much more common in the UK, at 20.86% as against 14.23%, and there are marked differences between the two countries in the distribution of overskilling by educational level, occupational level and industry. Severe overskilling in the UK is more or less evenly distributed across educational categories, but in Australia its incidence declines strongly with education level, except for postgraduate qualifications. Respondents with bachelor’s degrees have the highest incidence of good matches in Australia (61.91%), but the lowest among all categories in the UK (44.43%). In both countries, the incidence of overskilling varies inversely to occupational level, but the distribution is much more even in the UK, with severe overskilling in the managerial and professional classifications running at around three times the level shown in the Australian data. The distribution of severe overskilling across industries also shows much more variation in Australia, ranging from 7% to 25% across ANZSIC major categories as against 17-27% for the comparable UK categories.

While a number of credible explanations could be put forward for these differences (e.g. higher workforce expectations, a more recent bulge in the proportion of the workforce holding degrees, or the persistence of the low-skill equilibrium in the UK), some caution is

required in interpreting the findings because it is not certain that the two scales have been appropriately matched in the comparison, or even that they measure the same construct. The verbally anchored response categories in the (Likert-type) WERS question could be seen as encouraging confidence in both the reliability and the interpretation of the response, whereas the meaning of the unlabelled individual points on the (true) Likert item in HILDA is open to a variety of interpretations besides that followed by the authors. This problem will be further discussed shortly, and is addressed in more detail in Chapter 6. Meanwhile, without supporting evidence that the difference between the findings reflects a real difference in the working of the respective skilling systems, it remains at least open to hypothesise that the threshold of “severe” overskilling may have been set higher for the Australian than the UK data.

These doubts are somewhat offset by the results when the underskilling variables were fed into a standard wage regression for each country. The model used for the regression in this paper was different from that used in the paper previously cited, resulting in a more modest estimate of the wage penalty for severe overskilling in Australia at 8.2%. However, the corresponding penalty for the UK was almost half as high again at 12.0%. The penalties for moderate overskilling were more comparable, at 2.5% for Australia and 2.9% for the UK. If the prevalence of severe overskilling in the UK was indeed overestimated by comparison with Australia, one would expect the wage penalties for the moderate and severe categories to be closer, *ceteris paribus*, in the UK because the “severe” category would include many respondents whose job-person match would have qualified as them only moderately overskilled on the scale used for the Australian data. That the actual gap is so much bigger suggests, if nothing else, that *cetera* are not *paria* and there are different circumstances in the UK labour market which result in a much larger penalty for overskilling across the full range of possible levels of mismatch, albeit still with a strong bias against the most overskilled. Such a conclusion appears to be much more robust to differing assumptions about the comparability of the two scales, and on the surface is hard to dismiss as an artefact of the method.

Disaggregating the results by educational level, the contrast between the two countries is strongest at the Year 10 level, but this time in favour of the UK, with the respective wage penalties suggesting that Australia has by far the larger problem with skills mismatch at this level. At most other levels the two countries produce broadly similar results, with holders of degrees and postgraduate qualifications experiencing the highest disadvantage (remembering that the *incidence* of overskilling at these levels is much higher in the UK). In both cases the wage penalty for severe underskilling disappears at the lowest levels of education; the authors surmise that this results from the existence in both countries of minimum wage laws which limit the scope for such a penalty to be imposed. Taking all the results together, the authors calculate that 61% of the Australian labour force and 79% of the British labour force experience a wage penalty of at least 10% as the result of underutilisation of their skills.

This third paper briefly examines the impact on wages of job discretion, an analysis only foreshadowed in the earlier paper. Inexplicably, the authors do not merely overlook the task discretion variables in HILDA, but actually assert that no such variables exist (2007b: 24). Hence, the analysis is carried out only for the UK. Using the same regression model as the other analyses in the same paper, they find a strong positive association between wages and job discretion, most marked in the case of the variable “involvement in decision-making” (directly corresponding to HAVESAY). They find that the wage effects of

overskilling are offset, albeit modestly, when workers have reasonable control over their work, and suggest that this results from the workforce having more discretion to determine its own level of productivity.

The work of McGuinness, Mavromaras and their colleagues, presumably still in progress, has considerable relevance to this thesis and has laid invaluable groundwork for the analyses to be carried out in subsequent chapters. In many respects, given their far greater command of advanced inferential methods, they set an example which the present author cannot hope to equal in the timeframe of this thesis. They also make a contribution that will not even be attempted here by setting a dollar value (however tentative) on the productivity that is lost across the economy as a result of underutilisation of the skills of the workforce. This said, two potentially important differences exist between their methodological paradigm and focus and those to be followed in this thesis:

- The work of these authors incorporates many assumptions of the traditional labour economics and human capital paradigms, albeit with an important distinction. They see their findings as supporting the class of theories on the operation of the labour market known collectively as assignment models (Mavromaras et al, 2007a: 24; Sattinger, 1993). These models replace the more traditional assumption among quantitative economists that productivity is directly determined by the individual characteristics of the worker with the premise that the main problem for the labour market is to assign the available workers among the available jobs in a way that produces the best match – a function parallel to that of allocation in the model set out in Chapter 3 above<sup>1</sup>. Assignment models acknowledge the importance of exogenous factors, e.g. the availability of complementary assets, in shaping the range of jobs that is actually on offer at any given time, and thus provide an account of how it is possible for some workers to be deployed, and/or remunerated, at less than their optimal productivity even in the absence of market imperfections. They thus represent a kind of middle path between conventional human capital theory and system approaches that takes account of many of the confounding factors listed in 3.1 above. Nevertheless, they still ultimately assume the theoretical possibility of equilibrium, and hence depart from the assumption of constitutive dynamic imbalance which underlies the system approach.
- The main focus of such models is different from that of the analysis undertaken in this thesis. The ultimate aim of such econometric approaches is to develop a model that can predict efficiency wages in a range of circumstances, or at the least, can account for observed levels and patterns of wage inequality. Skills (generally treated as fixed attributes of the individual worker) feature in such models as an important independent variable, but are not the true object of interest. By contrast, the analysis of skilling systems outlined in this paper treats skill, as exercised at the point of production, as its key output variable. Wages may enter the equation as an independent variable, an indicator or possibly even a proxy, but the model does not purport to explain or predict wage levels in any comprehensive fashion.

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<sup>1</sup> Strictly speaking, assignment in these models is treated as an aspect of *efficiency* that is reflected in outcomes. Allocation, in the model developed in this thesis, is an observable *process or mechanism* that requires study in its own right, with considerations of its efficiency determined in the context of the overall skilling system or its subsystems. Although subtle, the distinction seems sufficiently substantive to justify using different terms for the two constructs.

While both these differences are fundamental at the level of underlying concept and mechanism, they do not necessarily rule out individual analyses or findings which are common to both kinds of model. At the level of analysis currently under discussion, the practical differences between the two approaches are unlikely to be significant, but the gap can be expected to widen as the analyses become more ambitious. One issue on which the distinction is already apparent is that this present research will not attempt its own calculation of the productivity costs of skill underutilisation because a systems model, in which all the elements are in constant, asynchronous adjustment to one another, does not allow for such straightforward and unequivocal counterfactuals. This said, the work done by Mavromaras et al provides a very useful order-of-magnitude indication of the degree of flexibility that exists within the Australian NSS as currently configured.

A more strictly technical point of methodology also needs to be signalled. The present research follows a more conservative approach to the interpretation of scores on each question than that taken by McGuinness et al. On the face of it, it is difficult to see why a score of 5 on the HILDA question (i.e. marginal agreement with the proposition "I use many of my skills and abilities") should be included in the range of responses classified as overskilling. When it comes to comparing the Australian and UK findings, it seems at least as problematic in principle that the range of responses classified as overskilling should cover four points on a seven-point scale in Australia, but only two points on a five-point scale in the UK. The difficulty is heightened by the way the questions are put in the different instruments: in WERS the category "moderately overskilled" is explicitly anchored on the response scale, whereas the wording of the HILDA question introduces a second ambiguity (How many of one's skills and abilities counts as "many"?) that further complicates interpretation of the response.

A pragmatic response would be to exclude the "moderate overskilling" category from the analysis, given its relatively low significance in the wage equations for both countries, and concentrate on those responses which clearly and unequivocally indicate overskilling. If one further accepts the argument set out in Chapter 6 and follows the standard practice in this thesis of confining the "definitely agree/disagree" response to the outer four rating points on the scale for the HILDA question, the proportion of HILDA SCQ respondents classified as "definitely overskilled" over the first four waves falls significantly to between 8.5% and 9%. This only serves to illustrate the point that any adjustment made in the intuitive direction to compensate for apparent interpretation bias greatly amplifies the contrast between the Australian and UK results. Thus it appears that unless clear evidence can be found of further design-related bias in either survey (e.g. sampling bias or questionnaire effects), the UK must be regarded as having an experience of workforce overskilling, at any rate in the period around 2004, significantly different from that of Australia in the same period. This should also be borne in mind when interpreting the results of the UK Skills surveys.

The most recent analysis of the relevant variables is that of Ian Watson (Watson I 2008<sup>2</sup>), who uses a pooled sample from the first five waves of HILDA as one of a range of sources to investigate the incidence of overskilling in Australian workplaces. His analysis takes NUSKILLS and USESKILL as the variables of interest (giving them virtually identical convenience labels to those used here). The first part of his analysis takes the first three points on the response scale for USESKILL as the band indicating skill underutilisation,

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<sup>2</sup> The extended reference style is used to distinguish this author from Nicole Watson (Watson N), the author of much of the technical documentation for HILDA.

justifying this as “a very low response” because the upper cutoff point is three scores below the median on a 7-point scale (2008: 10). In practice the higher cutoff raises the proportion in this category to approximately 14% across the five waves. He then disaggregates this by 1-digit industry and occupation to find that the incidence is highest (at 20% or over) among elementary clerical, sales and service workers and labourers and in retail trade and accommodation, cafes and restaurants. The figure for workers with VET qualifications is 11%. He follows this with a similar analysis using NUSKILLS, finding a much higher incidence of poor learning opportunities, and noting that the figures derived from HILDA are roughly twice the levels obtained from his complementary NCVET data sources. From the text it appears that his interpretation of this variable is somewhat different from that followed in this thesis, with the focus resting on purposive (even if informal) training *opportunities* rather than learning *needs* which arise out of the nature of the work.

The second part of his analysis combines each variable with corresponding ones from the complementary sources to form dependent variables in two regression models of a different kind from those used by the earlier authors, involving Bayesian posterior means as his test of model fit. Full technical details of his model are not shown in the paper. The sample is disaggregated by 2-digit ANZSIC and ASCO, with the unit of analysis defined as generic “jobs” averaging out the experiences of those employed within each industry/occupation cell<sup>3</sup>, rather than individual respondents (2008: 11, 20).

The analysis using USESKILL as the dependent variable finds a strong positive effect in jobs which are characterised by longer average occupational tenure, and less marked positive effects from higher proportions in each job category of young employees, employees with VET qualifications, public sector employment and small business employment. There is a strong negative correlation with the proportion of casual work. Skill use is found to rise predictably, though not in a linear progression, with position on a 5-point hierarchy of generic skill content (2008: 13).

The analysis on NUSKILLS once again finds positive associations with the proportions of younger workers, VET graduates and public sector employees. In this case, the strongest negative associations are found with part-time as opposed to casual employment, and with the proportion of workers who are working less than their preferred hours. Learning needs (or opportunities) do not correlate as expected with ranking on the formal skill hierarchy: while the top skill category still comes out well ahead, the lowest category rates somewhat better than the two above it (2008: 14, 15).

Watson's paper is an interim report on a larger study which had yet to be released at the time of writing. His conclusions draw particular attention to the role of contingent work in depressing the deployment and development of workforce skills, but this emphasis may be partly a reflection of the context for which the paper was written. An important difference from the present work is that his focus (at any rate in this paper) is on longer-term patterns rather than longitudinal change: indeed, his use of a pooled sample presupposes that the ruling behavioural patterns will not have changed over the five years. That said, his paper usefully reinforces some of the conclusions that are reached in this thesis.

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<sup>3</sup> Cells with fewer than 20 observations are excluded from the analyses.

## 5.4. Summary and discussion

The 35 years covered by this brief survey have seen radical shifts in expectation, research focus, method, and above all the quality of data resources available on what remains essentially the same subject. It began with rival absolute assumptions, on the one hand that technological and organisational innovation would lead inevitably to an increase in the quality and skilfulness of work across industrialised economies, and on the other that deskilling was a generic and spreading phenomenon driven by an inherent imperative of the current system of capitalism. It has ended with a general agnosticism on the core question, at least among serious researchers in the relevant disciplines, in tandem with a shift of focus to the distribution of change and its local manifestations, on the understanding that these more specific dimensions of change have the more interesting story to tell about the dynamics of modern economies and skilling systems. It began with the two sides of the controversy pursuing rival methodological paradigms which allowed little scope for dialogue: on the one hand relatively crude statistical analyses of aggregates based either on equally crude proxies or on a flawed occupational assessment system that was never designed to support this kind of research; on the other a substantial body of case studies, often highly perceptive and providing valuable insights with possible application well beyond the contexts in which they were gained, but with no means of establishing how far the findings could be generalised, and suffering from uneven coverage of the labour market, from lack of agreement or even clarity about the definition or dimensions of skill under investigation, and in many cases from *parti-pris* and/or conscious selection of the cases that would best support an argument. The gap between the qualitative and quantitative approaches is still not entirely bridged today, but over the period the two sides of the debate have tended to converge on a mixed-methods approach, helped along by a shift on the quantitative side, first to a greater use of sample surveys designed to examine particular aspects of skill use and demand, and latterly to population-level datasets that aim to measure different dimensions of skill directly, potentially allowing better comparison of findings with qualitative studies.

It seems fair to conclude that despite the longevity of the Labour Process school, it never really succeeded in producing conclusive proof that deskilling was a universal product of modern capitalism. Equally, it never tested the counterfactual by investigating whether the situation was substantially better in the comparably advanced socialist economies that might have been accessible for case study, while those economies still existed. Indeed, from very early on, many of the supporters of this position retreated to more sustainable expectations, either of skill polarisation (an expectation shared by many emphatically non-Marxist students of innovation – see Pianta 2005), or of the possibility of compromise outcomes where worker resistance proved strong enough. More precisely, their empirical research produced ample evidence that deskilling was occurring, and some very good insights into the processes by which it occurred, but was unable to establish that the phenomenon was either dominant or inevitable.

On the other side, the early quantitative studies had little success in proving the case for universal upgrading, and became generally less conclusive in this regard as the presence of a strong rival school of thought encouraged a greater focus on analytical rigour. The most common finding supported a “compensatory theory” (Adler 1992:47-8) whereby declining skill requirements in one part of the economy were counterbalanced by needs for more or higher skill in another. In any event, the pace of aggregate change appeared to be exceedingly slow, taking decades or longer to become evident.

As Spenner pointed out (Spenner 1985), the lack of apparent change may have been an artefact of indicators that were too indirect or too inexact to detect it. The amount of change detected by a study was highly sensitive to the measurement method, with the least convincing proxies generally showing the greatest change. On the other hand the case studies, if they proved nothing else, demonstrated that the process of skill change was “not simple, not consistent and cannot be considered in isolation” (Spenner 1985: 146), thus casting further doubt on the value of the quantitative evidence. Comparison across studies was also made difficult because they measured different dimensions of change, a difficulty which led directly to greater efforts to define skill and eventually to a recognition of its multidimensional character. The importance of this definitional impasse, which for some time seemed to block any further progress in resolving the controversy empirically, is shown by the fact that the best, most comprehensive and most accessible writing on the definition, meanings and measurement of skill is still to be found in a single issue of *Work and Occupations* from 1990.

In this context, the British Skills Surveys are instructive in demonstrating what could be achieved once this impasse was broken by the development of a purpose-designed research instrument capable of capturing skill as exercised, not only directly, but in multiple dimensions. Where earlier aggregate studies had struggled to find any overall change in the level of skill exercised over periods of half a century or more, the UK surveys showed that reliable and meaningful aggregate trends could be picked up over intervals of 4-5 years and change in those trends was identifiable between these periods. Moreover, because of their multidimensional character, these surveys have been able to show that even in the aggregate, the different dimensions of skill do not move in tandem, with different aspects moving at different paces and sometimes in different directions at different points in time, even over periods as relatively short as twenty years. These surveys illustrate how good, relevant microdata are not only worth the effort of developing, but make it possible to answer questions of a kind which have long been of widespread interest but would not otherwise be answerable.

In general the findings of the UK surveys can be seen as supporting the upgrading hypothesis over the period for which data are available, with the exception of task discretion which has been in general decline, especially among higher-skilled occupations. In this sense they provide some comfort to both the upgrading and the deskilling sides of the residual controversy. Importantly for the purpose of setting the HILDA findings in a historical context, they show that most of the trendlines flattened out in the period for which comparable data are available for Australia. However, some of the most important insights to come out of these surveys concern issues which lie somewhat outside the normal parameters of the deskilling debate. Perhaps the most useful of these concerns the need for on-the-job learning before workers, regardless of their level of prior education or training, become fully proficient in a job. In view of the increasing demand from business in Australia for recruits who will be fully productive from the day they come out of the training system, it is useful to have hard data across the full range of sectors and occupations showing a steady growth over two decades in the percentage of jobs in which a worker needs two years or more to come fully up to speed. Such jobs represented a quarter of all jobs in 2006, whereas those in which a new worker could become fully competent in less than a month had fallen to around one in five (Felstead, Gallie, Green and Zhou 2007: 56).

The HILDA data make it possible to repeat some though not all of this analysis for Australia, but so far the little research that has been done using the relevant variables, though distinguished by the sophistication of its analytical techniques, has covered different ground from the earlier research summarised in this chapter. Except for Watson's very recent paper, all of it has treated skill as an explanatory rather than a dependent variable, though the work of Mavromaras and his colleagues has addressed a traditional concern about overskilling and shown the value of a dataset like HILDA for clarifying such issues. Indeed, their research has taken discussion of that question a major step forward by putting a dollar cost on the inadequate or non-deployment of the skills of the existing workforce, possibly amounting across the full economy to as much as 5% of GDP. While their method is open to dispute on some points, headline findings such as this are important in creating public awareness of the role played by deployment in a time of general concern about skills shortages.

The main respect in which the existing body of research fails to take full advantage of the potential offered by HILDA is that none of it is longitudinal. Indeed, most of it intentionally blocks out any evidence of change over time by pooling the sample over several years. The reasoning behind this decision, presumably, is that the small amount of aggregate change expected within such a short period can safely be traded off against the advantages of maximising the sample size available for inferential analyses and in the process damping out some of the effects of annual variations in the response rate and random variability in the response. Such a tradeoff is entirely defensible, particularly for the early research carried out when there were only two or three waves of data available anyhow, and for the kinds of question these studies address.

However, given that nobody anywhere in the world has previously been able to undertake this kind of research using annually refreshed microdata, it would seem a wasted opportunity not to explore the potential of such data to provide evidence of more fine-grained change than has been detectable from any previous population-level data source in this field. Leaving aside for the present the question of whether the results justify the attempt, this is the main respect in which this thesis distinguishes itself, not only from the other research so far done using HILDA data on skill, but from the UK surveys and the earlier research which helped to define its agenda.

## Chapter 6

### Research questions and methodology

This chapter describes the logic by which relevant aspects of the NSS model set out in Chapter 2 have been converted into a research problem, and how the model of skill set out in Chapter 3 has been used to construct a methodology for analysing this problem using HILDA data. It includes a description and validation of the composite scales used to track the two key dimensions of skill. Finally, it describes the tests that have been applied to the data to check and control for the kinds of bias and error most likely to compromise the reliability of generalisations from the HILDA panel to the full employed population of Australia.

It is important at this point to repeat the clarification in Chapter 1, namely that the empirical work in the following chapters is intended as an introductory demonstration of the value of both the NSS model and the HILDA dataset for resolving policy and research questions related to skill supply and utilisation in Australia, and not as a comprehensive analysis of the current state of the NSS or its development over time. Such a full analysis would require the input of multiple researchers, using multiple research methods and data sources, not all of which are yet available; it certainly lies beyond the scope of a single doctoral thesis. In particular, the current bank of HILDA data is limited in the robustness of the conclusions it can support by the short period of time it covers and the absence of good population-level evidence on how the system behaved before 2001. At best, the present analysis may serve to demonstrate that the concept of a skills trajectory is meaningful, applicable at the level of the full economy, and definable with sufficient precision to permit its delineation on the basis of quantitative evidence. However, many more years' data will be required before that trace achieves its full potential as a guide to policy.

#### 6.1. A research problem

The research objective identified at the end of Chapter 2 was to reach an estimate of the amount of skill exercised across the economy at the point where it is converted to productivity, i.e. at the moment of deployment, and track this measurement over time to map a skills trajectory. Chapter 3 explained how this was best achieved by using data at the level of the individual job, defined as the set of tasks and work arrangements in which an individual worker is employed in an individual work context. This level of measurement captures the full variety which actually exists in the system, since it avoids conflating individual experiences into standardised skill sets or broader occupational or industry categories. By using a metric based on the match between the individual worker's skills and the skills demanded by the job, i.e. the point of intersection between the embodied, embedded and situated aspects of skill, it is possible to capture something very close to the intended object of measurement.

Thus the primary research problem can be redefined as follows:

**Research question 1:** How has the skill content of Australian jobs changed over the years from 2001 to 2006?

**Research question 2:** How has the change, if any, been distributed across industries, occupations and groups within the workforce?

As was pointed out in Chapter 1, it is not part of the present research to investigate regional variations, partly because issues of sample size and representativeness in HILDA make this difficult to achieve accurately in all cases, but mainly because the primary object of interest at this point in the elaboration of the model is the *national* skilling system.

The NSS model provides a broad framework and context enabling the most appropriate issues to be defined, as well as a basis for making sense of the findings. In this sense the empirical section of the thesis is not so much a test of the conceptual model of a skilling system as a first demonstration of how it can be applied and operationalised. To emphasise the practical relevance of the model, two more policy-focused questions are needed to round out the problem set:

**Research question 3:** What has been the contribution to these changes of known factors that affected the Australian labour market over this period, notably globalisation pressures, the emergence of major skill shortages and a level of full employment unprecedented in at least two decades?

**Research question 4:** What policy implications and challenges can be identified in the trends that emerge from this research?

Both these last two questions are difficult to address without data on industry behaviour at least as comprehensive and as representative of the population as those which HILDA provides on employees' experience of their jobs. A conclusive answer to them lies outside the scope of this thesis, though the final chapter will address them to the extent that is possible on the basis of this research. However, this chapter and the three which follow will concentrate on answering the first two questions.

## 6.2. A model of skill growth

The primary object of interest for the present research lies in the degree to which jobs, viewed at various levels of generality, involve the deployment of more or less skill over time. This is the fundamental definition of a skill trajectory as used in this thesis. The generic terms used to denote this object of interest are the *skill content* or *skilfulness* of a job. These terms embrace the three dimensions identified in Chapter 3: substantive complexity, skill-intensity and task discretion. A job which rates highly on any of these dimensions, or any combination of them, is said to be a skilful job. This term is preferred to "a skilled job" because of the latter's conventional association in Australian usage with a specific level in the qualifications hierarchy, i.e. trades-level qualifications gained through a traditional apprenticeship.

The literature on skill trajectories, already discussed in Chapter 5, acknowledges that different kinds of process underlie upward or downward movements in the skill content of jobs across an economy or industry. One set of processes is generic, and affects jobs across the economy, though not necessarily all to the same extent. Such processes can work through expansion, as where skill requirements rise because more workers even in lower-skilled jobs are expected to be able to use ICT, or through attrition, where the lower-skilled functions across an economy are progressively automated or outsourced to other countries.

The second is compositional, involving the addition to an economy of new industries and occupations which supplement or replace existing ones, or the decline of industries or occupations which once represented a high proportion of employment. Like generic change, it has an expansionary component, e.g. where innovation and evolution broaden the range of viable activities in an economy, and a component of attrition where lower-skilled industries decline as a proportion of economic activity because the country can no longer compete on labour costs in an international market.

The model followed in this thesis is based on that of Rumberger (1981) and differs from other versions of the job content/compositional model by assuming three distinct processes:

1. *increases in the skill content of existing jobs*: the jobs currently occupied by individuals change to require more skill, involve more learning and/or allow more task discretion;
2. *more skilful jobs at the industry or occupation level*: existing jobs in an industry, occupation or industry/occupation cell are replaced or supplemented by new ones involving more skill, learning or task discretion;
3. *a shift in the balance of economic activity towards more skill-intensive sectors*: jobs are lost in industries or occupations involving low levels of skill, learning or task discretion and replaced by new ones in higher-skilled industries and occupations.

The reason for splitting compositional change into two components is that each requires a different type of evidence, and the HILDA data lend themselves to this kind of separate analysis. In addition, a three-part model can more effectively capture a gradation, from changes affecting the nature of work in general at one end, through to changes which stem solely from a shifting balance of economic activity and may not imply any underlying change in the nature or organisation of work, even within the industries or occupations which are increasing their representation. It is important to be able to make this kind of discrimination, since in an economy which exhibits growing (or indeed, shrinking) overall requirements for skill, there is a good likelihood that all three processes will be occurring simultaneously to varying extents, and any aggregate growth in skill-intensity will represent the combined impact of all three. Several considerations could cloud the issue of what is happening to skill unless the methodology makes it possible to distinguish the incidence and impacts of each over any period of interest.

First and most obviously, the impact of one process may offset that of another. A compositional shift of investment towards an industry with high average skill-intensity but few exceptionally high-skilled jobs could entail the destruction of some highly skilled jobs in declining industries. Even if the overall level of skill deployed across the economy rises as a result, the implications for workforce flexibility and well-being in such a case will be different from those of a comparable shift in the skill trajectory distributed more evenly across industries. Even at the level of the national economy, the scarce skills which are lost in the displaced industries might represent a loss of national competitive potential in the future, unless the people who hold them are productively redeployed into the growth industries.

Conversely, a change in one process can trigger a complementary movement in the others that might not have occurred otherwise. For example, when new jobs utilising more skill are generated in an industry as the result of some kind of product or process innovation

(process 2), this may entail a complementary rise in the skill demands on older, previously low-skilled jobs in the same industry or its supply chain (process 1) before the full productivity benefits can be achieved. Alternatively, the growth of new industry sectors (process 3) may provide an incentive for existing sectors to increase their skill-intensity (processes 2 and/or 1) as the price of remaining competitive and continuing to attract investment.

In addition, the three processes may take effect over different time-scales, with feedback cycles of widely varying length and different degrees of path-dependence. Virtuous or vicious circles may be triggered in one process (e.g. cascades of investment or worker preference towards new industries perceived as sexy, or the development of costly types of long-cycle training that involve a large element of sunk cost for both the provider and the trainee) which block adjustment in another. Hence, the trend and sustainability of any overall change in the amount of skill exercised may depend on which process dominates at the time in question. This consideration is especially important in periods when the labour market is temporarily dominated by a one-off or cyclical spike in the demand for skilled labour in one sector, since meeting that demand can mean diverting both labour and training effort from other industries and occupations which have a longer learning cycle and might be more economically sustainable in the long term.

Finally, there will be different implications for the *content* of the skills exercised depending on which of the three processes is in operation at a given point in the system. Both process 2 and process 3 are logically associated with the development either of new kinds of skill or of new technical competencies within existing ones, whereas process 1 is more likely to imply a deepening of the existing technical skill content of jobs. However, even where the technical content remains essentially the same, process 1 may still require the workforce to acquire new soft skills: for example, greater control by individuals over their own work demands greater skill in such things as planning, time management and prioritising competing demands, and devolution of decision-making to the work group level depends for its success on the presence of teamworking skills that might not have been expected under a more directive style of work organisation. And even where strictly technical skill is concerned, and remains essentially the same skill, a deepening of the individual's capability beyond a certain point will involve a shift from knowing-what to knowing-how, and subsequently from knowing-how to knowing-why. Given that each of these kinds of skill has its own optimal learning method and/or training requirements, it is important to know which process is driving the change in which areas before determining how either the educational and VET infrastructure or organisational learning practices should best respond to changes in the aggregate skill requirement.

Thus the use of a dataset like HILDA, which contains practically no variables describing the actual competency content of jobs, makes it all the more important to preserve analytical separation between the three processes. Apart from a set of questions in the early waves about types of teaching and nursing qualification, the only two job content-related variables in a set of over 3,000 refer to highly generic soft skills, namely learning (NUSKILLS) and using initiative (Waves 5 and 6 only). While both of these might seem potentially valuable for an analysis of trends in the demand for soft skills, the very high level of positive responses and the virtual absence of significant movement in either between waves make them all but useless for tracking change over this limited period.

These qualifications do not invalidate either the construct of a skills trajectory developed in Chapter 2 or the conclusion in Chapter 3 that a metric combining skill-intensity with task discretion is the most appropriate one so far available in Australia for tracking the state of the national skilling system. The overall growth or decline in the amount of skill exercised in this broader sense remains the best construct with which to answer the question “How is the system travelling?” or “How is it performing?”, and the output it describes is the most directly relevant to the well-being and productivity of the workforce and the overall performance of the economy at a given point in time. At the same time, measurements of this aggregate can have only limited explanatory or predictive power. There is no contradiction here, but rather a distinction between the purposes of tracking, on the one hand, and understanding, predicting or anticipating on the other. The one answers the question “Where is the system at now, and how has it changed?”, the other answers the questions “Why is the system behaving this way, and how is it likely to behave in future?” It is important to keep the two sets of questions analytically separate, since the present research is directed primarily though not exclusively at the former question.

### 6.3. Measuring the three processes

Using the same dataset to investigate three distinct processes can pose problems of methodology. First and foremost, the assumed reliability of the data will vary according to the process which is the subject of an individual analysis. Change in the aggregate indicators which results from variability in the occupational composition of the panel over successive waves must be treated as error when the purpose is to track generic skill change (process 1), but where the objective is to track compositional change (process 3), it constitutes valid and relevant data – subject to the important assumption that these changes in panel composition accurately mirror changes in the occupational composition of the employed workforce as a whole. More generally, the process which is the object of inquiry determines whether it is more appropriate to treat the data as true longitudinal panel data (i.e. following individual members of the panel across waves) or a series of cross-sections.

As a general consideration, panel data permit the identification of two types of change. One is cross-sectional change, where the statistic of interest for the sample, either as a whole or disaggregated according to selected classificatory parameters, changes from wave to wave. Thus for example, aggregate mean scores on a skill-intensity scale may vary from year to year, as may the distribution of each score on the scale across industries and occupations; the probability of an individual reporting a certain score in a given year can be calculated depending on the category to which she belongs, but the data do not directly map individual trajectories. The other is gross change (Kalton, Kasprzyk and McMillen 1989: 264) which occurs at the level of individuals, or groups or cohorts of individuals, from wave to wave; by extrapolating from these individual trajectories it may be possible to arrive at rules or hypotheses predicting the future behaviour or experience of specified categories within the population, even if their actual membership is unknown. Ordinary time-series data sources, which draw a fresh sample for each time period, can only shed light on the former.

For many purposes the two can be treated as more or less interchangeable. For example, the experience or performance of an age cohort over time can be tracked either by selecting those individuals who reached the specified age in the first wave and tracking their individual or group progress across waves, or by taking the set of sample members in each wave who fall within the appropriate age range for that year, and either approach is capable

of producing statistically reliable findings. However, the strength of gross change is that it provides accurate information about flows, e.g. between programs, between employment and unemployment, from casual to permanent employment, or between industries or occupations. It can also be more informative about causal mechanisms, especially those which take effect over several years. Each type is more appropriate for particular types of inferential analyses, and each is vulnerable to different kinds of error. Both types have a role in tracking each of the three processes, but the importance of each varies from one process to the next.

A generic shift in the skill content of work resulting from process 1 will generally be reflected in cross-sectional change at the aggregate level, as a residual once the influence of the changing balance of employment across industries and occupations has been controlled for. Thus it is useful to look first for changes at the aggregate level from wave to wave. Even if the aggregates do not change significantly because the impact of process 1 has been offset by contrary trends in the other two processes, its net contribution can often still be identified by controlling for their impact through regression models.

However, a more sensitive indication of the incidence of process 1 can be achieved, albeit at the cost of some sample loss, by concentrating the analysis on those members of the panel who continued to occupy the same job across waves. Strictly speaking, the purpose in carrying out such an analysis is to track the same jobs rather than the same individuals; the individual identity simply represents the only reliable marker that is available for the identity of the job. Generic changes can be identified by repeated-sample T-tests on those respondents who answered the same question in adjacent waves, or by one-way ANOVA for longer periods, excluding from the analysis those who changed jobs between surveys. (Those who were unemployed or not in the labour force in the previous wave are automatically excluded by the requirement for an answer in both waves, since the questions of primary interest are asked only of respondents who are currently employed.) The results will reveal the extent to which changes in aspects of skill affected jobs already in existence. To the extent that the panel is representative of the employed population, the results of this analysis will be predictive of the experience that an average member of that population can expect in comparable employment circumstances.

For process 2, on the other hand, cross-sectional analyses for each wave will be more informative. The objective here is to determine whether and how the skill profile of each industry or occupation changes from year to year, regardless of who occupies the jobs or whether they are the same jobs as in the previous year. Even if there is substantial turnover between waves among the individuals making up the sample, the results will remain reliable so long as the sample is equally representative in both waves – in effect, so long as the variability in panel composition is random. Strictly speaking, that part of the change in each industry or occupational profile which results from the upgrading of current jobs constitutes noise, or at any rate double-counting if the same analysis is intended to shed light simultaneously on processes 1 and 2. However, some of this confusion can be avoided by concentrating on the movements in the skilfulness of different industries and occupations relative to one another, on the assumption that any growth in the overall skill content of work will be manifested in a rise in the base level of skill across all categories.

Identifying the impacts of process 3, i.e. true compositional change, strictly requires the reverse of the approach taken for process 1. Theoretically, the most valuable informants in a longitudinal sense are those respondents who have changed jobs at some time over the six

waves, moving to a different occupation and/or industry, and have experienced a change in the skill demands of their jobs as a result. However, the size of the HILDA sample offers little potential for tracking these cases at any useful level of disaggregation. Cross-sectional analysis can still provide part of the picture so long as it is possible to link any changes in the overall indicators of skill-intensity to changes in the industry/occupational profile of the sample – assuming, once again, that the latter accurately mirror changes in that of the workforce.

As a first step towards carrying out longitudinal analyses of gross change, and to simplify the specification of cross-sectional analyses which need to be carried out over multiple waves, a short longitudinal file was created using the SPSS MERGE FILES procedure. Source files for this procedure were the short working files constructed for each wave, which retained only between 85 and 135 relevant variables from the responding persons (Rperson) file for the corresponding wave. These single-wave working files were merged with a master file for all waves supplied as part of the Wave 6 data release, with individual respondent records sorted and matched on the cross-wave identifier which is included among the unit record variables for each wave. This operation was based on the syntax set out at page 25 of the 2008 HILDA Manual for creating an unbalanced wide longitudinal file. The resulting file contains the relevant variables for each year in which the respondent was interviewed, or returned the SCQ, depending on the variable. The order in which variables are entered consists of the full set of selected variables for each year, followed by the full set for the next. Responses on an individual variable in different years can be distinguished by the unique identifying character for each wave which begins the variable title.

The resulting file was then checked for accuracy of cross-wave respondent match by drawing a small random sample of respondents and visually comparing their recorded responses over all waves on two variables, Sex (`_hgsex`) and Age at last birthday before the date of interview (`_hhiage`). This check was backed up by taking two subsets of Wave 1 respondents, those who gave their sex in that year as male and those who gave their age as 25, and running frequency counts on their response to the same question in each subsequent year. All cases matched perfectly across all waves on Sex, while the mean age advanced by 1 year for each successive wave with a range not exceeding 0.2 years, a variance which is explainable by differences in the time of year at which the respondent was interviewed in adjacent waves.

#### **6.4. Construction of composite scales for the two dimensions**

The next important prerequisite to addressing the research questions is to combine the variables into scales which can be used for tracking the two core constructs of skill-intensity and task discretion identified in Chapter 3. A scale which has been tested for reliability, and which accurately reflects the associations which the respondents have perceived between variables, creates greater confidence that the raw variables, each representing a single aspect of a broader construct, have been combined optimally to capture as much as possible of the variation in the underlying construct. Composite scales with a large number of points enable overall changes, even small ones, to be followed much more sensitively than is possible using the 7-point scales for the individual variables (especially considering that the latter are strictly speaking ordinal rather than interval data). They can also serve as continuous variables suitable for use in linear regressions and other types of analysis which require a dependent variable of this type. A further and important

advantage of such composite scales is that the scores should be more normally distributed than those for individual variables, some of which are highly skewed. This has been tested and found to be the case for those developed in this section.

However, it should be understood that the scales developed in this section, despite their generally good performance in the conventional tests on both criteria, are still relatively crude and as such probably better suited for exploratory than confirmatory analyses. As already noted in Chapter 4, there is nothing in the HILDA documentation to indicate that the variables of interest were ever designed to be combined into scales, let alone in what combinations or what constructs they should measure. These matters have had to be worked out *post factum*, on the combined basis of the theoretical model on which the research is founded and the associations between variables that appear to be recognised by the respondents themselves. Had the variables been consciously designed to come together into meaningful scales, it is likely that far more variables would have been included for each construct, since it is most unusual to have a deliberately designed scale consisting of only three items, as is the case for the two primary scales which are developed here to track the key dimensions over the first four waves. Such a small number of items is virtually certain to omit important facets of the construct. These gaps in coverage are most likely exacerbated by the ambiguities and other weaknesses in the individual questions which have been discussed in Chapter 4.

For the limited purposes which the quantitative analyses in this thesis are meant to serve – specifically, to demonstrate that the concept of a skill trajectory is informative and can be operationalised through quantitative measurement using the kinds of hard data available in HILDA – such deficiencies can be tolerated. However, serious research into the latent traits reflected by the variables and the construction of appropriate measures on which to track them would almost certainly benefit from the use of more sophisticated and sensitive methods based on the insights of item response theory (IRT) (Baker 2001). Bayley (2001:16) lists ten criteria on which a scale constructed according the principles of IRT is likely to perform better than one based on the assumptions of classical test theory, as used in this chapter and most social science research. Among the most important advantages of this approach is that it sets out to calculate how much of a given individual's score on a given item is attributable to the respondent's "ability" (i.e. true intensity of preference or opinion) and how much to the "difficulty" of the question concerned, i.e. what score is needed to indicate a given level of preference. This is especially useful for scales made up of items of which some have highly skewed distributions, as is the case here. One technique specifically recommended for follow-up investigation is the Rasch unfolding model (Andrich 1988), which requires special software not available for the present research. The application of this kind of model should be especially useful in any study undertaken with a view to expanding and refining the relevant set of questions in the survey instrument.

#### **6.4.1. Preliminary analyses**

As a first step, principal component analysis (PCA) was applied to the responses in each wave on the full sequence of variables relating to perceived qualitative job characteristics in which the key variables for this research occur, in order to identify meaningful clusters (factors) which might suggest that respondents saw the variables in each factor as representing a common construct.

The full sequence for Waves 1-4 contains twelve variables (labels added for the purpose of this research):

- My job is more stressful than I had ever imagined (STRESSFUL)
- I fear the amount of stress in my job will make me physically ill (SICKSTRESS)
- I get paid fairly for the things I do in my job (FAIRPAY)
- I have a secure future in my job (SECURE)
- The company I work for will still be in business five years from now (FIVEYEAR)
- I worry about the future of my job (FUTURE)
- My job is complex and difficult (COMPLEX)
- My job often requires me to learn new skills (NUSKILLS)
- I use many of my skills and abilities in my current job (USESKILL)
- I have a lot of freedom to decide how I do my own work (OWNTASK)
- I have a lot of say about what happens on my job (HAVESAY)
- I have a lot of freedom to decide when I do my work (WORKFLOW).

In the rotated solution, using direct Oblimin rotation with Kaiser normalisation, these variables load clearly and consistently across all four waves on four factors, though in Waves 3 and 4 only three of the four show Eigenvalues exceeding 1. Each factor has an intuitively obvious theme. They are listed below by theme, in descending order of the proportion of total variance explained by each, followed by the labels of the variables which load most strongly on each. (Those variables marked with an asterisk load negatively against the others in the same factor.)

1. Task discretion (WORKFLOW, HAVESAY, OWNTASK)
2. Job stress (STRESSFUL, SICKSTRESS, FAIRPAY\*)
3. Job security (SECURE, FIVEYEAR, FUTURE\*)
4. Skill-intensity (NUSKILLS, USESKILL, COMPLEX).

The factors account respectively for around 24%, 21%, 13% and 8% of the total variance. Individual item loadings are generally above .7, with most showing a highly acceptable loading above .8. The exception is COMPLEX, which loads around or just over .6 in a four-factor solution across all four waves and also loads moderately (a little over .4) on the job stress factor.

Two points of particular interest emerge from this first analysis. One is the prominence of task discretion as a criterion on which workers discriminate between the qualitative aspects of their jobs. This could be partly a reflection of a higher actual range of variation (the relevant variables have the largest standard deviations of all those in the sequence, all exceeding 2 on a 7-point scale) but may also imply greater salience. The second is how small a part is played by skill-intensity. In Waves 3 and 4, if the extraction is confined to factors with an Eigenvalue exceeding 1 as is normal practice, the skill-intensity variables load on to the job stress factor, with USESKILL loading only moderately (.505) on to this factor and weakly but significantly (>.3) on the other two in Wave 4. Taken together, these findings suggest initially that the common construct represented by these three variables may be rather less evident to the respondents than it is to the analyst, and hence that some risk exists of perceptions of skill-intensity being influenced by other aspects of the job experience.

In Waves 5 and 6 a further nine variables have been added to the sequence:

- I have a lot of choice in deciding what I do at work (WHATDO)
- My working times can be flexible (FLEXTIME)
- I can decide when to take a break (TAKEBREAK)
- My job requires me to do the same things over and over again (REPETITIVE)
- My job provides me with a variety of interesting things to do (VARIETY)
- My job requires me to take initiative (INITIATE)
- I have to work very fast in my job (WORKFAST)
- I have to work very intensely in my job (INTENSE)
- I don't have enough time to do everything in my job (NOTIME).

This larger set of variables produces five factors with an Eigenvalue exceeding 1:

1. Task discretion (WORKFLOW, WHATDO, TAKEBREAK, FLEXTIME, OWNTASK, HAVESAY)
2. Job stress (SICKSTRESS, STRESSFUL, NOTIME, COMPLEX)
3. Job security (SECURE, FIVEYEAR, FUTURE\*)
4. Skill-intensity (VARIETY, REPETITIVE\*, NUSKILLS, USESKILL, INITIATE, COMPLEX)
5. Work-intensification (WORKFAST, INTENSE, REPETITIVE, NOTIME).

Note that in this analysis three variables, COMPLEX, NOTIME and REPETITIVE, have each been attached to two factors because their loadings on both factors were roughly equal. FAIRPAY drops out of the results because its loading in Wave 5 fell below .3, though it rises again to -.417 against the job stress factor in Wave 6. Its suitability for inclusion in this factor analysis is questionable in any case, since its communality value in all waves lies around or below .3.

The results confirm the primacy of task discretion as a dimension on which workers distinguish between jobs. Its contribution to variance remains virtually unchanged from earlier years, at 24.3% in Wave 5 and 24.0% in Wave 6. Closer inspection of the loadings on this factor indicates that they are strongest for those variables that refer to individual autonomy and to control over work timing. In this context the emergence of a fifth factor, again relating to control over the use of time and clearly distinguished by respondents from the other aspects of job stress, appears especially interesting. The relatively small importance of skill-intensity to overall variation is even clearer, with its contribution to total variance falling to 6.4% and 6.3% in the two years. COMPLEX now appears even more conceptually ambiguous than before, since it loads more strongly on the job stress factor than the skill-intensity factor (.487 as against -.463) in Wave 5, and moderately on both factors (.466 and -.501 respectively) in Wave 6. On the other hand, the analysis lends support to the accepted wisdom in the deskilling literature that workers associate repetitive work with a low-skilled job and variety with a skilful one. Another interesting implication of these results is that HILDA respondents appear to view the need to use initiative as an aspect of skill-intensity rather than of task discretion.

The overall conclusion from this broadly-based analysis is that the sequence of relevant indicators in HILDA is less potentially enlightening on skill-intensity than it might prove to be when applied to other aspects of job quality. Nevertheless it confirms that respondents see the three main component variables which were identified in Chapter 4 with skill-

intensity as making up a single construct which they are generally able to distinguish from the other constructs inherent in the broad variable set. Some reservations must be expressed about COMPLEX in this regard, especially given that it appears designed to capture a different construct, substantive complexity. However, the alternative explanation, that it loads ambiguously because it is seen as attaching to multiple constructs, fits this evidence at least as well. In any event, there is a pragmatic necessity to include some indicator of the difficulty (“stretch”) component in any scale that adequately covers the skill-intensity dimension as it has been defined in Chapter 3, and the communality values recorded for COMPLEX ( $>.6$  in all the analyses undertaken) suggest that it is at least sufficiently adequate for the purpose to warrant the trouble of testing its contribution to the reliability of such a scale.

On the other hand, all the factor analyses undertaken on both the initial and the extended full sequences strongly confirm both the validity of task discretion as a single construct and the importance of its contribution to understanding of the way jobs are perceived by those who work in them. To the extent that task discretion can be taken as a proxy (however indirect) for substantive complexity, it arguably contributes more to understanding of the overall skilfulness of jobs than does the skill-intensity dimension, at least as measured by HILDA. The new and previously unremarked finding from the PCA is the relative importance of those variables that relate to the control a worker has over the timing of her tasks.

This second preliminary factor analysis thus demonstrates that composite scales can be used to capture the two main constructs of skill-intensity and task discretion with reasonable confidence (especially in the latter case) that the scores on each will not be systematically distorted by the influence of theoretically unrelated factors. This is an important confirmation of the central premise, arising out of Chapters 3 and 4, that HILDA provides the basis for a methodologically defensible pair of indicators which can be used to track two of the key dimensions of skill.

The next step was to undertake more targeted factor analyses, using a smaller range of variables which bear a strong theoretical relation to one another, with a view to developing such scales and testing their reliability. Two scales were developed for each major construct, one applicable to all waves and one using the expanded set of indicators available from Wave 5 onwards. In addition to these core scales, the expanded variable set provided the opportunity to experiment with a supplementary set of more focused scales designed to investigate issues of specific theoretical significance.

#### **6.4.2. The all-wave scales**

So far as the all-wave scales are concerned, there appears to be no practical alternative to the obvious arrangement: COMPLEX, NUSKILLS and USESKILL in the first scale for skill-intensity, OWNTASK, HAVESAY and WORKFLOW in the second for task discretion. As noted above, it is extremely uncommon for a purpose-designed scale to be constructed from only three questions, and it is difficult to see what value would be added to the original variables by a scale made up of only two. Nevertheless, PCA was carried out on the full set of six variables to test the validity of this operation. In all years the six variables fell clearly into two factors, each with an Eigenvalue exceeding 1, and with the two factors jointly accounting for 70% of the total variance. The variables all loaded as expected, and of the two factors, that corresponding to task discretion consistently explained the higher proportion of the variance, ranging from 44.85% in Wave 1 to a

minimum of 43.13% in Wave 3. This analysis confirms that the two constructs were clearly distinguished by respondents and recognised by them in the same general sense as the terms are defined in this thesis.

Of the two resulting scales, that for task discretion also showed the better Cronbach's alphas, ranging from .807 in Wave 2 to .827 in Wave 6, with a mean inter-item correlation ranging from .588 in Wave 2 up to .622 in Wave 4. These figures are exceptionally good for a three-item scale, comparing very favourably with the .63 obtained by Jonsson for an autonomy scale and .74 for a more directly comparable codetermination/job control scale (Jonsson 1998: 629, 631) and giving reason for strong confidence in its reliability. However, it should be noted that WORKFLOW contributed negatively to the reliability of this scale in all waves, as its deletion would have increased Cronbach's alpha by between .007 and .016.

The results for skill-intensity were somewhat less satisfactory, with Cronbach's alpha ranging from .701 in Waves 2 and 3 to .727 in Wave 5. Such a figure would be considered marginal for a scale of normal size, but can be treated as acceptable for one comprising so few items, and also compares more than favourably with the .64 achieved for Jonsson's broadly comparable "human capital growth" score (1998: 631). Mean inter-item correlations ranged from .440 to .471, the weakest single correlation (down as far as .355) being that between COMPLEX and USESKILL. All items contributed positively to the reliability of the scale, the weakest being USESKILL.

No clear overall trend emerges across the six waves affecting the reliability of either scale, except for the drop in Cronbach's alpha which was evident for both scales between Waves 1 and 2. This drop parallels other unexplained discrepancies between the mean item scores for these two waves, suggesting that at least part of the differences could be an artefact either of non-response or of panel conditioning. The next section of this chapter describes the procedures followed in an attempt to tease out these possible sources of bias. It should also be noted that the reliability of the skill-intensity scale rose sharply between Waves 4 and 5, suggesting the possibility of a response effect resulting from the addition of new variables covering the same construct. No such change is evident in the task discretion scale.

#### **6.4.3. The extended scales**

As a preliminary to developing extended scales for both constructs from the expanded variable set in Waves 5 and 6, a targeted PCA was carried out using the variables COMPLEX, NUSKILLS, USESKILL, OWNTASK, HAVESAY, WORKFLOW, WHATDO, FLEXTIME, TAKEBREAK, VARIETY, REPETITIVE and INITIATE which had loaded most strongly on the relevant factors in the broader-based analysis. Two factors emerged with Eigenvalues exceeding 1, but the proportion of total variance explained by these two factors was lower than in the case of the analysis carried out on the core all-wave variables, at 58.24% in Wave 5 and 57.86% in Wave 6. In the rotated solution, the variables loaded as expected, with OWNTASK, HAVESAY, WORKFLOW, WHATDO, FLEXTIME and TAKEBREAK loading on the first factor, explaining 39.6% of the variance in Wave 5 and 39.2% in Wave 6, while COMPLEX, NUSKILLS, USESKILL, VARIETY, REPETITIVE and INITIATE loaded on the second, explaining 18.6% and 18.7% of the variance respectively. REPETITIVE achieved only a moderate loading of .45 in both waves, and its communality value was low at .207 in Wave 5 and .221 in Wave 6;

these figures were unchanged (except obviously for a change of sign on the loadings) when the variable was reverse-scored.

Based on this analysis, the extended skill-intensity scale contains five variables: COMPLEX, NUSKILLS, USESKILL, VARIETY and INITIATE. Cronbach's alpha for this scale was .805 in Wave 5 and .795 in Wave 6, both significantly stronger than for the all-waves scale. Reliability analysis confirmed the impression from the PCA that REPETITIVE, even when reverse-scored, does not contribute sufficiently to the scale to be worth including, as its lowest inter-item correlation was unacceptable at .205 and its inclusion would have reduced Cronbach's alpha to .787 and .782 in the respective years. Of the remaining variables, the strongest contribution is made by USESKILL and the weakest by COMPLEX.

The task discretion scale contains six variables: OWNTASK, HAVESAY, WORKFLOW, WHATDO, FLEXTIME and TAKEBREAK. Cronbach's alpha is .879 and .880 in the two years, again indicating a very robust scale. While it would have been desirable to keep the same number of points on both extended scales for the sake of comparing scores on the two, there is no clear theoretical argument for excluding either FLEXTIME or TAKEBREAK, though removing the former would have had only a minimal effect on reliability, reducing Cronbach's alpha by .003.

These extended scales have respectively 35 and 42 points, meaning that they are much better able than the all-wave scales to pick up small changes in the levels of the underlying constructs. On the evidence available from these analyses, there appears to be no compelling argument for basing the scales on anything other than simple summed scores, as is normal practice for a-priori scale construction. Using standardised variables would have improved Cronbach's alpha by at best .004, in the case of those scales which show the strongest reliability anyhow, and by .002 or less in most cases. Weighting the items on the basis of their median scores over the first six waves would imply an assumption that those relativities will remain unchanged over a longer period, and hence could distort the results in future years if the same scales continue to be used. The element of relative change can be captured in any case by tracking index or percentage change in each variable from wave to wave, using the Wave 1 mean as the baseline.

While it was argued in Chapter 3 that the relationship between the constituent variables is different for the two constructs – cumulative for skill-intensity, complementary for task discretion – summing the scores remains the most appropriate means of capturing the net outcome of either relationship. Considering the complications that would be involved in constructing balanced scales and the weaknesses which have already been identified in the individual variables, the effort would almost certainly be better spent in constructing a different and more sophisticated type of model such as the Rasch unfolding model that was suggested earlier.

However, it is important to bear in mind that a change in the overall reading on either score may have different implications depending on the composition of the change. For example, a rise of 1 in the mean score for WORKFLOW (median 3 over the first six waves) would clearly imply a more radical shift than the same increase in the mean score for OWNTASK (median 5), but each would have the same impact on the overall mean for the task discretion scale. This makes it important to follow up any observation of a sustained trend in the scales with a more detailed examination of how the scores on the constituent

variables have changed. One way of achieving this, while still addressing a broader construct than individual variables, is to develop separate subscales which capture more specific constructs.

#### **6.4.4. The subscales**

The wider range of relevant variables offered from Wave 5 onwards opens up the possibility of more specialised scales that can be used to track specific aspects of the key dimensions of interest. Three such subscales within the task discretion dimension have been examined and found to be viable, at least for the purpose of exploratory analysis.

##### **6.4.4.1. Time control**

With a view to further investigating the high loadings recorded by timing-related variables in the analysis of the full expanded sequence that has been described in 6.5.1 above, a three-factor solution was tried on the set of variables used to construct the extended scales (i.e. excluding REPETITIVE). The results of the rotation show a very different picture from that revealed by the original two-factor solution. The most important factor, accounting for 42.4% of the variance in Wave 5 and 41.8% in Wave 6, was made up of the three variables FLEXTIME, WORKFLOW and TAKEBREAK, with WHATDO also loading more moderately (.512 and .492) on the same component. The second component, explaining an additional 19.8%, is made up of NUSKILLS and COMPLEX. USESKILL loads only weakly on this second factor (.353 in Wave 5 and .401 in Wave 6), but more strongly on the third factor, which also includes HAVESAY, OWNTASK, VARIETY and INITIATIVE and accounts for another 7.2/7.3% of the variance. WHATDO loads more or less equally on the first and third factors.

Although not as clean as the previously described analyses, this result suggests strongly that respondents see a sufficiently clear distinction between the control they have over the organisation of their working time and the other aspects of task discretion to make it worth developing a special subscale which can be used to track this construct in isolation. This scale is made up of WORKFLOW, FLEXTIME and TAKEBREAK, and achieves a Cronbach's alpha of .799 in both waves. While this figure is entirely acceptable for a 3-item scale, the scale itself should be used with caution, given that none of the constituent variables adequately captures the important sub-dimension of control over the sequence of tasks.

##### **6.4.4.2. Autonomy**

A second sub-dimension of task discretion which has particular relevance to the literature is the personal control exercised by the individual worker over her work. This aspect of skill is central to much of the deskilling debate since Braverman and deserves logically to be studied separately from that element of task discretion which is exercised in some way collectively, e.g. through consultation or group decision-making. It must be emphasised that this scale and the one which follows are not derived from factor analysis, i.e. respondents do not appear to see their constituent variables as making up a unitary construct. The reason for developing them is rather that they serve an analytical need and correspond to meaningful constructs in the theoretical model that underlies the research.

The autonomy scale embodies the three similarly worded variables which directly address the issue of individual control, OWNTASK, WORKFLOW and WHATDO. Once again

the Cronbach's alpha in both waves is high for a 3-item scale at .866 and .839, indicating a scale that can be used with reasonable confidence.

#### **6.4.4.3. Job content control**

The third subscale complements the time control scale by focusing on those aspects of task discretion that concern the content rather than the timing or sequencing of tasks. It also contrasts with the autonomy scale by including the element of task discretion that is achievable even where the nature or circumstances of the job rule out high levels of individual autonomy. The scale consists of OWNTASK, HAVESAY and WHATDO, and shows a Cronbach's alpha of .866 in Wave 5, rising to .899 in Wave 6.

### **6.5. Sources of bias and artefacts**

The small size of the effects which emerge from the limited run of HILDA data so far available for analysis makes it essential to eliminate possible error arising out of artefacts in the response before any confident generalisation can be made about changes affecting the full population. While panel surveys can be regarded as more reliable in some respects than a normal time-series data collection in which a fresh sample is drawn for each wave, they create their own special set of risks which need to be anticipated and, so far as feasible, controlled for. This section elaborates on these sources of error, providing a context and justification for the tests which will be applied in the next three chapters in an attempt to isolate and control for them.

The strongest practical reason for applying such checks is that the two most statistically significant wave-on-wave changes in the mean scores on the core skill-related variables, those occurring between Waves 1 and 2 and between Waves 4 and 5, have no obvious explanation and do not appear to represent part of a sustained trend within the period for which data are available. This issue will be examined in detail in the next chapter. The fact that both sets of changes affect all the variables of interest, in the same direction albeit to widely varying extents, suggests a strong possibility that they represent a real change in the experience of the average member of the employed workforce for which an explanation will eventually be found. However, a number of circumstantial considerations, notably the fact that they occur in the two years with the highest proportion of missing SCQs, make it necessary to take seriously the possibility that some or all of the apparent change in each may be an artefact.

One important category of threats to the reliability of inference results from a sample whose composition does not match that of the population. It was noted in Chapter 4 that the original HILDA sample is imperfectly representative of the distribution by industry and occupation of the full employed population as revealed by the 2001 Census, and remains unrepresentative in the next census year, 2006. This error stems partly from the design of the original sample, and partly from the differential effects of sample attrition. The two sources of error interact in ways that are not easily identified. These unknown interactions imply that the standard weights supplied with the data in each of the later waves to adjust for the known pattern of attrition would not necessarily result in a more accurately representative sample for present purposes, since the model used to generate them includes several of the demographic parameters which appear to be partly responsible for the unbalanced representation of employment in the original sample. In the interests of

transparency and simplicity in this initial phase of the research, therefore, unweighted data have been used for the analyses in this thesis, though future research will need to examine the possibilities for applying different weights.

One obvious way of weighting the data for the purposes of labour market analysis would be to rebalance the sample in each wave to mirror the industry/occupational composition of the ABS Labour Force sample in the quarter closest to the HILDA survey period. Given the small amount of year-on-year change evident so far in the relevant HILDA results, it is not clear whether such an exercise would produce sufficient gains in accuracy to justify the added complication while so few waves of data are available for analysis. However, a more accurate if less frequent rebalancing can be carried out by using the Census data for the two years which fortuitously mark the beginning and end years of the run of data available for this research. Such an approach has the obvious disadvantage of restricting detailed analyses of change to the full period between Waves 1 and 6. Despite this limitation, an initial analysis along these lines offers a simple means of calculating the magnitude, and indeed the direction, of the apparent error in the findings of interest which is attributable to sampling factors. This analysis will be carried out in Chapter 9.

A less easily estimated source of sampling-related error is differential non-response across waves, which vitiates the central assumption in panel data that the composition of the sample remains unaltered from wave to wave. Non-response, as indicated in Chapter 4, is a significant problem with HILDA and will be addressed briefly in this section because of the way it interacts with, and can sometimes be confused with, the effects of panel conditioning. However, the main focus on identifying its impact will be left to Chapter 7, where it will be treated as one of the most important considerations in assessing the reliability of those indications of aggregate change which appear in the raw data.

This leaves a range of non-sampling biases to be taken into account. Kalton, Kasprzyk and McMillen (1989: 265) point out that estimates of gross change are highly sensitive to measurement error, which can easily result in spurious changes to individuals' results from wave to wave. They list eleven main sources of non-sampling-related error that were commonly encountered in panel surveys at the time they were writing:

1. random variability in individual scores (response instability), e.g. because of the influence of the respondent's mood at the time of survey;
2. change of respondents where one member of the household responds for the entire household;
3. changes in the mode of data collection;
4. changes of interviewer;
5. response effects resulting from changes in the questionnaire;
6. changes in respondents' interpretation of the meaning of individual questions;
7. panel conditioning;
8. change in the identity or practices of coders;
9. inaccurate imputation for item non-responses;
10. errors in matching individuals across waves;
11. errors in keying in the data.

As a meticulously designed and administered survey with well documented quality control procedures, HILDA is unlikely to suffer from most of these deficiencies. Where those procedures fail, user feedback (including the experience of the survey team, who are

themselves among the most active users of the data) is generally effective in correcting technical deficiencies in data entry or coding, as evidenced by the errata for past waves that are listed and for the most part corrected retrospectively in each new release. The second listed source of error is not applicable to the questions of interest to this research because they all involve individuals reporting only on their own behalf. Except for a slight increase over time in the incidence of telephone interviews (Wooden and Watson 2007: 212), the method of data collection did not change before Wave 8, and the fourth source of error is minimised by the careful training and monitoring of interviewers. Changes in the usage and meaning of words are unlikely to influence the findings over only six years, though this risk will need to be provided against as the survey moves into its second decade. The ninth risk is ruled out because variables selected for these analyses involve raw data without any imputation, and missing data have been excluded from the analyses; except where otherwise indicated, this has been done on a pairwise basis.

Thus only the first, fifth, seventh and tenth of these sources of error need to be either evaluated or eliminated. The checks undertaken to ensure consistent cross-wave matching have already been described. This leaves the issues of panel conditioning, random variation and the impact of changes in the questionnaire to be resolved.

### **6.5.1. Response instability**

Randomness is a threat to validity in panel surveys primarily because it can lead to inconsistency in the way respondents score the same level of agreement or preference in different waves. Respondents are generally not experts at this kind of assessment, and with no guidelines on how to score their level of agreement, it is only to be expected that the scores they give may vary randomly over time, independently of any change in their actual level of agreement. In particular, the choice between adjacent points on the scale may be arbitrary in a great many cases, and the more points there are on a response scale, the more arbitrary the choice between adjacent ratings is likely to be. Thus the distinction between 6 and 7 on a ten-point scale is likely to be less clear-cut in the respondent's mind than that between 3 and 4 on a five-point scale. This risk is stronger for the type of response scale used in HILDA where the individual response points are not verbally anchored. It has been shown in section 5.3 how this last factor contributes to uncertainties about the comparability between the HILDA and WERS scales for the same underlying construct.

This means that for a given level of agreement on a given question, the same respondent could well give a different score if surveyed an hour later, never mind a year later. Ordinary inferential techniques are designed precisely to filter out this kind of random error, and as a general rule will be relied on to do so in this thesis. However, given that year-to-year variation in the aggregate mean for all the key variables is quite low (mostly within a quarter of a point on the scale), it needs to be borne in mind when approaching the descriptive statistics that any unexplained change in a single year is as likely to be the result of chance as of any more systematic error, or of real change in the average level of agreement.

A panel, assuming its composition in successive waves is not too severely affected by attrition or non-response, will arguably suffer less in this regard than fresh samples because of a common expectation that members will grow better at estimating that score that reflects their true intensity of agreement as a result of practice from answering multiple runs of the same questionnaire. This is one of the more beneficial alleged aspects of panel

conditioning, and will be discussed further under that heading below. To the extent that such a learning effect exists, however, it detracts from confidence about the reliability of any inference drawn from changes which appear in the statistics of interest in the early waves, between earlier and later waves, or between the first and subsequent waves, depending on how long the effect takes to manifest itself.

In general it has been assumed in the chapters which follow that the standard techniques for calculating the statistical significance of changes between runs of a survey, which have been designed to meet the more rigorous challenge of independently drawn samples with few or possibly no members in common, will be sufficient to account for this source of error in a well-administered panel. As a general safeguard, changes are not regarded as genuine for the purposes of this study unless they reach a 99% level of significance.

However, in a few instances where a conservative estimate has been preferred in the interests of minimising the risk of Type 2 errors, this has been achieved by binning the relevant variables, i.e. effectively converting the seven-point scale into a three-point one: “definitely disagree” (1,2) “neutral or marginal” (3-5) and “definitely agree” (6,7). This procedure reflects an intuitively logical expectation that random fluctuations are more likely to occur between the three central points on the scale than between the more extreme scores, though without specific follow-up research there is no way of demonstrating whether this hypothesis actually holds good for the HILDA panel. Binning the individual variables in this way undoubtedly results in the loss of much valid and useful information, and restricts the sensitivity of the findings to small but real changes in the construct of interest, but may nevertheless provide a useful safeguard against rash inference, especially in cases where it is important to take account of the fact that these Likert scores are strictly speaking ordinal and not interval data.

Conversely, the same procedure has not been applied to the composite scales, because the whole purpose of these is to provide a continuous interval variable for use in analyses which require this type of data. Pooling the scores from multiple variables into a larger scale may also be seen as helping to damp down the net impact of random variations in individual respondents' scoring of individual variables, in much the same way as a pooled sample, because of the greater likelihood that randomly distributed errors will cancel one another out when the scores are summed.

### **6.5.2. Questionnaire effects**

Biases resulting from the wording or arrangement of questions differ from response bias in being directly attributable to the survey design. They create a risk of unreliable data even if respondents react rationally (i.e. in the way envisaged by the survey designers) to the questions they are asked. The only real remedy to such biases lies in redesigning the questionnaire. However, they need to be considered in the present context as part of the spectrum of data quality issues that must be taken into account before accepting any counter-intuitive or otherwise unexplained findings.

The important questionnaire effects in the relevant part of HILDA have already been covered in the evaluation of the individual variables in 4.2. To recapitulate, the two most important weaknesses in the questions as asked are the practice of including qualifying adjectives like “many” or “a lot of” which effectively ask the respondent to rate her own perceptions against some presumed norm or average, and that of asking about two different

things in the same question. The latter has already been discussed with regard to COMPLEX, but it is also visible in the two questions on job stress which each cover not just the issue of whether the job is stressful, but a different issue besides: respectively, whether the level of stress was anticipated, and whether the stress has affected the respondent's subjectively perceived physical health. Because of this failing, neither question is able to provide clean and unequivocal data on the central issue of how stressful the job is, and the need to satisfy both requirements of the question in order to give a positive response means that both items almost certainly under-report the true incidence of job stress among the sample.

Another possible kind of questionnaire effect involves grouping and sequencing biases, where the context and order in which questions are presented induces respondents to answer a given question differently from the way they would have if presented with it in isolation. This occurs because a respondent assesses the individual question against others in the same set rather than reaching an opinion on it in its own right. For example, if there is a long sequence of questions on which most respondents have positive opinions, and a question appears somewhere in the middle to which many respondents' normal reaction would be negative, the sequence effect may lead them automatically to provide a positive answer to that one. For a more complex hypothetical illustration, suppose the two questions on job stress had been preceded by one worded simply "My job is stressful". Had this happened, it is likely the scores on the existing two questions would have been even lower than they are, because respondents would not have needed to resort to them as their only option for conveying the message that their job was stressful. But conversely, the hypothetical introductory question, by coming right before two very strongly worded ones, might well have resulted in over-reporting of stress simply because the question would have looked "easy" in that context.

There is little reason to suspect such effects from the key sequence of questions in the SCQ, and the combined HILDA questionnaire in general shows signs of having been consciously designed to avoid them by rotating frequently between blocks of questions on clearly unrelated topics. Frequency counts of the responses to each question in the full sequence containing the skill-related variables show no evidence of such bias, as high-scoring and low-scoring items follow one another across all six waves in no detectable pattern. However, the results of the first few waves from 5 onwards will require some scrutiny to check whether the longer sequence of obviously skill-related questions is producing any such effects.

Other kinds of artefact can arise from respondents' reactions to changes in the questionnaire from one wave to the next. For the most part, questions once added to the HILDA questionnaire remain unchanged in format, wording and position in the sequence in which they occur in subsequent waves. Thus the only real risk of response artefacts caused by changes in the questionnaire occurs when new questions are added to an existing sequence. This was the case for the sequence of particular interest to this research when nine new variables were added in Wave 5.

A possible contributory factor to the otherwise unexplained jump in scores on most skill-related variables between Waves 4 and 5 is that the need to answer a new set of related questions may have focused respondents' attention more closely on the issues, though the precise mechanism underlying this effect – i.e. why it led specifically to a rise in scores on the pre-existing variables – is unclear. A more theoretically grounded possibility is that

having a wider range of complementary questions encouraged respondents to concentrate more closely on the specific implications of each variable, whereas previously they may have needed to use each of the original ones as a nearest-fit opportunity to express an opinion on some aspect of their workplace experience which was not directly relevant to the subject of the question. This should logically result in a greater consistency of responses across the items in a scale. Such an effect was in fact apparent for the skill-intensity scale, with Cronbach's alpha rising sharply in Wave 5 to .727, its best figure in any wave. The same sudden rise did not occur for task discretion, but the alpha for this scale in Wave 6 was the highest so far recorded.

On this evidence alone it is difficult to conclude with any certainty that this effect is genuine. Sturgis, Allum and Brunton-Smith (2009) found evidence for a similar effect in four scales in the British Household Panel Survey, but theorise it as an aspect of panel conditioning, whereas here it appears to have eventuated as a result of changes to the questionnaire, but cannot be convincingly linked to time in sample. In any case it is impossible, on the evidence currently available, to disentangle such an effect, if it existed, from the impact of the unusually high rate of SCQ non-response in that year.

### **6.5.3. Panel conditioning**

Kalton, Kasprzyk and McMillen define panel conditioning as “a change in response that occurs because the respondent has had one or more prior interviews” (1989: 254). Waterton and Lievesley offer a more comprehensive definition: “the phenomenon whereby the very act of being interviewed changes attitudes or behaviour or – more likely – changes the *reporting* of attitudes or behaviour” (1989: 320, emphasis in original). They list four alternative terms: panel bias, reinterview effects, time-in-sample bias and rotation group bias. Van Zouwen and van Tilburg (2001: 36) describe the phenomenon as reactivity, and list other synonyms including repeated measurement effect, interview effect and panel effect.

Panel conditioning is an issue which has not yet been raised in any of the technical literature on HILDA or in any of the known studies that use the dataset. It is relevant to the present study primarily because of the major discrepancy already mentioned in the findings on the six core variables between Waves 1 and 2. While the possibility cannot be ruled out that it reflects a genuine shift in opinion, the size of the change between these two waves is far greater than between any other pair of years, and on all these variables it exceeds the total movement in mean scores over the full six waves. This raises a strong possibility that there was some systematic change in respondent behaviour which must be controlled for before any conclusions can confidently be drawn from the change in mean scores.

Panel conditioning has been a concern with a number of overseas surveys, with the US Census Bureau making a practice until 2006 of excluding the responses of first-wave members of the rotating panels for its National Crime Victimization Survey from the public release file because of doubts over their reliability (US Census Bureau 2007: 24). There is also a high level of agreement within the fairly small academic literature on the subject that panel conditioning is a matter for concern, but very little consensus exists on why it occurs or what kind of bias it induces. Indeed, its presence may be better seen as a matter of apprehension or tacit knowledge among survey practitioners, given that despite its regular appearance as a concern, hardly any authors so far have succeeded in conclusively demonstrating its presence. Sturgis, Allum and Brunton-Smith (2009) describe it as “a

truth universally acknowledged”, while Clinton (2001: 2) can only substantiate it *a contrario*: “Given the nature of the research, it is scientifically *impossible to definitively and generically dismiss* the possibility of panel bias” (emphasis added). Most of the evidence which has appeared in the literature suggests that it is not in fact a major threat to validity of inference, especially in comparison with the other known sources of error, since the effect sizes found have been nearly all quite small (Holt 1989: 347; Waterton and Lievesley 1989: 336).

Sturgis et al (2009) suggest that the research to date on panel conditioning has suffered from two main defects: a lack of declared and consistent hypotheses about the mechanisms by which it occurs, and research designs which do not permit its isolation from other sources of sampling and non-sampling error. Waterton and Lievesley also draw attention, in the specific context of opinion surveys, to the impossibility of distinguishing effects on true opinion from effects on reporting behaviour (1989: 320). Speaking more generally, one of the major problems with all such research is the difficulty of empirically distinguishing a response biased by conditioning effects from a genuine one. In practice, reliable evidence for this purpose is present only in two circumstances: where the survey in question relates to either past actions (e.g. use of health services) or future intentions (e.g. voting) that can be verified from factual sources, and where one round of a panel survey coincides with a cross-sectional survey covering the same items in the same population (Waterton and Lievesley 1989). In other circumstances it is necessary to look for unexplained but systematic patterns in the response which match a theoretical model of the expected results of the conditioning effect.

Partly because of this evidentiary problem, the empirical research which has been carried out on the subject does not lend itself to generalisation to the sort of survey which HILDA represents. Most has concentrated on the kinds of survey which ask about either the past actions or the future intentions of the respondent, in circumstances where the accuracy of these reports can be verified at either the individual or, more commonly, the population level. Of the limited body of studies which do examine attitudes as opposed to behaviours, most focus on surveys addressing social or political topics on which many respondents can be expected to have neither the knowledge or the interest to reach firm, logically consistent opinions. It is in such circumstances that the experience of being re-interviewed over several waves is expected to be most effective in developing the kind of improved consistency of response which can be demonstrated statistically in the results of successive waves of the same survey (Sturgis et al 2009). However, no exact precedent has been found for an analysis of an opinion survey on a topic such as work which can reasonably be expected to be familiar to all in-scope respondents on the basis of everyday experience, and hence highly salient in most cases.

This makes it necessary to approach the identification of panel bias in HILDA from a theoretical perspective adapted to its specific focus and the circumstances in which it is administered. For this purpose the range of assumed mechanisms and expected effects put forward in the literature has been reclassified into three primary mechanisms: deliberation, habituation and disengagement. The advantage of this model is that it links the theorised mechanism to the expected effect far more closely than most of the preceding models. Each of these mechanisms should lead to specific effects which will, in favourable circumstances, be empirically identifiable and distinguishable from one another even where they occur simultaneously, and even in the presence of real changes in the underlying construct:

- **Deliberation** occurs when the experience of being selected in a survey panel encourages the respondents to become more aware and/or more informed than a randomly selected member of the population about the issues covered by the survey. While deliberation is generally seen as improving response quality, it still represents bias when comparing the results between those users to whom it applies and those who have yet to undergo the same experience. Deliberation effects may be evident in such ways as a decreased incidence of “Don’t know” responses (Waterton and Lievesley 1989) and greater internal consistency in the way individuals score cognate items (Sturgis et al 2009). If one accepts the argument of Waterton and Lievesley, such biases should show up in early runs of the survey and diminish over time in their contribution to wave-on-wave change. Indeed, the most likely reason for its occurrence is that respondents may reconsider their responses in the light of reflection on how they answered in the initial round, perhaps in conversation with friends and family, resulting in large discrepancies between the results of the first two rounds. Waterton and Lievesley report evidence for this process from follow-up surveys (1989: 327).
- **Habituation** occurs as the questionnaire and individual questions become more familiar to respondents. The respondents start to recognise coherent sequences of questions, gain a stronger (if not necessarily more accurate) feel for what questions mean or why they are in the survey, and settle on the responses they consider most appropriate to their own views, after which they consciously try to remain consistent over successive waves. This will have a positive impact on the quality of response so long as it implies greater consistency in scores for the same level of agreement, but a negative one if a respondent’s concern for consistency over time takes precedence over the accurate reporting of changes in the perception or opinion concerned. Another possible consequence of familiarity with individual questions is that respondents may be less inclined over time to view their experience on the relevant topics as being out of the ordinary (particularly if their actual perception or preference remains constant over several waves), resulting in a gradual move away from extreme scores. Waterton and Lievesley found some evidence of this effect when testing the opposite hypothesis on the British Household Panel Survey, though the effect was reportedly small and unevenly distributed (1989: 328). Habituation effects should logically occur progressively over several waves, resulting after some time in a stabilisation of individuals’ scores.
- **Disengagement** occurs once the novelty of participation in the survey has worn off. Panel members may cease to put the same thought or care into answering the questions as they did in the initial rounds, resulting in a higher incidence of noncommittal or random answers. In these respects the impact of disengagement is the opposite to that of deliberation, and may actually supersede the latter after several rounds. A declining willingness to put effort into the survey may also be evident in less accurate factual responses (e.g. about income, expenditure or the timing of events) where the data exist to check these from independent sources. Alternatively, panel members may become increasingly impatient of the respondent burden and act strategically to minimise it, e.g. by recognising filter questions that lead into a difficult sequence and answering them in such a way as to bypass that sequence. This change of behaviour may be detectable in a declining item response to these sequences even when overall wave response rates remain steady.

Disengagement is unlikely to start affecting the response significantly until several waves into the survey.

Of the three mechanisms, disengagement is the easiest to test unequivocally in HILDA, since the database includes several questions relating to response quality which are filled in by the interviewer after each interview. The most important of these as possible sources of evidence on disengagement are quality of cooperation with the interviewer, the respondent's apparent level of understanding of the questions, the extent to which respondents appeared suspicious of the survey after completing the interview, and the extent to which they were prepared or found it necessary to consult documents when answering the more difficult factual questions in the face-to-face interview. All except the last of these showed a small but unequivocal improving trend between Waves 1 and 6, with the proportion of respondents whose cooperation was rated "excellent" rising from 79.3% to 81.9%, those whose understanding was assessed as excellent" rising from 67.3% to 72.2%, and those reported as "very" or "somewhat" suspicious falling from 4.7% to 2%. The proportion who never referred to documents fell from 63% to 61.9%, but the proportion who frequently referred to documents also fell, from 5.6% in Wave 2 to 4.9% in Wave 6. However, this variable is ambiguous in its implications for intensity of commitment, since a decline in recourse to documents could just as easily indicate a better level of pre-interview preparation as a decline in willingness to put effort into accurate reporting.

This increase in the proportion of high scores can probably be attributed to learning effects which fall under the deliberation and habituation mechanisms. If the purpose is to find evidence of disengagement, it is arguably more logical to look for an increasing incidence of low scores on each of these items. However, responses at the lower end of the scale repeated the improving trend evident at the higher end, with those whose cooperation and understanding was rated fair, poor or very poor falling respectively from 2.4% to 1.7% and 5.5% to 3.7%. This does not necessarily mean that disengagement was not a problem, but simply that it was not apparent in those who continued to respond; in other words, the disengaged panel members may have simply dropped out or, in the face of encouragement from the survey managers to remain in or rejoin the panel, engaged in higher levels of item non-response. An obvious avenue of non-cooperation would have been failure to return the SCQ, since this is something that would have not been picked up by the interviewer at the time these items were filled out. The proportion of interviewed respondents who failed to return the SCQ rose as high as 11%, though without any consistent trend. These matters are examined in more detail in Chapter 7.

Most of the other tests used by other authors were not applicable to HILDA for one reason or another. The one which could be applied was the prediction of Sturgis, Allum and Brunton-Smith (2009) that deliberation and habituation will combine to make respondents more consistent in the way they score the items across composite scales designed to capture single constructs. The HILDA results provided no support for this hypothesis, as Cronbach's alpha for the skill-intensity scale actually fell between Waves 1 and 2 to .701, its lowest level in all six waves, with the task discretion scale also showing the lowest Cronbach's alpha in Wave 2 as well as the lowest annual mean inter-item correlation (see 6.4.1 above). The results in later waves showed no consistent pattern in the reliability of response apart from the rise in Waves 5 and 6 which was described in the previous section, but which has been interpreted there as evidence of a questionnaire effect rather than of panel conditioning in the strict sense.

However, a new kind of test, with no known precedents in the literature, was applied to the HILDA results and found unusually strong evidence of one kind of panel effect between Waves 1 and 2, along with possible evidence of a second. These results are described in section 7.1.2.

## 6.6. Summary and conclusions

Starting from the model and metric of skill developed in Chapter 3, this chapter has taken the process of developing a methodology for the empirical section of the thesis through the stages of conceptual model, research strategy, development and validation of composite scales to measure the key constructs of interest, and evaluation of the known sources of error in the data and their possible impact on the findings. This methodology has taken account of the strengths and weaknesses of the data source as outlined in Chapter 4, and where practicable has aimed at complementarity with the precedent literature summarised in Chapter 5.

Two primary research issues were defined: whether the amount of skill exercised in Australian jobs increased over the period 2001-2006, and how this increase, if there proves to have been one, was distributed across different sections of industry and the labour market. These lead on to two subsidiary and more practically oriented research questions: how these changes were influenced by the known factors affecting the Australian labour market over this period, notably the gradual movement towards full employment and the emergence of severe skill shortages in critical areas of the economy; and what policy implications arise out of the findings. It is in answering these latter two questions that the conceptual model of a national skilling system is likely to show its greatest value. However, the present thesis can go only a little way towards answering them because there are no suitable matching data yet available on the behaviour of business and industry.

Growth in skill requirement was divided for the purposes of analysis into three processes: overall growth in the skilfulness of jobs, reflected in a growing skill component in existing jobs; growth of skill content in specific industries and /or occupations; and changes in the composition of employment whereby individuals move from industries and occupations with lower skill content into new ones that use more skill. This categorisation reflects the distinction recognised in the deskilling literature between the generic and compositional dimensions of skill growth. Each of these processes will be the subject of its own chapter.

To make the analysis possible, it was necessary first to develop composite scales which would accurately capture the two dimensions of skill-intensity and task discretion. Factor analysis demonstrated that the three variables used to construct the task discretion scale were recognised by most respondents as belonging together, and the common construct they represented was responsible for the largest proportion of variation among all the factors identified. The skill-intensity scale was less satisfactory, with some evidence of ambiguity as to the construct with which respondents identified COMPLEX, but it nevertheless recorded Cronbach's alphas of over .7, acceptable for a three-item scale. However, it must be accepted that scales with so few items inevitably fail to capture important elements of the constructs to which they belong, however good their technical reliability.

With a view to developing more sensitive scales for future research, further factor analysis was carried out which included the new variables introduced from Wave 5 onwards. The

results made it possible to define extended composite scales for the two main dimensions which achieved much better Cronbach's alphas than the original scales. Both extended scales can now be regarded as satisfactorily reliable. Since this second round of factor analysis showed that issues of control over the timing of their work were the most important element shaping respondents' perceptions of the amount of task discretion they had in their job, a sub-scale was also developed to capture this element in isolation. Two other sub-scales were developed within this dimension to cover personal autonomy and control over job content (including collective input to decision-making). None of these new scales is extensively used in this thesis because with only two waves of data so far available, it is not yet possible to identify trends in them. However, they are expected to prove their value in follow-up research once more years of data become available.

This process has resulted in the development and validation of reasonably reliable composite scales for tracking the dimensions of skill-intensity and task discretion which are central to the methodology for this part of the thesis, even if their coverage of the respective dimensions is likely to be incomplete. It must be kept in mind that it is still not fully possible to track overall change in skill through the HILDA evidence because there are insufficient data to construct a scalar indicator of the third complementary dimension in the model, substantive complexity. At a number of points in Chapters 8 and 9, however, it has been found necessary to obtain some indication, however inexact, of the movement in this dimension. For this purpose an ad-hoc composite indicator has been used to allow industries and occupations to be ranked using proxies. This indicator should not be seen as reliable or statistically validated in the same sense as those developed in this chapter for the other dimensions.

The final part of this chapter covers the possible sources of bias and error in the data and attempts to evaluate whether they represent serious threats to the validity of inference from the results to the full population. Such error is a particular source of concern for the present research because there is no obvious explanation for the sharp drop in aggregate mean scores on all the key variables that took place between Waves 1 and 2, or for the less pronounced spike in scores that occurred in Wave 5. It was noted that both these phenomena were recorded in years when an unusually high proportion of respondents failed to return the self-completion questionnaire, suggesting that non-response may be part of the explanation.

Three kinds of non-sampling error were examined in addition: response instability, where the same respondents give different scores in different years for the same level of actual agreement, possibly because they perceive the distinction between adjacent points on the rating scale as arbitrary; impacts on the response caused by changes in the questionnaire; and panel conditioning, where respondents' scores in successive waves are affected in various ways by the experience of having already answered the same question one or more times in previous waves. The first was found to be an unavoidable problem, especially considering that none of the relevant questions uses any verbal anchors for the intermediate points on the response scale. However, it has been assumed that normal inferential techniques will be generally adequate to control for this type of error, with the fallback option of binning the scores for each variable into a simulated three-point scale in those instances where more certainty is required. The only apparent questionnaire effect came from the introduction of nine new variables to the relevant sequence in Wave 5, which may be somehow associated with higher scores on both composite scales and a jump in the consistency of the response on these scales as measured by Cronbach's alpha. This must be

kept in mind when comparing the results for Wave 5 and 6 with the earlier years. The tests carried out for known mechanisms of panel conditioning showed no evidence of the expected biases. However, subsequent testing revealed evidence of a significant panel conditioning effect which may account for much of the difference in scores between the first two waves. This will be described in Chapter 7.

## Chapter 7

### Generic trends in skill requirement

This chapter begins the analysis of the HILDA data by focusing on the first of the questions that were identified in Section 6.1: How did the skill content of Australian jobs change over the five years from 2001 to 2006? It examines the evidence on whether any generic change occurred between 2001 and 2006 in the amount of skill deployed in Australian workplaces, and how the change (if any) was distributed across different demographic groups in the workforce. The focus in this chapter lies on the kinds of change that affected the skilfulness of Australian jobs in general, independently of those shares of the aggregate change which simply reflected either a different mix of jobs in individual industries and occupations, or shifts in the sectoral balance of the economy. These latter aspects of change will be the subjects of Chapters 8 and 9 respectively.

Generic skill change is a legitimate object of inquiry because so much public commentary over the last quarter of a century has centred on the proposition that rising skills are a general prerequisite of growth and economic survival, rather than a need which specifically applies to identified occupations or industries. Two main mechanisms can be adduced to explain this kind of change. The first is an evolution in the nature of work which imposes new demands for skill even in previously low-skilled jobs, e.g. a wider requirement to use ICT or the spread of newer styles of working that depend more on interactional skills such as customer service and teamwork. The second is a differential attrition of tasks, even within existing jobs, as the lower-skilled operations are either automated or moved offshore to countries with lower labour costs.

To identify this generic element it is necessary first to describe the aggregate change that took place from all sources in the amount of skill deployed. Once this has been established, tests will be applied to estimate what proportion of the growth (or decline) is attributable to compositional changes, and hence the residual which can be assumed to be at least partly generic.

This chapter is structured around a succession of hypotheses emerging from the main research question. However, the discussion on each hypothesis is not confined to the basic issue of whether the corresponding null hypothesis can be disproved, but serves as a marshalling point for other evidence which reflects, perhaps indirectly, on the issues raised by the original hypothesis.

Throughout these three chapters, skill-intensity and task discretion will be analysed as separate constructs. While it is implicitly assumed that they are cognate, this assumption effectively represents the key underlying hypothesis in this study. As such it needs to be tested in its own right, just as the precise nature of the relationship between them requires empirical examination. A tentative evaluation of this relationship will be undertaken in the concluding chapter, in the light of evidence from other sources on the possible reasons behind the trends which emerge from the HILDA data. However, it must be recognised that a conclusive evaluation of this relationship, and of the metric based on the association between the two constructs, cannot be undertaken within this thesis because there are currently insufficient data for Australia on the third complementary element of the

proposed metric, substantive complexity. For the same reason, no attempt will be made to weight the individual measures and combine them into a single index of skill change.

## 7.1. Generic changes in skill requirement

The basic hypothesis tested in this section is that the amount of skill deployed across the Australian economy, as measured by the two scales and their component variables, grew over the period 2001-2006. Two issues are raised by this hypothesis. The first is the amount and nature of change that is evident in the data. The second is whether the apparent change is a genuine effect rather than the result of simple random variation, i.e. whether it is statistically significant.

Three different measures have been used to estimate the extent and direction of change. The first is the movements between waves and across the full six waves in the aggregate mean raw scores for each scale and constituent variable. While this metric is the most intuitively meaningful and in the case of the scales, can safely be treated as a continuous variable for analysis purposes, it is vulnerable to the problems of sample variability and random variation in individuals' scoring behaviour which were discussed in Chapter 6. The second metric is the binned variables created by recoding the original variables into what amounts to a three-point ordinal scale: definitely disagree (1-2), neutral or marginal (3-5) and definitely agree (6-7). This approach provides a partial corrective to the kinds of error just mentioned, or at any rate an alternative estimate that can shed some light on their impact, but is much less sensitive than the mean scores to small year-on-year movements in the underlying constructs and excludes genuine movement which occurs around the midpoint of the scale, e.g. marginal but analytically significant shifts from positive to negative opinion or vice versa. Neither of these metrics offers a rigorous method of calculating the statistical significance of the changes. To fulfil this purpose, the method chosen was a one-way ANOVA which bases this calculation on estimated marginal means across the six waves. The limitation of this method is that it depends on using the same respondents in each of the waves analysed, which even in a well-administered panel survey such as HILDA means a loss of around half the sample in each wave. The results of these three methods are set out in turn below.

### 7.1.1. Trends in aggregate mean scores

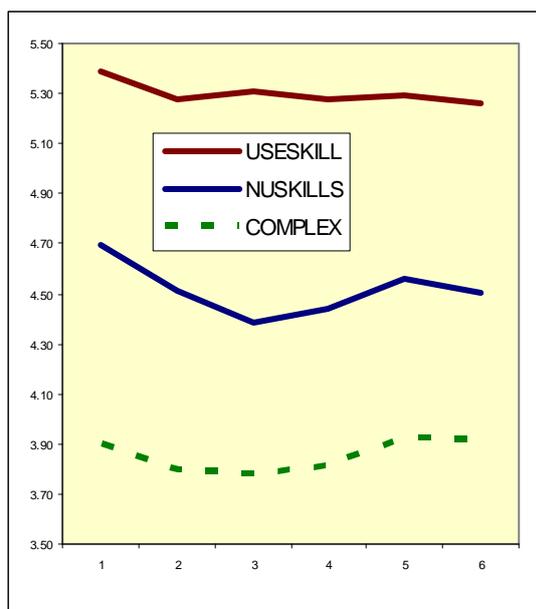
The mean scores for both indices and all but one of the constituent variables show a flat or declining trend over the six waves. However, the trend in most indicators is not consistent, but rather is marked by a relatively steep drop between the first and second waves and an almost equally sharp rise between Waves 4 and 5 which was not sustained into Wave 6. Of the three skill-intensity variables, NUSKILLS shows the greatest variation from year to year and COMPLEX the least. For task discretion it is once again the lowest-scoring variable, OWNTASK, which shows least variation. Table 7.1 below sets out the details.

As noted in previous chapters, the figures for Wave 5 stand out strongly from the trendline on most variables, while the sharp drop in scores from Wave 1 to Wave 2 applies across all variables and is not repeated in any later wave. In general, from Wave 2 onwards, the movements in the mean for the task discretion variables are considerably less pronounced

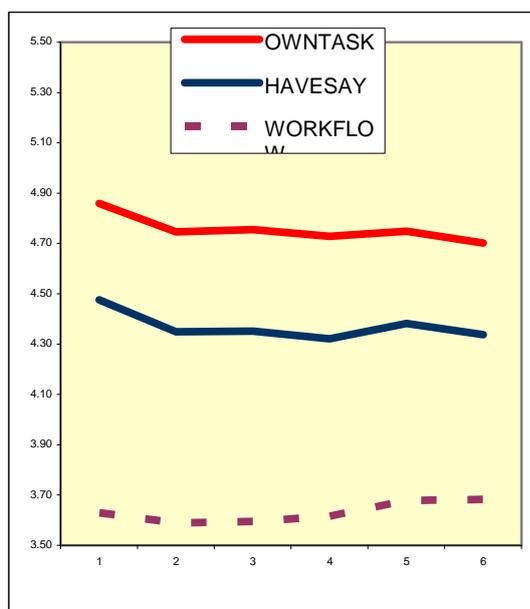
than for those relating to skill-intensity. Both these features appear clearly in Figures 7.1 and 7.2 below.

Wave	1	2	3	4	5	6	Average all waves
COMPLEX	3.90	3.80	3.78	3.81	3.93	3.91	3.85
NUSKILLS	4.70	4.51	4.38	4.44	4.56	4.50	4.52
USESkill	5.39	5.27	5.31	5.28	5.29	5.26	5.30
OWNTASK	4.86	4.75	4.75	4.73	4.75	4.70	4.76
HAVESAY	4.48	4.35	4.35	4.32	4.38	4.34	4.37
WORKFLOW	3.63	3.59	3.60	3.62	3.68	3.68	3.63
Skill-intensity	13.99	13.59	13.48	13.53	13.78	13.68	13.68
Task discretion	12.97	12.68	12.70	12.67	12.81	12.72	12.76

**Table 7.1**  
**Mean scores by wave - core variables and composite scales**  
**(All respondents in wave)**



**Figure 7.1**  
**Mean scores, skill intensity variables**



**Figure 7.2**  
**Mean scores, task discretion variables**

**7.1.2. Trends in binned variables**

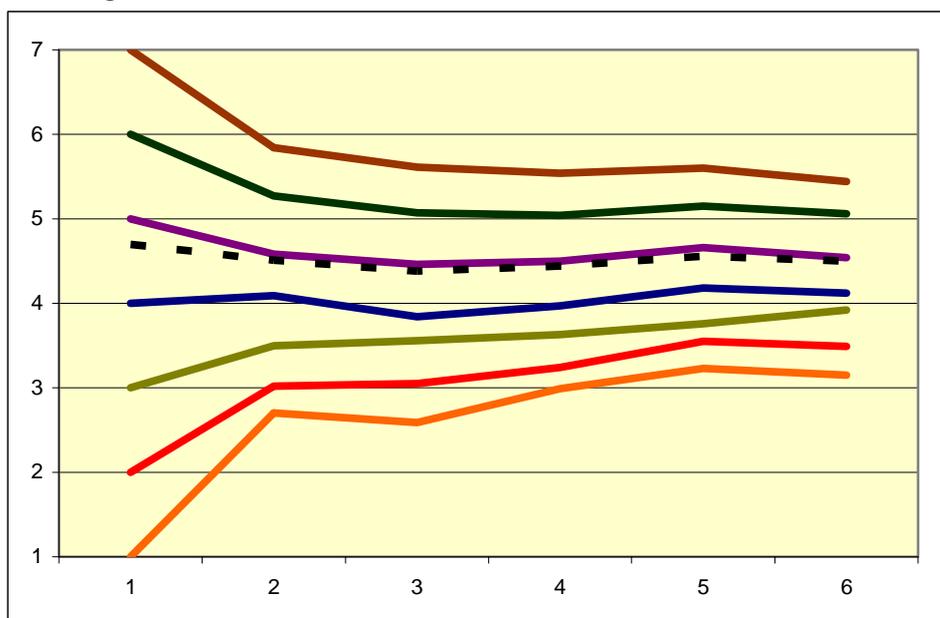
A slightly different perspective emerges from the binned variables, where tracking the proportion of respondents who qualified as “definitely agree” (scores 6-7) excludes the impact of any random fluctuation that may have occurred around the midpoint of the scale. Table 7.2 shows how these percentages moved over the six waves for each variable.

Wave	1	2	3	4	5	6
COMPLEX	25.0	22.9	22.9	22.8	23.8	23.6
NUSKILLS	41.6	36.5	34.5	34.1	36.7	34.6
USESKILL	61.0	57.0	58.0	56.4	56.7	55.9
OWNTASK	46.4	42.2	43.2	40.7	41.5	40.6
HAVESAY	36.9	32.9	32.8	31.4	32.7	31.6
WORKFLOW	25.0	23.3	23.6	22.9	23.6	23.4

**Table 7.2**  
**Percentage of respondents “definitely agree” (6-7)**

By excluding the movement (genuine as well as random) around the middle of the scale, these figures greatly reduce the discrepancy between Wave 5 and the remainder, but continue to show a strong break in continuity between the first and following waves. The overall pattern of movement remains very similar to that observed in the means. Its amplitude is somewhat reduced for the skill-intensity variables, but more pronounced for the task discretion indicators, especially OWNTASK. NUSKILLS remains the variable showing greatest variation around the trendline. Whereas WORKFLOW was the only variable to achieve a significantly higher mean score in Wave 6 than in Wave 1, its “definitely agree” ratings show the same downward trend as the remaining indicators.

The other interesting trend which is evident in the binned variables is the steady increase in central ratings already discussed in Section 6.6.3 above as a possible artefact of panel conditioning. One way of examining this phenomenon is to take the set of respondents who answered at each point on the scale in Wave 1 and track their mean scores over the following waves. By way of illustration, Figure 7.3 maps the trends for NUSKILLS, the indicator which showed the greatest variation over the six waves. The y axis represents an individual's score in Wave 1 and the mean score in subsequent waves (x axis) for individuals who gave that score in the first wave.



**Figure 7.3**  
**USESKILL: Wave 1 scores and mean scores in later waves**  
*(dotted line: mean, all respondents in wave)*

The fishtail pattern clearly visible in this graph shows how those who gave scores at or towards either end of the scale in the first wave reverted sharply towards the centre of the range from Wave 2 onwards, after which their mean scores stabilised while still tending to converge slowly. This reversion is equally marked at either end of the scale and represents the strongest apparent movement in all waves, though its impact on the aggregate mean is masked partly by the relatively small *N*s, especially for the lowest scores, and partly by the highly skewed distribution of scores on this variable in Wave 1. The same pattern is repeated in the remaining five variables, albeit with varying degrees of dispersion of scores in the later waves, and represents the strongest evidence identified of any form of panel conditioning. The apparent explanation is that respondents were more likely to experiment with extreme ratings the first time they saw the questions, but scored them more conservatively on all subsequent occasions. This could be either a deliberation effect (respondents gave more thought to their real level of preference after reconsidering their initial estimate) or a habituation effect (they gave more noncommittal scores because the question had lost its novelty).

Whatever its cause, this effect is confined to the initial pair of waves, and does nothing to explain away the rise in Wave 5. Since it reappears in the new variables when they are introduced in Wave 5, it would appear to be a reaction to previously unseen questions rather than to the overall novelty of participating in the survey. However, it is still possible that the much smaller movements in subsequent waves, notably the apparent gradual convergence towards the aggregate mean, reflect a different mechanism of panel conditioning.

### 7.1.3. Results of one-way ANOVA

To test for the statistical significance of the wave-on-wave changes, a repeated measures ANOVA was carried out on those respondents who answered the relevant questions in Wave 1 and all subsequent waves. The results which emerge from this analysis, shown in Table 7.3 below, reveal interesting differences from those for the full-wave sample in each year.:

Wave	1	2	3	4	5	6	Average all waves
COMPLEX	4.13	4.05	4.04	4.10	4.27	4.23	4.14
NUSKILLS	4.83	4.64	4.50	4.55	4.67	4.56	4.62
USESKILL	5.56	5.42	5.47	5.48	5.52	5.45	5.48
OWNTASK	4.99	4.89	4.91	4.92	4.97	4.88	4.93
HAVESAY	4.56	4.45	4.52	4.53	4.66	4.58	4.55
WORKFLOW	3.60	3.61	3.67	3.67	3.80	3.78	3.69
Skill-intensity	14.54	14.11	14.01	14.14	14.48	14.26	14.26
Task discretion	13.15	12.96	13.09	13.14	13.44	13.25	13.17

**Table 7.3**  
**Estimated marginal means, Waves 1-6**  
**(repeated measures ANOVA, respondents who answered in all waves)**

Change over the whole five years was found to be statistically significant at the .01 level for all six variables and both scales, but failed in many cases to reach the .05 level of significance between individual waves. Table 7.4 below shows where significant

differences occurred in the estimated marginal means for each variable between each wave and all the others, rather than just the changes from one wave to the next. This information is important to understand the degree of variation that occurred in each variable over the full period.

Wave	1	2	3	4	5	6	Partial $\eta^2$	N
<b>Skill intensity</b>	2, 3, 4, 6	1, 5	1, 5, 6	1, 5	2, 3, 4*	1, 3, 5	.037	2961
<b>Task discretion</b>	5	5, 6	5	5	1, 2, 3, 4	2	.014	2980
<b>COMPLEX</b>	3*, 5	5, 6	1*, 5, 6	5, 6	1,2,3,4	2, 3, 4	.027	3001
<b>NUSKILLS</b>	2, 3, 4, 5, 6	1, 3	1, 2, 5	1,5	1,3,4,6	1, 5	.043	3005
<b>USES KILL</b>	2, 3*, 4*	1, 5	1*	1*	2, 6*	5*	.012	3009
<b>OWNTASK</b>	2, 6*	1			6*	5*	.008	3010
<b>HAVESAY</b>	2	1, 6	5	5	2,3,4	2	.015	3008
<b>WORKFLOW</b>	5, 6	5, 6	5, 6*	5,6	1, 2, 3, 4	1, 2, 3*, 4	.015	3010

**Table 7. 4**  
**Significant differences between estimated marginal means, Waves 1-6**  
**(repeated measures ANOVA – respondents who answered in all waves)\***

\*Findings marked with a single asterisk are significant at .05. All others, including  $\eta^2$ , are significant at .01.

The partial eta-squared figure in the second-last column is an indicator of effect size over the full period, based on Wilks' Lambda. Effect sizes of this magnitude would be considered trivial if the purpose were to determine the short-term impact of a purposive intervention, but can be regarded as meaningful if small when applied, as here, to effects arising from an unknown variety of causes over an unknown but possibly quite extended period. The main reason for including them here is identify which of the variables or scales show the strongest and weakest change over time. The provide a more statistically rigorous confirmation of the impression gained from the findings of the first two analyses that skill-intensity showed more movement over time than task discretion, and that USESKILL is the individual variable which shows most year-to-year change. On the other hand they show that the variation over the six waves for COMPLEX is much more pronounced, at least for this more limited sample, than would appear from either the raw or the binned scores.

The findings reached by this method permit a number of substantive conclusions, some of which reinforce trends appearing in the aggregate means and binned scores, while others contrast with them:

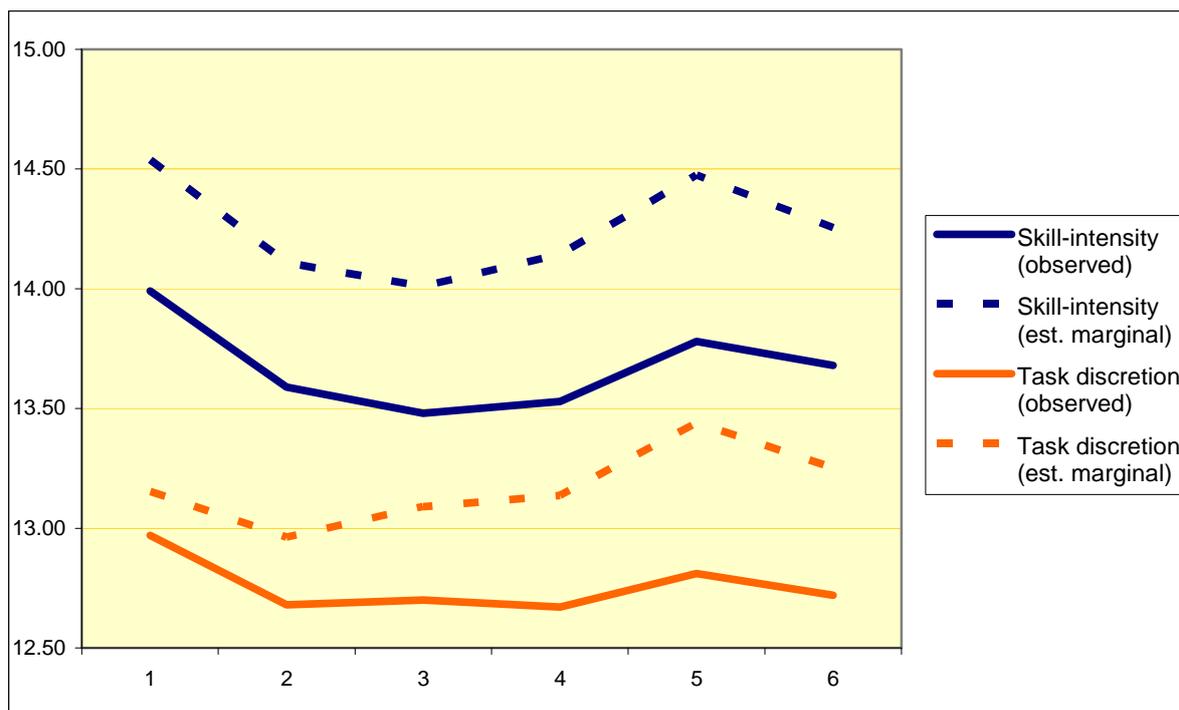
- While both scales show a declining trend in aggregate mean scores over the full period, the task discretion scale for this more limited population trends slightly but significantly upwards from Wave 3 on;
- Movement on the task discretion scale is nevertheless much smaller than for the skill-intensity scale. Without the spike in scores for Wave 5 this scale would have remained practically static over these five years;

- The rise in Wave 5 continues to stand out on both scales and most variables. However, where the aggregate figures suggest a return to a lower trendline after a single-year spike, the relative paucity of significant changes between Waves 5 and 6 leaves open the possibility that on some variables at least, this rise may signal the start of a sustained rising trend;
- The drop following Wave 1 also remains evident but less pronounced, with significant change between Wave 1 and 2 affecting only four out of the six variables, and only the skill-intensity scale;
- COMPLEX and NUSKILLS show the greatest relative volatility, with the latter having the greater range of variation, as shown by its higher (though still low) eta-squared coefficient. NUSKILLS is also the only variable for which significant differences occur between a single wave and all the rest. The variables exhibiting greatest stability are OWNTASK and USESKILL, with the former showing no significant change over the middle three years;
- Significant change between adjacent waves (shown in bold in the table) is relatively uncommon, especially in the middle years, suggesting that trends over this timescale emerge either very slowly or unevenly.

Many of the discrepancies between these marginal means and the aggregate means (i.e. the means for all respondents in each wave) can be explained by the drastic sample loss which is the price of moving to a sample that remains genuinely constant from wave to wave. Although the size of the remaining sample is fully adequate to support the kinds of inferential analysis for which it is used here, the choice brings an inevitable tradeoff between validity of inference (i.e. confidence that the changes observed reflect genuine changes in the construct of interest rather than random variations in sample composition) and representativeness (confidence that the remaining sample reflects the composition of the full population as accurately as the full achieved sample in an individual wave).

The latter must be in question given that there is no reason for confidence that the non-response is randomly distributed. It was noted in Chapter 4 how the managers of HILDA have calculated that panel attrition is concentrated among those members most likely to be poorly educated, low-paid and precariously employed. If this assumption is extended to item non-response in individual waves, one might expect the all-waves sample to represent a slightly different population from the designed or indeed the full achieved sample, one which was likely to be in higher-skilled or higher-quality work, and hence to score higher on most of the key indicators. This is precisely the impression that emerges from Figure 7.5, where the movements in the two sets of means are plotted together.

While the movements of the two curves on each scale, particularly skill-intensity, are generally in the same direction and of roughly comparable magnitude, those respondents who answered in all waves score consistently 0.5 to 0.75 higher than the full set of respondents in wave. Such a finding would be consistent with a population more likely than the average randomly selected member of the public to be employed, permanently employed, educated, and engaged in challenging or responsible work.



**Figure 7.5**  
**Composite scales: observed mean scores (all respondents in wave) vs. estimated marginal means**  
**(repeated measures ANOVA, respondents who answered in all waves)**

In addition to these possible differences in the key parameters, the all-waves sample is more likely than later-wave recruits, later-wave dropouts or sporadic responders to feel the impact of any panel conditioning that has taken place: for example, to have become “better” at answering surveys, more familiar with the individual questions and their place in the respective sequences, and more attuned to the issues about which they are being asked to respond. Conversely, they may be closer to experiencing survey fatigue than those who have been in the panel for fewer years or less continuously. While the data offer no clear evidence of panel conditioning in the HILDA panel except for the first two waves, these two risks together make it necessary to look closely at the patterns of non-response before any assessment can be made of the relative merits of the three approaches to estimating change over time.

#### **7.1.4. Impact of non-response**

In the case of HILDA, non-response can be broken into three categories: attrition, where respondents drop out of the survey altogether; item non-response, where respondents complete most of the questionnaire but fail to answer individual questions; and SCQ non-response, where respondents complete the interview but fail to return the SCQ.

The extent of attrition has been discussed in subsection 4.3.2, and the top line in Table 7.5 below, which is derived from counts included in the data file for each wave, illustrates its impact on the number of respondents who provided data for the interview questionnaire in each wave. This shows a loss of individual responding persons considerably less drastic

than the overall loss of households, especially between Waves 1 and 2 where it amounted to 6.6% of responding persons as against 13% of households.

Item non-response among those who actually returned the SCQ appears to be barely more than trivial, as can be seen in the final column of Table 7.4 above, where the number of respondents who provided data over all waves for WORKFLOW, the most frequently answered of the six key questions, exceeds by fewer than 50 the number who answered all three questions required for a score on the skill-intensity scale. A count in individual waves shows that of those SCQ respondents who reported themselves or were presumed by the coders to be in paid employment, a maximum of 62 in any year failed to complete all three of these questions.

This leaves the issue of SCQ non-response as the most important contributor to sample loss. Table 7.5 below shows how this affected both the overall sample and the sample of employed respondents in each wave.

Wave	1	2	3	4	5	6
Interviewed	13969	13041	12728	12408	12759	12905
No SCQ	911	1403	981	1012	1294	1196
% no SCQ	6.52	10.76	7.71	8.16	10.14	9.27
Employed	8525	8088	7991	7822	8247	8357
Employed, no SCQ	525	885	589	625	857	797
% employed no SCQ	6.16	10.94	7.37	7.99	10.39	9.54

**Table 7.5**  
**Interviewed respondents who failed to return the SCQ**

These figures show that SCQ non-response peaked in Waves 2 and 5 at over 10% of the interviewed sample. The proportional impact was slightly higher for respondents who reported in the interview that they were employed at the time of survey. Between Waves 1 and 2 the rate of SCQ non-response for employed persons who completed the interview jumped by almost 78%, amplifying the impact of overall sample attrition to reduce the achieved sample for the key questions by just under 800, or 10%. The rise in the non-return rate exceeded 30% again in Wave 5, but this time was offset by a rise in the interview rate to produce an achieved sample for this sequence around 200 greater than in Wave 4. The degree to which this affected the reliability of the Wave 5 findings, relative to the previous year, depends on how closely any non-response bias affecting the SCQ in the two waves mirrored that for interview non-response.

Given that these were the two years in which the sharpest change occurred in the aggregate means, this evidence provides some reason for caution in treating the whole of the change in each year as genuine. While nothing can be demonstrated conclusively, it seems prudent to assume that at least part of the drop in mean scores between Waves 1 and 2 was an artefact of non-response bias. Taken together with the evidence found earlier of a response effect influencing the movement in scores over the same pair of years, this possibility strengthens the argument against reading too much into that apparent shift.

As an additional gross check against systematic bias, tests were applied to see whether the same effects appeared in different parts of the questionnaire. Some kinds of response bias, if they occurred, might be expected to affect the results across most or all areas of the questionnaire, including questions unrelated to the subject matter of the variables studied in

this research: an example would be the apparent tendency of respondents to experiment with more extreme scores the first time they saw or heard the questions, but revert to more conservative scores on subsequent occasions. Unexplained consistency across the responses on different topics, in different parts of the questionnaire, might be evidence of this kind of systematic bias. Other kinds of bias might be related to unobserved sources of bias specific to parts of the questionnaire, e.g. in the way particular sequences of questions were asked, the position of individual questions within a sequence or of that sequence within the questionnaire, respondent fatigue setting in towards the latter end of either questionnaire, or differences in the way respondents answered questions in the interview and the SCQ. These would show up in otherwise unexplained discrepancies between the response trends for the key variables of interest and those for questions in other sequences, or in the interview questionnaire, which covered similar topics.

To test these possibilities, five control variables were selected and subjected to the same tests as the main variables of interest. All represent subjective ratings of aspects of job quality, but with different emphases, and are asked in different contexts:

- *Overall job satisfaction* is a summary rating given by the respondents at the end of a sequence of questions on individual aspects of their job (pay, work-life balance, etc). It occurs in the interview questionnaire and uses an 11-point response scale. It correlates modestly with task discretion (around .26 in Wave 5), but only weakly (though still significantly) with skill-intensity;
- *Chance of losing job in next 12 months* is a percentage rating given by respondents in the interview questionnaire. Besides using a different kind of response scale, it differs from the main variables studied here in that it rates the probability of an event rather than a simple opinion on a qualitative aspect of the respondent's job. It might be expected intuitively to move in line with the state of the labour market, with the mean getting lower as the economy approaches full employment. Its correlations with the key variables of interest are statistically significant but very weak (<.05);
- *Chance of voluntarily leaving job in next 12 months* is the adjacent question in the interview questionnaire and uses the same response scale. However, it differs in measuring the respondents' own intentions, and thus in indicating the extent to which a respondent might be prepared to act on his views about the quality of his present job. In fact, it correlates very strongly (around .7) with the previous question, and more strongly with skill-intensity than with task discretion, though the correlations in both the latter cases are well below .2;
- *FAIRPAY* ("I get paid fairly for the things I do in my job") is part of the same sequence in the SCQ as the main variables of interest, but loaded on a different factor in the PCA. It correlates modestly with task discretion (.2) but non-significantly with skill-intensity;
- *FUTURE* ("I worry about the future of my job") is also part of the same sequence but loaded on a non-related factor, job stress. Its correlations with skill-intensity and task discretion are statistically significant but well below .1. It might be expected to correlate strongly with chance of losing job, but the actual correlation is

a little below .2, suggesting that respondents answered SCQ questions differently from questions on the same general topic in the interview.

On the repeated-measures ANOVA, all five control variables show very different patterns from those for the variables of primary interest. Job satisfaction shows no significant variation whatever, either between waves or over the full period, while the variation in FAIRPAY is significant at the .05 level over the full period, but not between any two waves. On none of the remaining three does any significant change appear either between Waves 1 and 2 or between 4 and 5. On “chance of voluntarily leaving job” the only significant differences are between Waves 4 and 6, while on “chance of losing job” they appear between Wave 1 and Waves 3-6. The same divide occurs for FUTURE, albeit significant differences also appear between Wave 2 and the later waves; this suggests that despite the relatively poor recorded correlation, the pattern of response has been essentially the same for the two questions that cover the same general underlying construct in the interview and the SCQ.

Turning to the aggregate scores, the marked drop between the first two waves reappears for FUTURE and “chance of losing job” but not for the other three control variables, while the three variables that relate to expected job change all show a rise between Waves 4 and 5. The fishtail pattern shown in Figure 7.4 recurs in the responses across waves for those three variables where the response scale permits such an analysis (job satisfaction, FAIRPAY and FUTURE), again converging on the aggregate mean trendline rather than the midpoint of the scale, though the convergence is more gradual and the break between Waves 1 and 2 less sharp in the case of FAIRPAY.

The evidence provided by these control variables is incomplete and impressionistic. Nevertheless, it represents some cause for confidence that HILDA respondents can and do discriminate in their response between questions in the same sequence covering different topics, and hence that the response patterns on the skill-related variables are indeed specific to the aspects of skill to which they refer and not simply manifestations of some more broadly applying artefact, such as might result from panel conditioning, sequence effects or non-response bias. This applies in particular to the problematic breaks in the trendline, at least so far as the aggregate means are concerned, at Waves 2 and 5, though this evidence is not sufficient by itself to demonstrate that they represent actual change. At the same time the broad similarity in response patterns between the two control variables which refer to the construct of perceived job insecurity in the interview and the SCQ respectively suggests that SCQ non-response need not be biasing the findings as badly as might be feared. On the other hand the fishtail effect, where the distribution of responses shifts sharply away from the extreme points on the scale after the initial wave, appears to apply across both questionnaires and a range of topics, and hence must remain under consideration as a convincing possible explanation for at least part of the first of those breaks.

### **7.1.5. Summary**

This critical review of the key trends in the data has been more exhaustive than would have been necessary had those trends been more pronounced or consistent, or had there been a longer run of data within which to locate them and assess their ecological significance. It remains ultimately inconclusive. Each of the three methods applied to measure the change has its own strengths and its own weaknesses as a basis for valid inference to the population, and none emerges as the most methodologically compelling on all criteria. Their findings conflict on some matters which are absolutely critical to making sense of the data. The

choice of which method to prefer in each case, or how best to reconcile the inconsistencies between their findings, must ultimately be a matter of judgement rather than the unequivocal outcome of formal analysis. To summarise their strengths and weaknesses:

- The aggregate means have the advantages of staying closest to the recorded results and maximising the sample available for analysis in any one wave. However, they suffer the drawback of being susceptible to bias as the result of random – or worse still, non-random – variations in the composition of the sample from wave to wave due to differential rates of non-response. In this respect they undermine many of the arguments for using a panel sample. The fluctuations in sample size across the waves are so substantial by comparison with the actual movements in the indicators that in some waves at least – notably those where the greatest average change appears in the data – they could quite feasibly account for all of that change.
- The binned scores provide some insurance against misinterpreting purely random variations in individuals' scores across waves for the same level of agreement, if one assumes that such random movement is most likely to occur around the middle of the scale where the choice is a matter of greatest indifference. However, while this assumption is intuitively persuasive, there is nothing in the data to prove or disprove whether it actually applies in this instance. Similarly, they compensate for the possibility that some respondents will use central scores as a substitute for the missing "Don't know/ not applicable" response category; but this (if it in fact occurs) is more likely to be a problem with the interview questions than with the SCQ where respondents who genuinely cannot commit to an opinion have the option of leaving the question unanswered without risk of embarrassment. Perhaps the strongest argument for their use is that they compensate for the main inferential problem arising from the use of a response scale with no verbal anchors for the intermediate points, namely that no two respondents can be guaranteed to perceive the same distance between the same two points on what is, after all, an ordinal scale. A score towards one end or the other, though it cannot be confidently assumed to represent the same intensity of opinion for all the respondents who give it, can at least be taken as representing a clear preference one way or the other. From this point of view the binned scores are useful for extracting strong or unequivocal trends over this specific period. In a longer-term perspective, however, they may equally conceal more pervasive trends that emerge only gradually and have their main impact on respondents whose opinion lies around the centre of the distribution.
- The use of repeated measures ANOVA on the set of respondents who answered in all waves provides the most rigorous method of formally estimating the statistical significance of recorded changes from wave to wave, and eliminates any contribution of unintended sample variation. Restricting the analysis to identifiable changes from individuals' Wave 1 responses can be seen as enhancing the accuracy of the findings because the Wave 1 sample was the closest to the original designed sample and hence can be assumed to be the most representative of the population. From another perspective, though, it represents a weakness because in the presence of known high levels of non-response, the set of respondents who answered all the questions in all waves can reasonably be expected to differ from less conscientious respondents on some dimensions that critically influence their expected scores. Though the results may be highly accurate for the specific population they represent,

it is less certain that they can be accurately extrapolated to the broader population of interest.

More sophisticated modelling might go some way further towards resolving these uncertainties, but the only sure remedy, as has already been stressed several times, is a longer run of data. Pending this, a number of interim conclusions can be drawn, perhaps not altogether safely, but with sufficient confidence to form a basis for further analyses.

The closest thing to a certain trend that appears in all three methods is the decline in the average skill-intensity of Australian jobs between 2001 and 2006. While small, this trend appears to be statistically significant and strong enough to offset the rise in mean scores that occurred in Wave 5, at least over the period for which data are so far available. The main uncertainty attaching to this trend is the degree to which it depends on the fall in means between the first two waves, which more than accounts for the full difference between the first and latest waves on both composite scales. Without this movement, the true size of which is open to doubt because of the apparent contributions of sample variability and panel conditioning, the picture would look very different.

The direction of overall movement on task discretion is more equivocal, but in any case the movement so far appears to have been quite small, though statistically significant. The two individual variables which appear to stand out against the trend by showing a net gain in aggregate mean scores over the five years are COMPLEX and WORKFLOW. However, the failure of this countervailing pattern to show up in the binned scores for either variable suggests that most of the gain is taking place around the middle of the response scale, where it could include a large element of random variation in individuals' scores

It also appears reasonably clear that for whatever reason, representative scores (including those for some negative indicators of job quality) rose across the board in Wave 5, though on two out of the three measures used in this section, the rise does not appear to have been sustained. The lack of any obvious external explanation makes it necessary to treat this finding too with caution, especially as it too occurred in a year with an unusually high proportion of missing SCQs. It may also be due at least in part to a response effect caused by the addition of nine new relevant variables to the sequence in that year, and on the analogy of what appears to have happened in Wave 2, this could also account for some of the drop in scores in the following wave. Nonetheless it appears sufficiently robust to be treated as genuine until clearer evidence emerges to disprove it. Some of the evidence from the ANOVA opens the possibility that on some variables at least, it might signal the beginning of a more sustained upward trend. If this proves to be the case as more waves of data become available, it will require a thorough revision of many of the tentative interpretations that have been placed on the data in this thesis.

On present indications, however, it can at least be said with reasonable confidence that the null hypothesis has not been proven, since on the best available evidence the change in both the skill-intensity and the task discretion dimensions of skill was statistically significant over this period, albeit neither consistent nor steady. With equal confidence it can be said that the change was neither as marked nor as rapid as might be inferred from the public discussions about a skills crisis over these years. Indeed, most or all of the change occurred in the opposite direction to what might have been expected.

## 7.2. Contributions of generic and compositional change to overall movement in scores

The hypothesis tested in this section is that such change as occurred in skill requirement was the result of changes in the composition of the sample, or in its patterns of employment, rather than a change in the generic skill content of work in Australia.

The assumption behind this hypothesis is that even without any change in the nature of work, either across the board or in individual occupations, the aggregate statistic on the amount of skill exercised could still change because the representation of different demographic groups in the sample had changed over the six waves. For example, if women generally are employed in jobs with less task discretion than those occupied by men, and the proportion of women in the sample had grown, e.g. because men were more likely than women to drop out of the panel, then the total amount of task discretion exercised would fall without necessarily implying any change in the overall importance of task discretion, or even in the distribution of jobs across the economy in terms of their task discretion.

In the case just outlined, the apparent change would be an artefact of sampling error. However, it could equally occur as a genuine phenomenon because the demographic composition of the employed population had changed (e.g. more women were staying in employment after having children) and the pattern of available work had adjusted to the changing profile of the labour force, a central expectation of the system model. This would imply a real change in the dynamic of skill, but one reflecting change in population characteristics rather than generic change in the nature of work

Alternatively, while the composition of the sample remained the same, there could have been changes in the balance of the jobs in which it worked, either between industries and occupations, or between types of work. For example, if casual jobs tend to be less skill-intensive than permanent ones, and if the pattern of economic growth resulted in members of the panel moving from casual to permanent employment, the average skill-intensity of jobs in the sample would rise without necessarily implying a rise in the generic skill-intensity of either casual or permanent work. This compositional element of change, as noted in earlier chapters, is generally recognised in the literature as a major component in overall change over time in the nature of work, and the main debate has centred on the question of whether it accounts for all or only a part of the change. It will be treated in Chapter 9 as a key aspect of the skilling dynamic, but the purpose of this chapter is to determine whether any part of the change is *not* explained by compositional factors – in other words, whether there is indeed some generic element in the aggregate change that has just been discussed.

Strictly speaking the possibilities discussed above represent different hypotheses, one demographic and one to do with the labour market; indeed the first possibility of change in the demographic composition of the panel itself represents two hypotheses, one of sample error and one of real variation. Part of the reason for treating them as a single hypothesis for present purposes – essentially, a counter-hypothesis to the overall one of this chapter – is that it is often difficult in practice to define the boundary between them. For example, a change in the average education levels of the population could be seen as a change in the population parameters which the labour market has to accept as a given, but it is just as credible to see it as an active response by the labour force to signals put out by a changing

labour market. In any event, for the primary purpose outlined in the last paragraph, it is important to establish whether the data represent real change or real associations, i.e. to identify and minimise the contribution of error, but relatively immaterial whether certainty can be achieved about the exact nature or incidence of change within either the compositional or the generic category.

Considering how much attrition has occurred, the demographic profile of the HILDA sample has remained surprisingly stable. The male-female balance remained virtually unchanged at 53:47 over the six waves, and the ratio was the same for respondents who returned the SCQ. The median age also remained practically the same at 42, rising to 43 in the later waves. However, other parameters relating to labour market experience showed slight but in most cases steady change over the five years:

- the proportion of respondents who were employed rose from 61% to 65%, while the number who held more than one job at the time of interview grew from 8.8% to 9.2% in Wave 5, before falling back to 8.4% in Wave 6;
- the percentage of respondents who were employed on a casual basis peaked at 25.9% in Wave 2 and fell to 23.4% in Wave 5, rising back to 24.2% in Wave 6, while those employed by labour-hire or temporary employment agencies fell from 3.7% to 2.9%;
- job turnover increased, with mean time worked for present employer falling steadily from 7.1 to 6.7 years and median time in current occupation falling from 6 to 5 years from Wave 2;
- the proportion of employed respondents who were working in private business rose from 67.6% to 72.1%, peaking at 73.1% in Wave 2, while government employment (including government business enterprises) fell from 24.5% to 21.9%;
- median hours worked in main job fell from 40 to 38 from Wave 3 onwards;
- union membership fell from 27% to 24.5% of the sample;
- median workplace size grew from 3 to 5 employees;
- fewer respondents worked for themselves, self-employed and owner-operators falling from 19.7% to 16.7% as a proportion of all types of employment.

In addition and perhaps most strikingly, the average level of education grew, with holders of bachelor's degrees and postgraduate qualifications increasing from 18.4% to 20.4% of the sample, level III and IV qualifications (including tradespersons) increasing their representation from 17.3% to 19% and the proportion of respondents with incomplete secondary education (Year 11 or below) and no vocational qualification falling from 40.7% to 35.2%.

Finally, the five years saw some change in the distribution of employment within the sample by industry and occupation. While the modal industry and occupation at the 1-digit level (Retail Trade and Professionals respectively) remained the same in Wave 6 as in Wave 1, as did the rank order of occupations at the same level, crosstabulations show far

more mobility among individuals. Around half the respondents who started in each major occupational group in Wave 1 and were still employed by Wave 6 had moved to a different major group, and retention rates in individual industry divisions over the five years ranged from around 80% in Education and Health and Community Services down to only 33.7% in Wholesale Trade. Clearer aggregate changes occurred at the 2-digit level, with Health, Education, Government and Construction all increasing their representation in the ten top industries. These movements are examined in more detail in Chapter 9, but the purpose in this chapter is simply to assess their net contribution to overall change in skill deployment.

Almost all the variables listed above correlated significantly with both the composite scales in Waves 1 and 6; interestingly, the only exception was 2-digit industry, which failed to correlate at the .05 level of significance with the task discretion scale in Wave 6. Most of the variables achieved Pearson correlations and Spearman's rhos exceeding .1 with both scales. (In these and the other correlations described in this chapter, the difference in results between the parametric and non-parametric tests was trivial.) The strongest correlations with skill-intensity were achieved by Occupation and the ANU4 Occupational Status Scale, each exceeding .4 in both waves, while Highest Education Level, Hours Worked and Casual/permanent status both exceeded .3. Correlations with task discretion were generally somewhat weaker, the strongest being Occupation at just over .3, followed by ANU4 Occupational Status Scale, workplace size, age and hours worked. From these results it can safely be concluded that the composition of employment, especially by occupation, was a substantial though not overwhelming influence on the amount of skill deployed across the sample at any one time.

While these point-in time figures are useful in showing links between these parameters and both dimensions of skill, the more important focus of the present analysis is on changes over time. In other words, did individual scores on skill-intensity and task discretion change when the same employment characteristics changed for the individual? And was the association such as to suggest a causal link between the two kinds of change? To address these questions two new continuous variables were calculated for the amount of change in individual scores on each scale over the full five years. An additional dichotomous variable was created for the direction of change (down/no change = 0, up = 1) in scores on each scale between Wave 1 and Wave 6.

The variables referring to the amount of change on each scale were found to correlate strongly (around .55) and negatively with scores on the corresponding scales for Wave 1. These high correlations show that scores at the start of the five years were a strong predictor, not only of scores at the end of the period as expected, but of the amount of change that took place in these scores over the full period. Moreover, the negative sign on the correlation shows that declines in both scores were concentrated among respondents who had started this period in jobs with the greatest skill-intensity and task discretion. This impression is reinforced by a comparison of changes in mean score by education level, where the strongest declines were experienced by those who entered the survey period with postgraduate certificates or diplomas, bachelor's degrees and Level III or IV VET certificates. The same pattern is repeated in the changes in score by occupational category, which are examined in Chapter 8.

Sex and age in Wave 1, both variables which could be expected to remain constant over the full six waves, were found to correlate weakly but significantly with the amount of change

in skill-intensity, though only age correlated significantly with change in task discretion. These fixed variables were therefore also retained for modelling.

To track the contribution of compositional change, four dichotomous variables were created to cover whether a respondent was in the same 2-digit occupation in both waves, employed in the same 2-digit industry, working in the same sector (public vs. private, profit-making vs. non-profit) and working under the same kind of employment contract (fixed-term, casual or permanent). Partly to avoid exclusive reliance on dichotomous variables, a fifth, continuous change variable was calculated from change in score on the ANU4 Occupational Status Scale, a continuous ratio scale ranging from 0 to 100 (Jones and McMillan 2001). Scores on this scale in Wave 6 correlated fairly strongly with skill-intensity and less so with task discretion in the same wave (Spearman's  $\rho = .42$  and  $.203$  respectively). However, when change on this scale was correlated against the variables for change in each skill-related scale over the five years, the correlations came down to  $.246$  and  $.118$  respectively.

A series of *t*-tests was carried out to examine the difference in change scores for both skill-intensity and task discretion between the two categories in each of the dichotomous compositional change variables, and revealed highly significant differences ( $.01$  level of significance) on skill-intensity in all four, and on task discretion for three out of the four. The results are set out in Table 7.6 at the end of this chapter. Findings of specific interest were:

- Those respondents who had changed occupation at any time over the six waves experienced a rise in mean score for skill-intensity of  $0.107$ , while those who remained in their original occupations saw a fall of  $0.5347$ . The movements in task discretion for these two groups also ran in opposite directions, with an increase of  $0.4266$  for those who had changed occupations and a fall of  $0.0736$  for those who remained in their original occupations;
- Respondents who had changed industries experienced a rise of  $0.1969$  in skill-intensity and  $0.3904$  in task discretion, while mean scores for those who remained in the same industry fell by  $0.5444$  and  $0.0092$  respectively;
- For those who were on a different kind of contract of employment, the rise was  $0.6305$  for skill-intensity and  $0.5934$  for task discretion, while for those who remained on the same type, the falls were  $0.4494$  and  $0.0485$ ;
- Those who were employed in the same sector saw their mean skill-intensity score fall by  $0.2361$ , while it rose by  $0.1919$  for those who were in a different sector. On this variable the differences for task discretion are non-significant.

While all these movements are quite small in the context of 21-point scales, the findings at least establish the basic point that compositional change in the labour market was significantly associated for individuals with positive changes on both scales, even if it provides only part of the explanation. However, the individual factor associations cannot be taken as conclusive because they should be assumed to be partly the result of interactions with other variables. In an attempt to assess the net contribution of compositional change, two pairs of regressions were undertaken using different types of model.

The first of these consisted of two hierarchical linear regressions using Amount of change in skill-intensity and Amount of change in task discretion as the respective outcome variables. In each of these the Wave 1 scores on both scales, as the predictors which recorded the best gross correlations with the outcome variables, were entered as the first block. These were followed by the other two fixed variables, Age in Wave 1 and Sex, as Block 2, with all five compositional change variables being entered together as Block 3. The final model for change in skill-intensity explained 35.2% of the variance, but the compositional change variables together contributed only 3% to the total variance explained. In the final model containing all the predictor variables, Wave 1 skill-intensity, Age and Change in ANU4 score made statistically significant contributions at the .01 level and Sex at the .05 level, the highest significant Beta coefficients being those for Wave 1 skill-intensity, Change in ANU4 score and Age. The model for task discretion was less satisfactory, accounting for 30.1% of the variance, of which only 0.7% was contributed by the compositional change variables. Statistically significant contributions at the .01 level were made by Wave 1 scores in skill-intensity and task discretion, Age, Sex and Change in ANU4 score. Detailed results of these regressions are shown in Appendix 1 to this chapter.

The second pair of analyses took the form of direct logistic regressions using the same five predictor variables, with Direction of change as the outcome variable (Appendix 2). Both models were significant at the .01 level, the model for skill-intensity correctly predicting 72.4% of cases and that for task discretion 69.8%. The percentage of variance explained ranged from 23.1 to 31.2 for the skill-intensity model and 20.1 to 26.9 for the task discretion model. In the model for skill-intensity four predictor variables made a unique statistically significant contribution: Change of employment sector, Change in ANU4 score, Age and Wave 1 skill-intensity score. Of these the change in employment sector recorded the largest inverse odds ratio of 1.414. In the task discretion model there were also four predictor variables that made a unique statistically significant contribution: change in ANU4 score, Sex, and Wave 1 score on each of the composite scales, with the Wave 1 skill-intensity score recording the highest inverse odds ratio of 1.021.

It should be stressed that these are relatively simple analyses which reveal little about where or how the change actually occurred. However, for the purpose of assessing the present hypothesis, the test required is not demanding. All that is necessary is to establish that there is a statistically significant part of the overall change in skill utilisation which cannot be explained by compositional change, or at any rate by the types of compositional change generally cited in the literature. The analyses just described in fact suggest that hardly any of the change in individuals' scores over the six waves was uniquely attributable to changes in occupation, industry or sector of employment, though the associations with all three remain statistically significant with one exception. They also suggest that gender, one of the factors most commonly cited in the literature to account for unequal skilling outcomes, is unimportant so far as skill-intensity is concerned once the interactions have been controlled for, though it remains a small but significant influence on the amount of task discretion embodied in individuals' jobs. Even when generous allowance is made for their weakness as predictive models, for the unsuitability of many of the available variables to this kind of analysis, and for the limited range of relevant data in the dataset and the limited period it covers, it still seems safe to conclude that a significant element of generic change took place over this period for this population.

To call this change generic is not necessarily to suggest that it applied uniformly across all jobs. Some of it will almost certainly have been a consequence of across-the-board adjustments to a labour market that was steadily approaching full employment, e.g. a greater determination to retain skilled employees. However, it is likely that much of it involved changing trends in work or management practice, the use of technology, etc., which penetrated different industries and occupations to different extents, possibly leaving some untouched, but not sufficiently pervasive or sufficient in their impact even in those where they occurred to make a significant difference to the overall skilling outcomes for each.

It is also possible that mobility actually counteracted the impact of some changes of practice which would otherwise have affected the aggregate outcomes for the population. In other words, there could be industries or occupations where the relevant practices changed in a way which would have had a detectable impact on the mean scores for the population, if only the level of employment in those industries or occupations had remained constant. In such cases, if they exist, it would still be accurate to speak of a compositional effect, but that effect would take the form of net stability at the population level where there would have been change in a more static labour market.

Another possibility is that while changes of occupation, industry or sector were important to the skilfulness of individual respondents' subsequent jobs, these impacts were balanced out by movements in the opposite direction as soon as the individual results were aggregated for analysis – for example, that for everyone who moved to a more skilful job in another industry, there was someone else who moved to a less skilful one.

For just such reasons it is necessary to look specifically at the changes that took place in the skilfulness of individual industries and occupations, and in the balance of employment between more and less skilful industries and occupations, in search of effects that for whatever reason failed to show up in the aggregate outcomes. This will be undertaken in the next two chapters.

### **7.3. Summary and conclusions**

This chapter has addressed two primary questions relating to trends in the overall skilfulness of Australian jobs as represented by the HILDA sample over the period for which data are available:

- whether any statistically significant movements took place in the skill-intensity and task discretion dimensions of skill;
- whether any of this change was generic as opposed to the result of individuals moving between occupations, industries or sectors with different levels of skilfulness.

On the first question, it has been found that statistically significant change occurred both in the relevant variables and in the scales for both constructs over the full 5-year period, and between most individual years. However, the movements were small, generally uneven in magnitude and direction, and mostly in the opposite direction to that expected. There was an overall aggregate downward trend in scores on the skill-intensity scale which appears to

be robust to a variety of methods of estimation and to a range of assumptions concerning the possible impact of sample variability (including non-response) and panel conditioning. The movement in the task discretion scale was much smaller, and its direction differs according to the method of estimation used and the sample on which it is based. For those members of the panel who answered in all waves it rose marginally, but the mean scores for all respondents in Wave 6 remained well below those for the full sample in Wave 1.

The overall movement on both scales was dominated by two events: a large drop in scores on most of the constituent variables in Wave 2, and a sudden rise in Wave 5 which was not sustained into the following wave for most variables. Both these movements need to be treated with caution because they occurred in years with unusually high incidences of non-response on the relevant items. The first also appears to be attributable in part to a response effect, referred to here as the fishtail effect, whereby respondents who gave scores towards the extreme ends of the scale the first time they saw a question reverted to more conservative scores in subsequent waves. The second may be partly due to a different kind of response effect caused by the addition of nine new variables to the relevant sequence in that year. Nevertheless, the same movements did not occur in other variables in the same series which covered different topics, suggesting that if they were indeed artefacts, they were artefacts specific to this set of issues rather than the result of a more generally applying bias.

The true magnitude of these two movements is critical to the interpretation of the data, since between them they more than account for all the change that took place between Waves 1 and 6. It would be tempting to discard the first-wave findings as untrustworthy, following the practice of the US Census Bureau (2007: 24), except that there is no assurance that the Wave 2 findings actually are more reliable. In fact, it can be argued that the Wave 1 sample was the most representative of the population, while Wave 2 and to a lesser extent the two subsequent waves suffered from bias and diminished representativeness due to loss of sample. On balance it seems best for the time being to treat the movement as genuine but remain agnostic about its magnitude. A similar conclusion applies to the apparent spike in Wave 5, with the additional consideration that this movement could turn out to be the start of a more sustained upward trend once more waves of data become available.

The downward trend in skill-intensity appears anomalous in the context of public and industry concerns over the last decade or more about increasing shortages of skill and their impact on competitiveness, and as such deserves further investigation. However, this chapter has probably done about as much as can be achieved with the currently available evidence to probe its causes at the level of aggregates, and further advances in understanding are more likely to result from an examination of how the problem manifested itself across different areas of the economy.

On the second question, the findings appear equally paradoxical. On the one hand it emerged clearly from the analyses that compositional factors were an important influence on the amount of skill which respondents exercised in their jobs, and more interestingly, that those who had changed their industry, occupation or sector of employment had far more positive experiences in this regard than those who remained in their original area of employment. On the other hand, once interactions were controlled for, the regressions showed only a very weak influence of such job change on individual skill trajectories over the full period. Once again this second finding needs to be treated with some reservation in

view of the limited power of the analyses used, but this matter too clearly demands further investigation. As with the first paradox, this is probably best achieved by micro-analysis to track the experience of individuals or specific areas of the labour market rather than by continued attention to the aggregate figures which may have been shaped by contradictory trends.

A surprising finding from this part of the analysis was that while scores on both scales over the full period were primarily determined by the Wave 1 score, the determination worked in the opposite direction to what might be expected. Those who had higher scores at the beginning generally appear to have experienced a decline over the five years, while those with low initial scores saw an increase. This could conceivably be the result of a gradual convergence of scores on the mean which is apparent across most of the relevant variables, possibly reflecting a different kind of panel conditioning from the original fishtail effect, rather than evidence of a genuine trend towards homogenisation in these aspects of work. However, specific evidence from the trajectories of individual industries and levels of qualification appears to confirm the existence of a real trend. On first sight this looks like evidence against the polarisation hypothesis, but other evidence to be introduced in Chapter 9 contradicts this view.

The general inconclusiveness of the findings in this chapter must be seen in large measure as a consequence of having to work with such a short run of microdata, without even sketchy evidence of the longer-term patterns in which it might be embedded. The kinds of relatively static trend observed over most of this period, and indeed the apparent anomalies at either end, could in principle be interpreted with equal credibility as part of a longer-term trend of stability, the end of an earlier change trend in either direction, the prelude to a future change trend, or an anomalous and largely fortuitous interlude in which apparent trends were visible in a more chaotic long-term pattern.

In this sense it is necessary to bear in mind how much of the interpretation of what happened over this period depends on the starting point one chooses. It is simple chance, in other words arbitrary in a methodological sense, that the survey happened to start in 2001. One is tempted, again, to speculate whether the findings would have been different had 2002 been the initial wave. But this argument overlooks the strong likelihood that what are now the Wave 2 findings, and the changes observable between that and the immediately following wave, would themselves have looked very different had they rather than Wave 1 been subject to the fishtail effect, and had they enjoyed the benefit of the full designed sample. The bottom line is that these questions cannot be resolved until enough additional waves of data become available for analysis. Pending that, the only choice concerns how to make the most informative use of the admittedly inconclusive data which are now available.

On the other hand, the limited change observable in these data may be sending a real and valuable message about how much change can actually be expected over such a short period. No previous research has been done on skill-related issues using such frequently refreshed population-level microdata, and little is known about how rapidly the qualitative characteristics of employment adjust to changes in the labour market. If employment characteristics lag behind broader changes in the economy in the way employment itself is recognised to do, then it may take much longer than five years for rational patterns to emerge.

Thus, though there is no compelling methodological reason to choose five years as a meaningful period over which to look for significant change, there is equally no reason to expect any gain in certainty from choosing a shorter period to study because of questions over the reliability of the initial wave of data. With so few years available to choose between, it makes sense to go for the longest possible distance between end points in the hope that this will increase the likelihood of ironing out chance fluctuations. At the same time the conundrum must be faced that most year-on-year changes over this timeframe are likely to be chance fluctuations due to random variation or one-off events, but some will be significant events whose significance will become apparent only once more years of data are available to identify the trend they signalled.

This entails a compromise approach. On the one hand it is important to flag apparently meaningful changes in the year-on-year figures when they appear, even if their actual significance (if any) is not yet clear. On the other, when it comes to identifying cross-sectional changes, the effort may be better spent on comparisons at longer intervals where there can be slightly more confidence that the change identified will be real enough to be worth studying. The five-year period fortuitously offered by the current dataset does offer real methodological advantages for this kind of study: firstly because it corresponds to the average gap between runs of the UK surveys, which have regularly revealed significant change over that period; secondly because both those years were Census years, providing an opportunity to rebalance the findings to the true occupational composition of the working population. The latter is the strongest argument for adopting that approach to analysis in the two chapters which follow.

**Table 7. 6**  
**Independent samples *t*-tests to test impact of job change on individual scores**

*Test 1: Changed occupation (2-digit) between Wave 1 and Wave 6*

	N	Mean change, skill-intensity score, Wave 1-Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	2270	0.1070	4.66	0.6507	5.326	4815.049	.000
No	2233	-0.5437	3.46				
	N	Mean change, task discretion score, Wave 1-Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	2274	0.4266	5.16	0.5002	3.533	4400.444	.000
No	2242	-0.0736	4.32				

\*Estimates based on non-equal variances. Levene's test is significant at .01.

*Test 2: Changed industry of employment (2-digit) between Wave 1 and Wave 6*

	N	Mean change, skill-intensity score, Wave 1-Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1971	0.1969	4.75	0.74125	5.799	3513.782	.000
No	2400	-0.5444	3.5				
	N	Mean change, task discretion score, Wave 1-Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1980	0.3904	5.25	0.3996	2.728	3810.649	.006
No	2504	-0.0092	4.34				

\*Estimates based on non-equal variances. Levene's test is significant at .01.

*Test 3: Changed sector of employment contract (public/private/NGO) between Wave 1 and Wave 6*

	N	Mean change, skill-intensity score, Wave 1- Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1105	0.1919	4.32	0.42792	2.87	3759	.004
No	2656	-0.2361	4.10				
	N	Mean change, task discretion score, Wave 1- Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1105	0.2100	4.92	-0.18607	-1.08	3767	.280
No	2664	0.3960	4.77				

\*Estimates based on equal variances. Levene's test is non-significant at .05.

*Test 4: Changed form of employment contract between Wave 1 and Wave 6*

	N	Mean change, skill-intensity score, Wave 1- Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1115	0.6305	5.04	1.07989	6.43	1667.297	.000
No	2421	-0.4494	3.63				
	N	Mean change, task discretion score, Wave 1- Wave 6	SD	Mean difference	<i>t</i> *	df	Significance (2-tailed)
Yes	1114	0.5934	5.04	0.64188	3.627	1971.525	.000
No	2432	-0.0485	4.55				

\*Estimates based on non-equal variances. Levene's test is significant at .01.

## Appendix 1

### Results of multiple regressions

Two multiple hierarchical regressions were carried out using, respectively, change in skill-intensity score between Wave 1 and Wave 6 (regression 1) and change in task discretion score between the same two waves (regression 2) as the dependent variable. The same predictor variables were entered in both regressions in three steps. The predictors entered in Step 1 were those found to have the highest correlation with the dependent variable: Wave 1 skill-intensity score and Wave 1 task discretion score. These were followed in Step 2 by Sex and Age in Wave 1. In step 3 the five compositional variables covering changes between Wave 1 and Wave 6 were entered in a single block: four dummy variables for change of occupation, change in industry of employment, change in sector of employment and change in type of employment contract (change = 0, no change = 1), together with one continuous variable, gain on the ANU4 Occupational Status Scale.

#### Regression 1

The coefficients for the predictor variables in each of the three models are shown below.

Model		B	Std error	Beta	t	Sig
1	(Constant)	7.434	.221		33.586	.000
	W1 skill-intensity	-.525	.014	-.549	-37.384	.000
	W1 task discretion	-.022	.012	-.026	-1.804	.071
2	(Constant)	8.610	.318		27.118	.000
	W1 skill-intensity	-.526	.014	-.550	-38.874	.000
	W1 task discretion	-.005	.012	-.006	-.390	.697
	Age last birthday, Wave 1	-.027	.003	-.114	-8.101	.000
	Sex	-.141	.116	-.017	-1.210	.226
3	(Constant)	8.678	.342		25.391	.000
	W1 skill-intensity	-.516	.014	-.540	-37.361	.000
	W1 task discretion	.002	.012	.002	.139	.890
	Age last birthday, Wave 1	-.023	.003	-.099	-6.831	.000
	Sex	-.260	.115	-.031	-2.256	.024
	Change of occupation*	.149	.122	.018	1.223	.221
	Change of industry*	.216	.125	.026	1.735	.083
	Changed employment sector*	-.645	.127	-.070	-5.100	.000
	Changed employment contract*	-.094	.126	-.011	-.747	.455
Gain on ANU4 scale	.039	.003	.159	11.420	.000	

\*Effectively reverse-scored (true variable = "same both waves")

Model 1 explained 31% of the variance, with Model 2 accounting for a further 1.3% and Model 3 an additional 3%. All three contributions were statistically significant at the .01 level. The full model accounted for 35.2% of the variance and was likewise significant  $p < .001$ . In the final model, the statistically significant predictors at the .01 level were Wave 1 skill-intensity, change in sector of employment and age, while sex was significant

at the .05 level. The strongest predictor, based on its beta coefficient, was score on the same scale in Wave 1, followed by gain on the ANU4 scale, and age.

### Regression 2

Model		B	Std error	Beta	t	Sig
1	(Constant)	6.584	.259		25.435	.000
	W1 skill-intensity	.037	.016	.033	2.252	.024
	W1 task discretion	-.533	.014	-.555	-37.974	.000
2	(Constant)	7.188	.374		19.235	.000
	W1 skill-intensity	.030	.016	.027	1.874	.061
	W1 task discretion	-.544	.014	-.566	-38.109	.000
	Age last birthday, Wave 1	.011	.004	.039	2.700	.007
	Sex	-.557	.137	-.058	-4.066	.000
3	(Constant)	6.696	.409		16.354	.000
	W1 skill-intensity	.047	.017	.042	2.850	.004
	W1 task discretion	-.541	.014	-.563	-38.044	.000
	Age last birthday, Wave 1	.017	.004	.061	4.054	.000
	Sex	-.556	.138	-.057	-4.033	.000
	Change of occupation*	-.163	.146	-.017	-1.118	.264
	Change of industry*	-.076	.149	-.008	-.510	.610
	Changed employment sector*	.260	.152	.024	1.717	.086
	Changed employment contract*	-.215	.151	-.021	-1.419	.156
Gain on ANU4 scale	.021	.004	.076	5.276	.000	

\*Effectively reverse-scored (true variable = "same both waves")

Model 1 explained 29.8% of the variance, with Model 2 contributing a further 0.5% and Model 3 another 0.7% for a total of 30.9%. All three contributions were once again significant at the .01 level, as was the final model. In the final model, Wave 1 scores on both scales were significant predictors at the .01 level, as were age, sex and gain/loss on the ANU4 scale. Once gain, the Beta coefficients showed Wave 1 score on the same scale (i.e. task discretion) as by far the strongest predictor, with the next highest coefficients being recorded by change in ANU4 score, age, sex and Wave 1 skill-intensity score.

## Appendix 2

### Results of logistic regressions

Two binary logistic regressions were carried out to test predictors of whether individual respondents' scores on the skill-intensity and task discretion scales would rise or fall between Wave 1 and Wave 6. The dependent variable for regression 1 was direction of change in skill-intensity score (down or no change = 0, up = 1). For regression 2 it was direction of change in task discretion score, identically coded. The categorical predictor variables tested in each case were sex, whether the respondent was employed in the same 2-digit industry in both waves (Sameind 2), whether s/he was in the same 2-digit occupation in both waves (Sameocc2), whether s/he was employed in the same sector (private, public, community/NGO) (Samesector), and whether s/he was employed under the same kind of employment contract (Samecontract). A change in any of these employment characteristics was scored as 0, and no change as 1. Continuous variables tested were age in Wave 1 (ahhiage) and gain/loss in score on the ANU4 Occupational Status Scale between Waves 1 and 6.

#### Regression 3

The full model containing all test variables was significant at the .01 level,  $\chi^2 = 163.8$ . It correctly predicted 90.5% of rises in skill-intensity and 24% of falls, or 64% overall. However, this compares with 60.2% for the baseline model, suggesting little real gain in predictive value, and the model as a whole explained only between 4.6% (Cox and Snell  $R^2$ ) and 6.2% (Nagelkerke  $R^2$ ) of the variance. Of the variables tested, only change in employment contract, age and gain on the ANU4 scale were significant at the .01 level, while change in industry and change in sector were significant at .05.

	B	S.E.	Wald	df	Sig.	Odds ratio	Inverse odds ratio
Sameocc2(1)	.107	.086	1.558	1	.212	1.113	
Sameind2(1)	.066	.087	.577	1	.447	1.068	
Samesector(1)	-.346	.088	15.324	1	.000	.707	1.414
Samecontr(1)	-.126	.089	1.990	1	.158	.882	1.134
GainANU4	.015	.003	35.467	1	.000	1.015	
sex(1)	-.129	.081	2.524	1	.112	.879	1.138
ahhiage	-.013	.004	11.235	1	.001	.987	1.013
askill	-.274	.012	535.392	1	.000	.761	1.314
atask	.004	.009	.144	1	.704	1.004	
Constant	4.120	.240	293.567	1	.000	61.562	

*Regression 4*

The full model containing all test variables was significant at the .01 level,  $\chi^2 = 777.363$ . It correctly predicted 60.7% of rises in task discretion and 77.2% of falls, amounting to 69.8% of all cases. This is a clear improvement over the 55.3% of cases accurately predicted by the baseline model. The model explained between 20.1% (Cox and Snell  $R^2$ ) and 26.9% (Nagelkerke  $R^2$ ) of the variance. Of the variables tested, only change in employment contract, age and gain on the ANU4 scale were significant at the .01 level, while change in industry and change in sector were significant at .05.

	B	S.E.	Wald	df	Sig.	Odds ratio	Inverse odds ratio
Sameocc2(1)	-.110	.083	1.756	1	.185	.896	1.116
Sameind2(1)	-.147	.085	3.021	1	.082	.863	1.159
Samesector(1)	.093	.086	1.172	1	.279	1.097	
Samecontr(1)	-.018	.087	.042	1	.837	.982	1.018
GainANU4	.006	.002	7.528	1	.006	1.006	
sex(1)	-.203	.079	6.663	1	.010	.816	1.225
ahhiage	.000	.004	.000	1	.998	1.000	
askill	.021	.010	4.608	1	.032	1.021	
atask	-.240	.010	549.104	1	.000	.787	1.271
Constant	2.521	.219	132.853	1	.000	12.437	

## Chapter 8

### Skill change at the industry and occupation level

This chapter examines the second of the change mechanisms proposed in Chapter 6, whereby existing jobs in an industry, occupation or industry/occupation cell are replaced or supplemented by new ones involving more skill, learning or task discretion. Such changes can have important long-term repercussions but remain undetectable for some time within the aggregate figures, for example because contrary trends in different occupations balance each other out. This aspect of skill change sits halfway between compositional and generic change as traditionally understood: it affects specific areas of the labour market differentially, but would occur even if everyone in the employed workforce remained in their original industry or occupation. Change due to shifts in the balance of employment between industries and occupations, i.e. compositional change in the true sense, will be examined in Chapter 9.

The data quality requirements for this purpose are not the same as for the analysis of overall and generic change in Chapter 7. The crucial requirement is that the sample should provide a representative coverage of each industry and occupation in every wave, but not that the same respondents be in each cell from wave to wave. Occupational mobility is a normal feature of the labour market and part of the process by which industries and occupations adjust internally to meet changing requirements, meaning that no accuracy is lost if the sample retains the same feature. Thus, variations in the sample from year to year due to attrition and non-response will not compromise the reliability of the findings unless they can be shown to affect individual occupations or industries non-randomly. Similarly, the method of analysis needs to concentrate on a cross-sectional picture of each industry and each occupation in each wave, rather than tracking individuals' trajectory through them, which is really a more relevant issue to the experience of the representative member of the labour force (Chapter 7) and the evolving composition of the labour market (Chapter 9). Consistent with the argument set out at the end of Chapter 7, the analysis here will concentrate on changes that took place between the two end years, 2001 and 2006.

As was pointed out in Chapter 4, HILDA offers limited potential for this kind of analysis because the data for both industry and occupation are not available for public access at any level of disaggregation beyond two digits. Even if they were, the overall size of the employed sample means that many cell sizes at the 3- or 4-digit level would be too small to permit valid inference. Many developments of the kind that ultimately influence the direction of the NSS – notably innovation and productivity improvement – originate in a single firm or cluster of firms, and may initially make little difference to the aggregate statistics for the 2-digit industry in which they are located. Such changes also, to the extent that they are specific to a firm or cluster of firms, have an impact on skilling that runs across a number of occupations but may make little overall difference to the aggregate outcomes for any one of them. Even when the change is systemic, i.e. results from the emergence or dynamic of a sectoral skilling or innovation system, such systems typically coalesce around a supply chain that crosses even the broad industry classifications (Malerba 2005), making its impact harder to isolate. The coarser

the disaggregation, the less likely it is that such emergent changes will become evident over a short period.

For that reason the present analysis must be seen only as a beginning, and any effects it shows up are likely to represent only a small sample of the similar change processes that are in progress, but for the most part still invisible to analysis at the 2-digit level. The lack of specificity in these employee-derived data also means that even those trends which do emerge will be difficult to pinpoint and explain without complementary industry-derived data such as will be available when the ABS Business Longitudinal Dataset is released.

## 8.1. Changes in skill by occupation

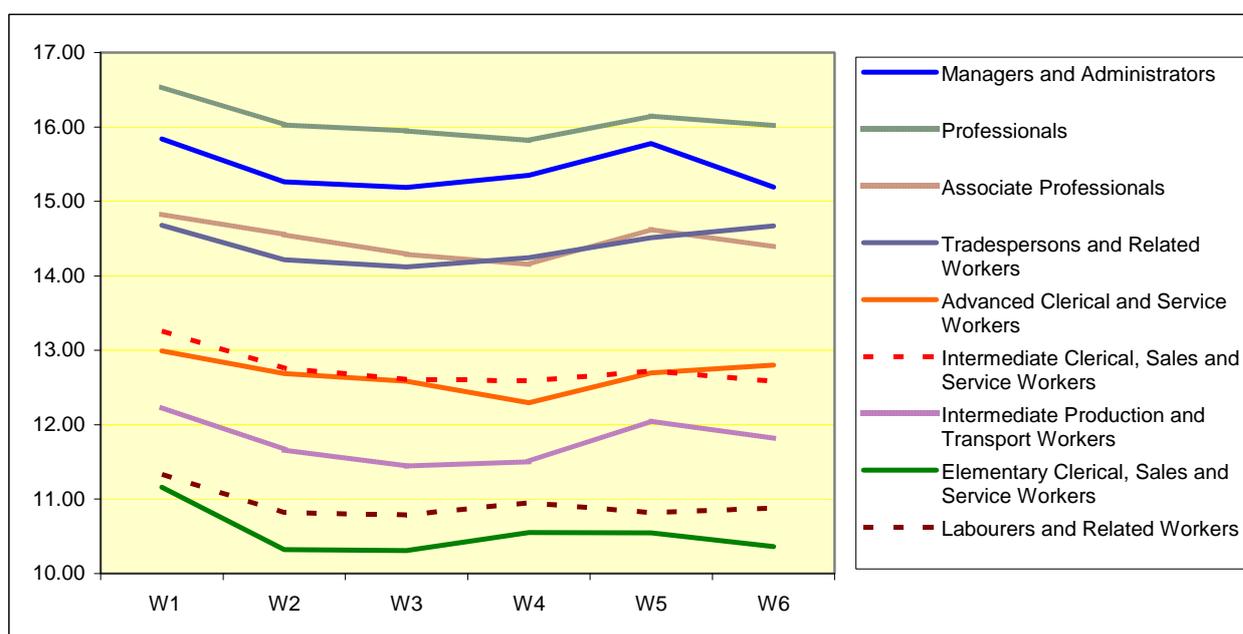
It was found in Chapter 7 that a respondent's 2-digit occupation correlated more strongly with skill-intensity score than any of the other predictor variables that were tried. Its correlation (Spearman's  $\rho$ ) in each of Waves 1 and 6 exceeded .4, and it also achieved a correlation with task discretion better than .3. Change of occupation at any time over the six waves was also associated with rises in both skill-intensity and task discretion, whereas the scores of respondents who remained in the same occupation fell. This association was confirmed by both regressions, but the unique contribution made by occupational change to skill change was small and in the case of task discretion, statistically significant only when measured through the proxy of the ANU4 Occupational Status Scale. Together these results suggest that overall scores were at least as likely to have been affected by changes in the skill requirements of individual occupations as they were by movement between occupations.

Skill can logically be expected to correlate with occupation in any case because the 1-digit level of ASCO was explicitly designed as a hierarchy of skill, as explained in Chapter 3. Thus a movement up or down the 1-digit hierarchy should be automatically associated with a change in the amount of skill exercised by an individual. Where an individual remained in the same 1-digit category, the amount of skill exercised should have remained broadly the same unless the respondent had moved to a different type of work within that broad category, with a different technical content (i.e. a different occupation at the same level). Any growth or decline in the average skill-intensity of any one occupational group could be evidence of a change in the nature of work specific to that occupational level, or at any rate to a significant proportion of the 2-digit occupations making up the major category. Alternatively, if the average skill-intensity score of individuals in any major occupational category increases over time without a change of occupation, it may be evidence that the skill deepening model described in Section 3.2 applies in that category. These are different hypotheses, and will be tested separately below, starting with the first.

### 8.1.1. Generic changes affecting occupations

Figure 8.1, which tracks the mean scores on each scale for all respondents who were in each occupation in the wave concerned, shows that the major occupational categories fell into two clear bands of skill-intensity. Managers, Professionals, Associate Professionals and Tradespersons formed the upper band with scores moving between around 14.5 and 16.5, while Advanced Clerical & Service Workers, Intermediate and Elementary Clerical, Sales & Service Workers, Intermediate Production & Transport Workers and Labourers made up the lower

band where scores ranged over the six waves between just over 13 and a little over 10. The relativities between these bands did not change notably over the full period, and even within the bands the relative positions of the major categories remained mostly unaltered, the only interesting trend being that by Wave 6 Tradespersons had overtaken Associate Professionals and appeared to be on a converging course with Managers. They were also the only category to show a consistent rising trend, at least from Wave 2 onwards. Throughout the period Professionals maintained their position at the top of the list and Elementary Clerical, Sales & Service workers theirs at the bottom, with little sign of convergence. Scores for all occupations show evidence of the overall drop in means in Wave 2, and all except Tradespersons and Labourers show at least a small peak in Wave 5 and a subsequent drop-off.

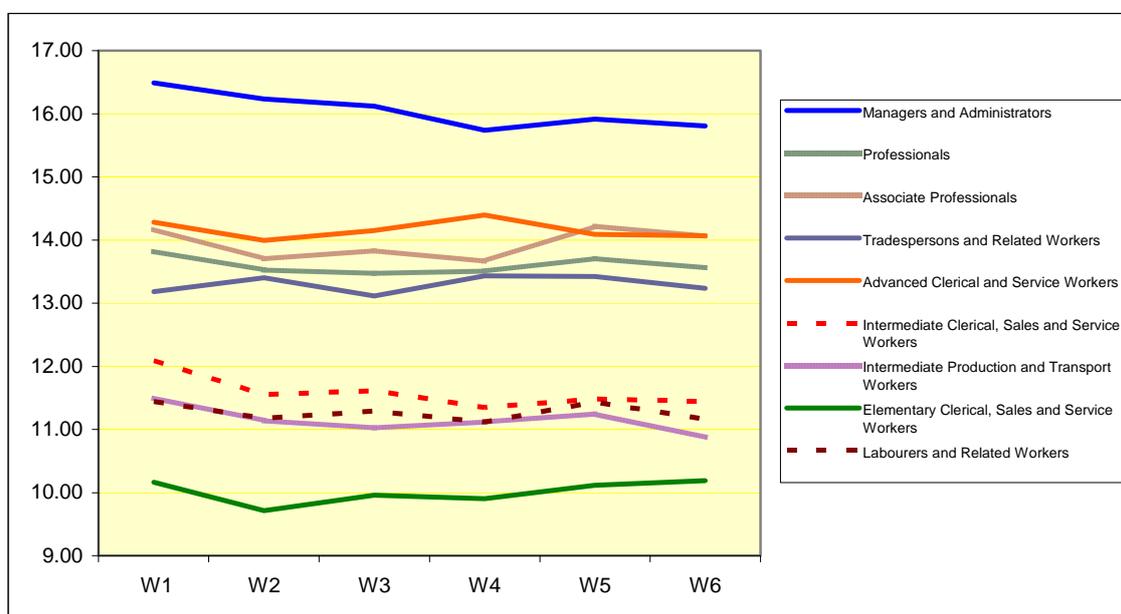


**Figure 8.1**  
**Mean scores, skill-intensity, by 1-digit ASCO, Waves 1-6**

Figure 8.2 repeats the exercise for task discretion. The picture here is broadly similar but shows a less even dispersion. Managers and Elementary Clerical, Sales & Service Workers appear as outliers at either end of the scale, while two bands, each even more tightly clustered than in the skill-intensity graph, can be identified in the middle, with the gap between them once again remaining broadly constant. The main point of interest is that Professionals, the highest-ranking group on skill-intensity, are now well down towards the bottom of the upper band, below Associate Professionals and Advanced Clerical & Service Workers, who score better than anyone except Managers.

The clearest trends appear at either end of the scale, with Managers showing the most consistent falling trend (paralleled, to a lesser extent, by Intermediate Production & Transport Workers), and Elementary Clerical, Sales & Service Workers being the only group to show a consistent if very small rise across the last five waves. As with the aggregate scores, the

movements in Waves 2 and 5 are still evident but much less marked and less consistent: Tradespersons actually increased their mean score in Wave 2, while the mean for Advanced Clerical & Service Workers dropped in Wave 5.



**Figure 8.2**  
**Mean scores, task discretion, by 1-digit ASCO, Waves 1-6**

Two conclusions begin to emerge from this initial comparison. The first is that very little of the change in aggregate scores over the six waves (small though that was) can be attributed to changes in the skilfulness of any one major occupational group. This impression was reinforced when a one-way ANOVA was carried out on those respondents who were still in the same group in Wave 6 as they had been in Wave 1 – admittedly a much smaller sample - and revealed that the association between 1-digit occupation and change in score on either scale was non-significant even at the .05 level. However, any such conclusion must be subject to the same qualification that was expressed at the end of Chapter 7, namely that it may be unrealistic to expect a significant shift in rankings at this level of disaggregation over such a relatively short period. Some of the trends apparent on both graphs, if prolonged over a decade or more, could well result in an interesting realignment, perhaps with consequences for the overall amount of skill exercised in the economy. Of course, only time will show whether any of these apparent trends eventually reach statistically, let alone ecologically significant proportions.

The second conclusion is that the association between skill-intensity and task discretion appears far from robust at the level of individual occupations. The relatively poor experience of Professionals, the most skill-intensive group of occupations by a large margin, and the relatively good position of labourers who have conventionally been seen as standing at the bottom of the skill hierarchy, both suggest that task discretion at this level of generality must be allocated on some criterion other than, or besides, the amount of skill exercised. Against this must be set the evidence for task discretion, as for skill-intensity, of two clearly separated bands of scores, with no sign of convergence between them and only one group, Advanced

Clerical & Service Workers, finding itself on a different side of that divide where skill-intensity is concerned.

A methodological point raised by these findings is that the drop in Wave 2 scores, and to a lesser extent the peak in Wave 5, are repeated across nearly all major occupational groups. This adds to the concerns expressed in Chapter 7 that at least part of both movements may be the result of a generic response effect rather than a real event which, even if generic in its impact, might be expected to influence mean scores decisively in some occupations but not in others.

Perhaps predictably, a more confused pattern appears when the data are analysed at the 2-digit level. For this purpose, rather than use movements in raw score, the mean score for each occupational group in later waves was indexed against the Wave 1 score for the same occupation, allowing change to be assessed in proportion to the specific distribution of scores for the occupation concerned. This adjustment, together with finer disaggregation, reveals that the movements at either end of the range were more evenly shared between occupational levels than the 1-digit aggregates suggest.

The highest percentage increase in skill-intensity was recorded by Health & Welfare Associate Professionals at 4.83%, followed by Automotive Tradespersons at 2.23%. Science, Building & Engineering Professionals were the only profession to record an increase in mean skill-intensity, a very marginal 0.08%. These three occupations, along with Construction Tradespersons, Food Tradespersons and Cleaners, were the only ones out of 35 in this classification (excluding cells with fewer than 20 observations in either year) whose skill-intensity increased at all. The largest drop was recorded by Elementary Clerks at 22.6%, followed by Intermediate Sales & Related Workers, Factory Labourers, Other Associate Professionals and Generalist Managers. All professions except Science, Building & Engineering and Business & Information experienced decreases exceeding the all-occupations mean of 3.08%.

The rankings of occupations in either year show a more intuitive relationship with reputational skill levels. Health and Education Professionals retained their position as the most skill-intensive occupations over both waves, while cleaners remained at the bottom of the list, a full standard deviation below the all-occupations mean. By Wave 6 another three occupations had joined the top bracket, more than half a standard deviation above the all-occupations mean, but only one of these – Automotive Tradespersons - was not a profession. All professions, in both waves, remained more than a quarter of a standard deviation above the overall mean, while all occupations at the bottom two levels in the 1-digit hierarchy remained at least the same distance below it.

Together these scores suggest that skill-intensity remains a reasonably good proxy for the broader concept of skill embodied in ASCO, and by implication, that the alignment model of skill described in Chapter 3 was a reasonably good fit to the Australian labour market over this period. Credible explanations can be suggested for some of the exceptions just listed, notably the case of Automotive Tradespersons whose skills would have been stretched over this period by a tightening of pollution controls on new vehicles and the virtually universal shift among car makers to computerised engine management systems. However, it needs to be borne in

mind that 2-digit remains a fairly coarse level of disaggregation, and some of the most interesting movements in terms of the NSS model may have taken place in 3- or 4-digit occupations and been concealed by stability or contrary movements in the 2-digit aggregates. Another caution is that some of the lower occupational mean scores could be at least partly due to respondents in the occupations with the lowest reputational skill content not recognising the competencies they exercised in their jobs as skills.

Once again, the picture becomes much less straightforward when task discretion is taken into account. Movements on this scale appear to be logically unrelated to occupational level, skill-intensity or any other single factor. The highest growth was experienced by Elementary Clerks, the same group who reported the largest fall in skill-intensity. Tradespersons were generally more likely to be among the occupations which saw a growth in task discretion, and "intermediate" classifications among those which experienced the largest reductions, with the two lowest-skilled 1-digit categories mostly coming somewhere in the middle of the range. The only professionals not to report a decline in task discretion were Science, Building & Engineering Professionals. Professionals generally moved down two or three places in the ranking, while most Tradespersons moved up by the same amount.

The extent of the discrepancy between the two dimensions, and the way it varies across occupations, is clear in Table 8.1 on the next page, which compares the rankings of the top and bottom occupations for skill-intensity (respectively half a standard deviation above and below the Wave 6 mean) on various aspects of task discretion. The more sensitive extended task discretion scale available for Wave 6 is used as the basis for ranking, along with two of the sub-scales made possible by the new questions.

This table is notable for the number of anomalies it contains. Four out of the five most skill-intensive occupations are ranked below the least skill-intensive one on extended task discretion and time control, with the second most skill-intensive occupation coming lowest of all on time control. In the case of the top-scoring occupation, Health Professionals, the surprise is rather the relatively small amount of control which practitioners feel they exercise over the content of their work, a concern they appear to share with paraprofessionals in the same industry. Within the top professions, the contrast is stark between Education and Health on the one hand, and Science, Building & Engineering on the other. Most of the occupations with really low skill-intensity scores are closer to the task-discretion rank one might instinctively expect, but several are pulled up towards the middle of the ranking by relatively high scores on time control. Only Factory Labourers show the full degree of correspondence between the two dimensions of skill that would be expected if these co-varied to any significant extent.

**Table 8.1**  
**Task discretion rankings, Wave 6, occupations with highest and lowest skill-intensity scores**

	<i>Mean skill-intensity Wave 6</i>	<b>Extended task discretion</b>	<b>Job content discretion</b>	<b>Time control</b>
<b>Highest skill-intensity</b>				
Health professionals	<i>16.48</i>	29	21	23
Education professionals	<i>16.31</i>	27	11	35
Science, building & engineering professionals	<i>16.25</i>	3	4	3
Health & welfare associate professionals	<i>16.01</i>	20	18	21
Automotive tradespersons	<i>15.94</i>	21	14	26
<b>Lowest skill-intensity</b>				
Factory labourers	<i>10.83</i>	34	34	34
Road & rail transport drivers	<i>10.76</i>	28	31	29
Elementary service workers	<i>10.57</i>	31	28	19
Elementary sales workers	<i>10.39</i>	33	32	27
Elementary clerks	<i>9.64</i>	32	33	22
Cleaners	<i>9.43</i>	18	29	16

The table illustrates two points made earlier about task discretion. The first is that the time-related aspects of task discretion appear to be distributed very differently from the more content-related aspects. This is especially clear in the contrasting cases of Education Professionals, whose overall rating on task discretion would be far higher if the only criterion were control over the content of their work and the manner of their working, and of Cleaners whose overall rank is much higher than might be expected, simply because they tend to work under conditions where their use of time is not closely controlled or monitored. The second is the extent to which the amount of task discretion in an occupation is determined both by the nature of the work and by the form of work organisation under which it takes place, before skill even comes into the calculation. Thus teachers in the public education system, or health professionals working in hospitals or other large bureaucratically structured organisations, might feel constrained in the exercise of their skills if they work under highly structured and authoritarian management structures, whereas cleaners might credibly feel themselves to have more freedom if they work in small teams, outside their clients' working time, and with little direct supervision (Form 1987: 31). The question is how far these constraints or freedoms are an inevitable consequence of the client base or the event-driven nature of the work, and how far they result from contingent conventions and/or conscious decisions on how those kinds of labour are deployed.

As with skill-intensity, and arguably to a greater extent, it must also be kept in mind that perceived task discretion is essentially a matter of match between experience and expectations. Where an occupation or industry has a long-standing culture of autonomy or worker involvement in decision-making, small encroachments on these rights are likely to be noticed

even where they would be considered acceptable in a more hierarchically organised form of work. Conversely, workers who have been used all their working life to intensive direction may react positively to concessions to “empowerment” that would be viewed as token elsewhere. Employees who value their professional standing or are used to being respected for their expertise are more likely to see new forms of bureaucracy or managerial control as restricting the effective application of their skills than those who have become used to regarding their jobs as dispensable and themselves as unskilled, or those who have traditionally seen it as appropriate to exercise their input to decisions concerning the organisation of their work through the intermediary of their union in formal agreement negotiations.

This is not to say that task discretion as measured here is an imagined concept, or that changes of direction in this regard lack a practical referent. The impact of such changes in practice on morale and motivation, and hence on productivity, may well be anything but illusory. But this consideration reinforces the point made in Chapters 3 and 6 that purely cross-sectional comparisons between industries and occupations do not necessarily compare like with like, and should not be treated as if the figures referred to different quanta of a uniform commodity.

### **8.1.2. Change due to skill deepening**

An alternative or supplementary explanation for rising scores, where a respondent has remained in the same 1-digit category over the five years, is that workers gain both the capacity and the opportunity to exercise more skill as they learn on the job. This is the skill deepening model described in Section 3.2.1, which presupposes that skill development is not wholly determined by position in the occupational or qualifications hierarchy, but is possible at all levels in the workforce. The reason for testing the model separately at the different levels in the ASCO hierarchy is that its importance can be expected to vary with the formal skill content of an occupation, and the nature of the relationship between the two sources of skill development is not obvious in advance. In one view, informal learning is a substitute for formal learning, implying that this kind of skill development will be more likely to occur, and will assume higher relative importance, at levels in the workforce where little formal pre-employment training takes place. The alternative view is that the two forms of learning are complements, so that more informal learning can be expected to occur where it rests on a basis of a long and demanding formal pre-employment training.

The test of the basic model is that within each major category there should be a positive and statistically significant correlation between years worked in occupation and scores on both skill-intensity and task discretion: that is, for each year worked there should be an increase in score on both scales which, even if small, is greater than would be expected to occur by chance. It is important to measure both scales, bearing in mind the premise in Chapter 3 that the two constructs are complementary and neither measures skill in its own right. If the skill content of an individual job grows only gradually over time, keeping pace with growth in the individual's competence, the process will not necessarily be perceived by the worker as either learning or a more difficult job, but may be perceived as an increase in responsibility or autonomy. The issue of whether such informal development is a substitute or a complement for formal pre-employment training can be resolved to some extent, albeit impressionistically, by comparing the strength of the correlation at different levels in the occupational hierarchy.

Using the Wave 6 sample as a base for this analysis, a positive correlation exceeding .1 was found between occupational tenure and scores on both scales for that year across all employed respondents. Disaggregating the result by 1-digit occupation produced the strongest Pearson correlations with skill-intensity for Managers & Administrators (-.131), Tradespersons (-.129) and Intermediate Production & Transport Workers (.145). All three were significant at the .01 level, but for the first two categories the correlation was negative. None of the other categories recorded any statistically significant correlation. For task discretion the correlations were generally stronger and more positive, ranging as high as .302 for Tradespersons. The only negative correlations with task discretion, recorded by Professionals and Associate Professionals, were non-significant.

While reasonably persuasive, these figures need to be viewed with the qualification that part of the effect could simply represent the initial learning time required when someone first enters an occupation. To control for this, a sub-sample was analysed excluding respondents who had been in their occupation for less than two years, the time used in the UK Skills Surveys to mark the threshold of the top band for on-the-job learning time required to become fully proficient. Once this assumed initial learning phase was excluded, some of the strongest correlations – positive as well as negative – actually rose. With skill-intensity, the figure for Tradespersons was -.142 as against -.129 for the full sample, consistent with a diminishing positive impact from the initial learning component. However, for Intermediate Production & Transport Workers the positive correlation grew from .145 to .153. Elementary Clerical, Sales & Service Workers also achieved a positive correlation within the target range (.108, significant at the .05 level, as against a non-significant .046), perhaps indicating that skill deepening in this group is more common once one discounts the short-term attachments which are many young workers' only experience of this level of employment. On the other hand, correlations with task discretion were generally less strong, except for Managers & Administrators, where the figure rose from .218 to .237.

A second sub-sample was constructed, this time including only those who had been in their occupation five years or longer, to examine whether there was any mid- or late-career effect for workers who could be considered fully established in their occupations. Some of the strongest correlations were even more pronounced for this sub-sample, the positive correlation with skill-intensity for Elementary Clerical, Sales & Service Workers coming out at .162. Conversely, the negative correlation for Tradespersons rose again to -.151, while with task discretion their correlation fell to .128, though still remaining positive and significant at the .01 level. Managers followed the same pattern as in the other two analyses, a negative correlation with skill-intensity (this time significant only at the .05 level) and a positive correlation with task discretion of just over .2, very little changed from the figure for their division in the full sample. Most of the correlations for the other occupational levels were now non-significant on both scales, though Associate Professionals for the first time showed a significant (.05), negative correlation with task discretion.

Since many of these changes appear to show the influence of a learning effect, each occupation was checked for differences in mean score on NUSKILLS between those who had been in their occupation less than a year, less than two years, and five years or longer. For the three top levels in the occupational hierarchy, the stability of scores across the three groups was

remarkable. They varied by only 0.02 in the case of professionals, 0.03 for managers and 0.05 for associate professionals, suggesting in each case an extended period of learning well into their careers rather than a brief initial phase of getting up to speed. Tradespersons' scores in the first two years are higher than for associate professionals, but they drop off sharply for the 5-year plus group (mean 4.58, as opposed to 4.74 in the first year and 4.69 in the first two years). For the two lowest-skilled categories, there was a fall of around 0.1 after the first year and a somewhat larger one for the 5-year plus group, bringing the mean score for Elementary Clerical, Sales & Service workers down from an already low 3.41 (i.e. marginally disagree) in the first year to 3.20 in the fifth and beyond. These figures on the surface appear hard to reconcile with the positive correlation between years of experience and skill-intensity for this group, especially as the correlation appears to increase with time in occupation. One possible explanation, already raised above, is that workers at this level in the hierarchy may be less likely to think of the competencies they exercise in their job as skill, or of the processes by which they are developed as learning.

If these results show nothing else, they certainly show that the major occupational levels differ markedly in the strength and nature of the relationship between years of experience and the two dimensions of skill. While the interpretation of these differences can only be conjectural at this stage of the research (especially given that these figures are for a single year only), some strong possibilities suggest themselves:

- The experience of tradespersons appears to be characteristic of a strong substitution effect, with the long period of apprenticeship taking the place of the initial year or two of on-the-job learning to come up to speed with the realities of the workplace that is expected in occupations with a less elaborate pre-employment preparation. Based on these figures alone, it would appear that most tradespeople settle quickly into their skill set and their subsequent work experience does not notably challenge it;
- Elementary Clerical, Sales & Service Workers show evidence of a substitution effect in the opposite direction, with additional years of experience leading to progressively greater increases in skill-intensity, even if the base for this growth is low. Consequently this is the group that shows the strongest (though still far from conclusive) evidence of skill deepening. However, it appears that employees themselves do not see it in terms of learning or conscious skill acquisition, and it does not appear to be matched by any significant growth in task discretion;
- Managers appear to do most of their conscious skill acquisition in their first one or two years in the job, but skill deepening continues beyond that period in the form of steadily increasing task discretion;
- The case of Professionals is once again anomalous. They report the strongest and most sustained learning of all the major categories, and hence show the strongest evidence of complementarity between pre-employment and on-the-job skill development. By contrast, the absence of any significant change in either skill-intensity or task discretion as they move further into their careers is puzzling and concerning.

These questions are of primary interest for an understanding of the current state and dynamic of Australia's NSS, but cannot be satisfactorily resolved within the compass of this thesis. One reason is that the figures cited here are point-in-time ones, even if their reference is retrospective, and the really valuable information will come from analysing how the typical trajectories which they represent have changed over time. This will only be possible once there is a much longer run of data. The other reason, which must not be forgotten, is that they cannot be conclusively addressed without more accurate data on the third crucial dimension of skill, substantive complexity. Hence, all that can be done here is identify these as issues for future research once some of the data gaps have been rectified.

## 8.2. Changes in skill by industry

The variation of skill across industries cannot be expected to show the same predictability as variation between occupations, because the structuring element of a broadly skill-related hierarchy is absent from the classification of industries. Different industries may vary in their skill content because of differences in the intrinsic difficulty of turning their inputs into their characteristic outputs, variations in the availability of technology and the nature of its interaction with human skill, and varying degrees of challenge which their markets and/or their supply chains impose on their efficiency, quality of production and innovative capacity. Alternatively, the differences may reflect distinctive production cultures and forms of work organisation that have grown up in each industry, and which in turn affect both the kinds of skill they require and the way those skills are allocated among different occupations. And since most industries comprise a large range of occupations at various levels in the hierarchy, the way they respond to environmental change may have different and sometimes offsetting impacts on the experience of each occupational group, making it difficult to isolate and identify relevant industry-specific trends, especially from employee-derived data. The movements in scores which are discussed below illustrate the lack of consistent patterns or predictors.

At the 1-digit level relatively little change occurred in the rankings on skill-intensity, with Education and Government Administration & Defence taking the two top positions in both years and Retail Trade and Accommodation, Cafes & Restaurants the bottom two. All major industry groups had a lower mean score in Wave 6. At the 2-digit level, as with occupation, a more complicated pattern appears, with significant rearrangement of the rank order. Table 8.2 below illustrates this for the industries which registered the largest rises and falls on the scale between the two years.

Only a small number of industries showed a gain in average score, and most of these had a very small representation in the sample or started from a low base, as indicated by their Wave 1 ranks. Decreases in score were more common, and generally of greater magnitude, than increases. Two of the lowest-scoring industries in Wave 1 saw further declines over the five years, but another two of the industries which experienced the largest decline in scores had been above the all-industries mean in Wave 1. No clear patterns are otherwise identifiable in these results, except perhaps to note that with the exception of Property Services, all the industries which saw large shifts in either direction were predominantly employers of blue-collar labour.

**Table 8.1**  
**Largest gains and losses in skill-intensity, by percentage of Wave 1 score**  
**2-digit industry\*, 2001-2006**

Industry	Gains			Industry	Losses		
	Rank Wave 1	Rank Wave 6	% rise		Rank Wave 1	Rank Wave 6	% fall
Non-metallic Mineral Manufacturing	38	24	5.01	Food Retailing	44	44	6.54
Air Transport	24	11	4.78	Road Transport	42	42	7.58
Textile, Clothing, Footwear & Leather Manufacturing	37	22	4.64	Agriculture	27	34	7.58
Electricity & Gas Supply	17	5	3.45	Property Services	15	27	7.82
Machinery & Equipment Manufacturing	20	15	1.84	Food, Beverage & Tobacco Manufacturing	34	38	7.92
Sport & Recreation	35	25	1.65	Printing, Publishing, Recorded Media	19	32	8.39
Rail Transport	22	17	1.07	Basic Material Wholesaling	30	36	9.06
				Wood & Paper Product Manufacturing	21	35	10.46
				Storage	26	41	15.66

\* rank out of 44 2-digit ASCO 96 industries (excluding industries with fewer than 20 observations in either year)

Defence headed the rankings on skill-intensity in Wave 1 and was still in top place by Wave 6. The other industries in the top ten for Wave 1 were Education; Coal Mining; Other Services; Metal Ore Mining; Health Services; Insurance; Government Administration; Libraries, Museums & the Arts; and Services to Finance & Insurance. All these retained their position in the top ten in Wave 6, with some reordering, except Libraries, Museums & the Arts, which fell to twelfth place and was replaced by Electricity & Gas Supply. At the other end of the scale the three lowest-scoring industries retained their place and order: Road Transport; Accommodation, Cafes & Restaurants; and Food Retailing in bottom position. By Wave 6 the mean scores for these three industries were all more than half a standard deviation below the all-industries mean.

On the basic task discretion scale (Table 8.3), these ranks changed little between Waves 1 and 6, except for Insurance which fell four places, Road Transport which rose by four, and Government Administration which rose by ten, from 31<sup>st</sup> to 21<sup>st</sup>. This last change may have been influenced by the high level of recruitment to this industry over the period, with its representation rising from 3.4% to 4.4% of the sample. Interestingly, the additional variables included in the extended task discretion scale give Government Administration a much higher rank than on the basic scale. On task discretion, large movements in the average score were mainly concentrated in industries with small sample sizes, and show no obvious pattern.

**Table 8.2**  
**Largest gains and losses in task discretion, by percentage of Wave 1 score**  
**2-digit industry\*, 2001-2006**

Industry	Gains			Industry	Losses		
	Rank Wave 1	Rank Wave 6	% rise		Rank Wave 1	Rank Wave 6	% fall
Air Transport	42	21	20.56	Wood and Paper Product Manufacturing	12	35	16.4
Finance	39	31	7.37	Coal Mining	35	41	9.42
Services to Finance and Insurance	8	1	7.16	Machinery and Motor Vehicle Wholesaling	9	16	8.23
Electricity and Gas Supply	32	18	6.78	Metal Ore Mining	21	32	8.0
Services to Agriculture	2	2	5.86	Community Services	19	29	7.6
Government Administration	31	22	5.19	Other manufacturing	6	13	7.32
TCF	15	5	4.96	Construction Trade Services	5	9	6.29
Printing, Publishing, Recorded Media	18	17	4.0	Libraries, Museums and the Arts	3	6	6.28

\* rank out of 44 2-digit ASCO 96 industries (excluding industries with fewer than 20 observations in either year)

In rank order, Agriculture headed the list in Wave 1, probably a reflection of the high proportion of owner-operators in the sample for this industry. By Wave 6 this proportion had diminished and Agriculture had dropped to third place, ceding the top rank to Services to Finance & Insurance. However, Services to Agriculture (admittedly a very small sample) retained second place in both waves, suggesting that part of the high rating for agriculture in

general must be related to the way work is generally organised in that sector. Storage and Food Retailing, industries which also scored among the lowest on skill-intensity, were the lowest-ranked for task discretion in both waves. In other respects the same discrepancies appear as for occupation, with most of the industries that rated well on skill-intensity coming well down the list on task discretion in both waves.

One explanation for these apparent discrepancies could be that skill-intensity does not tell the full story about the exercise of skill; that is, a skill-intensive industry is not necessarily a skilful one. If both skill-intensity and task discretion are partial and complementary indicators of a broader construct of skill, then it could well make sense that some industries should be strong on one and weak on another without contradictory implications for their overall skilfulness. In principle, that is, a skilful industry might score relatively low on either one of these scales, and it should not be presumed a priori that either is the more reliable indicator of skilfulness.

To test this possibility it is necessary to examine the performance of each partial indicator against some broader measure of skill which goes part of the way towards capturing the substantive complexity dimension. In the case of occupations this is a relatively easy exercise because that alternative measure is already to hand in the ASCO classification, which was explicitly designed to capture something approximating to substantive complexity, albeit perhaps not in the most methodologically rigorous way. Where industries are concerned it is necessary, as foreshadowed in Chapter 6, to resort to an ad-hoc composite rating which involves not only direct measures but some of the more commonly used proxies. The ones used in this thesis are:

- mean score on COMPLEX, the only variable in the dataset which explicitly sets out to capture the complexity dimension;
- proportion of employees in the highest and lowest ASCO categories – this indicator captures the reputational and socially constructed dimensions of skill, but also exploits the intent behind that classification of capturing multiple dimensions of skill, specifically including substantive complexity;
- proportion of employees in the highest and lowest categories for level of education completed – provides a proxy for the learning time required to enter the industry at the base level, and for the amount of codified knowledge used in the industry, both of which have been seen in the literature as closely related to substantive complexity.

Two additional indicators are available for Wave 6 which could make the metric more sensitive:

- the proportion of employees who received training from their employers in the last year - a commonly used proxy for the value the industry places on developing new skills, as evidenced by its willingness to invest its own resources in doing so;
- mean score on VARIETY, the second variable that has high face validity as an indicator of job complexity.

Since these latter two indicators are so far only available for two waves, they do not yet provide a basis for identifying trends, and hence have not been used for longitudinal tracking in this thesis. For the purposes of future tracking, however, they offer the basis for an expanded metric which could pick up change in the complexity of jobs more accurately.

It should be stressed that this metric is not a scalar one, since there is no one methodologically compelling basis for combining these disparate indicators into a single continuous scale. The objective was rather to find an intuitively convincing means of ranking that would make it possible to identify a group of the most and least skilful industries in each year. To qualify for inclusion in either the high or the low complexity group, an industry needed to record a mean score on COMPLEX in the relevant year which lay a quarter of a standard deviation or more above or below the all-industries mean. This requirement represented a cutoff point in the distribution parallel to that used for defining the highest and lowest skill groups on the other two dimensions. Further selection took place according to each of the qualifying industries' ranks on four other criteria: percentage of graduates; combined percentage of respondents who were Managers, Professionals and Associate Professionals; percentage of employees with uncompleted secondary education and no post-school qualifications; and combined percentage of Labourers and Elementary Clerical, Sales & Service employees. To be included in either group an industry needed to come in the top or bottom ten, as appropriate, on at least two out of these four rank orders.

As with the other two dimensions, this grouping exercise was carried out only for Waves 1 and 6. Industries which met the initial qualification on COMPLEX, in order of scores from highest to lowest, were:

*Wave 1, top group:* Defence; Insurance; Services to Finance & Insurance; Education; Other Services; Health Services; Metal Ore Mining; Government Administration

*Wave 1, bottom group:* Road Transport; Services to Agriculture; Sport & Recreation; Personal & Household Goods Retailing; Personal Services; Accommodation, Cafes & Restaurants; Food Retailing

*Wave 6, top group:* Other Services; Defence; Government Administration; Education; Air and Space Transport; Petroleum, Coal & Associated Product Manufacturing; Insurance; Motion Picture, Radio & Television Services

*Wave 6, bottom group:* Personal & Household Goods Wholesaling; Basic Material Wholesaling; Road Transport; Personal Services; Personal & Household Goods Retailing; Accommodation, Cafes & Restaurants; Food Retailing.

Applying the secondary criteria resulted, more by chance than by design, in a final listing of five industries in each bracket in each year which met at least two out of the four criteria. Although this symmetry appears intrinsically satisfying, it does not imply any expectation that the two groups should be comparable in size, either to each other, or across time. To repeat: this is a ranking, and intended to show only how different industries rate relative to one another, and how the rank order changes over time. To emphasise this point, the proportions of the

workforce represented by the industries in each group are shown in Table 8.3 below, based on both the HILDA sample and population-level data from the Census in the respective years.

**Table 8.3**  
**Highest and lowest ranked industries, composite job complexity indicator**

<b>High skilled group W1</b>		<b>% HILDA W1</b>	<b>% Census 2001</b>	<b>High skilled group W6</b>		<b>% HILDA W6</b>	<b>% Census 2006</b>
Education	4/4	9.1	7.17	Education	4/4	9.6	7.45
Defence	3/4	0.7	0.75	Insurance	3/4	0.9	0.76
Services to Finance & Insurance	4/4	1.2	0.82	Other Services	3/4	1.7	1.83
Government admin	3/4	3.4	3.70	Government Admin	3/4	4.4	4.68
Insurance	3/4	0.6	0.93	Defence	3/4	0.8	0.73
<b>TOTAL HIGH SKILLED</b>		<b>15.0</b>	<b>13.37</b>			<b>17.4</b>	<b>15.45</b>
<b>Low skilled group W1</b>		<b>% HILDA W1</b>	<b>% Census 2001</b>	<b>Low skilled group W6</b>		<b>% HILDA W6</b>	<b>% Census 2006</b>
Food retailing	4/4	5.2	5.35	Food retailing	4/4	5.4	5.45
Services to Agriculture	3/4	0.4	0.22	Road Transport	3/4	1.7	2.41
Road Transport	4/4	2.3	2.06	Accommodation, Cafes & Restaurants	3/4	5.2	5.27
Accommodation, Cafes & Restaurants	3/4	5.1	4.95	Personal Services	3/4	1.8	1.76
Personal & Household Retailing	3/4	6.0	6.24	Personal & Household Retailing	3/4	6.1	6.17
<b>TOTAL LOW SKILLED</b>		<b>19.0</b>	<b>18.82</b>	<b>TOTAL LOW SKILLED</b>		<b>20.2</b>	<b>21.06</b>

Several things stand out about this list. The first is that the final rankings show far greater stability across the two years than the initial scores on COMPLEX. Introducing the secondary filters removes much of the variation that occurred between the two waves on the threshold test. This is a logical consequence of using proxies that relate to levels in the occupational and educational hierarchy. Since these are institutional features of employment in any given industry, they are unlikely to show significant variation over a period as short as this, unless really significant restructuring has taken place in the industry.

The second is that introducing these secondary tests reduces the variety of industries which feature in the top group, in particular eliminating the blue-collar industries that rated highest on COMPLEX. Even industries which are generally agreed to involve highly complex work, notably Health Services, are excluded because of their occupational composition.

This point emphasises the imperfect nature of these proxies and the need for a more accurate direct indicator of complexity such as job analysis might provide. However, it is equally arguable that a job may appear complex and difficult to those who work in it simply because they have a low skill base or have received inadequate training, rather than because it ranks high in complexity when compared with other jobs which attract a more sophisticated workforce. The hierarchical proxies, which work on the assumption that the qualifications required of the workforce rise broadly in line with the complexity of the work, represent a very crude corrective to this kind of error, but the only one which is currently available.

As far as the actual industries in each band are concerned, the striking thing is the dominance of the upper band by industries which are classified in the National Accounts as belonging to the non-market sector. Five of the six in this group in Wave 1 have a strong or exclusive public-sector component, and though the representation of market and non-market sectors had become equal by Wave 6 in terms of the number of industries represented, the predominantly or wholly private-sector industries which had moved into this bracket were relatively small in employment terms, making up 3.1% of the total employed sample as against 22.3% for the non-market-sector industries in the top group.

When this list is matched to mean task discretion scores, many of the anomalies that affected occupations are repeated for industries. Once again, and with only a few exceptions, the highest-skilled industries in this rank order of comprehensive skill were ranked relatively or very low on task discretion, while the lowest-skilled generally had comparable rankings on each measure. Table 8.4 on the next page lists the rankings on various aspects of task discretion for the top and bottom five industries on the composite substantive complexity ranking.

**Table 8.4**  
**Task discretion rankings\*, Wave 6**  
**Industries in top and bottom bracket for substantive complexity**

	Extended task discretion	Job content discretion	Time control
<b>Highest-skilled</b>			
Education	38	11	43
Insurance	25	28	23
Other Services	21	17	24
Government Administration	12	16	17
Finance	22	32	21
<b>Lowest-skilled</b>			
Personal & Household Goods Retailing	31	37	38
Accommodation, Cafes & Restaurants	39	41	39
Personal Services	8	10	10
Road Transport	23	36	26
Food Retailing	42	43	33

\*rank out of 44 2-digit ASCO 96 industries, excluding industries with fewer than 20 observations in either year

### 8.3. Summary and conclusions

This chapter set out to test the hypotheses that the movement in aggregate scores between Waves 1 and 6 reflects relatively large changes concentrated in single industries and occupations, or alternatively that the relative stability in the aggregates concealed strong movements in both directions at this level of disaggregation. The tests which have been applied here suggest that the change was spread fairly uniformly across both occupations and industries, with both the distribution and the rank order by either classification remaining largely unchanged.

The only apparent trends which might qualify this conclusion are that Professionals generally experienced a decline in both skill-intensity and task discretion over the five years, while most trades saw some rise in task discretion and possibly in skill-intensity. Some more interesting changes may have occurred in individual occupations or industries at finer levels of disaggregation, but if so they were not of sufficient magnitude to have a detectable effect on the broader categories used in this analysis.

Consequently this analysis is more useful for revealing what appear to be relatively durable features of the Australian NSS, at any rate in its current configuration. One of the most important of these features is the distribution of skill across the different levels in the occupational hierarchy. Rather than being equally spaced across the levels, the scores for skill-

intensity fall into two bands, each fairly tightly clustered and with some swapping of ranks over the five years, but with no sign of convergence between the bands. These bands individually reflect the conventionally accepted split of skilled *vs* unskilled occupations, but the ordering of occupations within each band does not exactly parallel the ASCO hierarchy. Professionals consistently fill the top rank, while Associate Professionals and Tradespersons score so closely to one another that the difference can safely be discounted. At the bottom end, Labourers and Elementary Clerical, Sales & Service Workers lie clearly further down the scale than the semi-skilled and intermediate occupations in the same band, but with the latter consistently showing lower scores. Task discretion scores also show this dichotomous pattern, but with Managers and Elementary Clerical, Sales & Service Workers standing well clear of the rest at the upper and lower ends of the scale and the remainder of each band generally too tightly clustered to be distinguishable for practical purposes. The overall pattern shows interesting differences from skill-intensity, with Professionals coming well down in the upper band and Advanced Clerical & Service Workers, who were in the lower band for skill-intensity, rising into the top part of the upper band, where they score better than Professionals.

A second feature of the system which can be deduced from these figures is the incidence and pattern of skill deepening, i.e. increases in the amount of skill actually exercised that result from experience and informal or at any rate uncertificated learning on the job. While these data can provide no more than an impressionistic picture, they do suggest that the typical pattern is different for different occupational levels. The phenomenon seems to be virtually non-existent for Tradespersons, with both skill-intensity and the learning content of jobs declining steadily with each additional year in occupation. This suggests a strong substitution of formal pre-employment training for on-the-job learning. Elementary Clerical, Sales & Service Workers show evidence of substitution in the opposite direction, since they generally have few if any certified skills but appear to continue learning and exercising increasing skill-intensity the longer they remain in their occupation. Professionals, on the other hand, provide evidence for the rival hypothesis of complementarity between formal and informal learning, since their initial qualifications are generally the highest and take longest to acquire, but they also show evidence of continuous learning even after several years in their profession. In their case, however, this favourable impression is offset by the absence of any apparent gains in either the skill-intensity of their jobs or the amount of task discretion they can exercise as they gain experience.

The most interesting of the questions raised by the analysis in this chapter concerns the relationship between skill-intensity and task discretion. Large discrepancies occur between the mean scores on the two scales for several occupations and industries. Most of these cases appear in higher-skilled industries or occupations, most notably Health Professionals who top the list for skill-intensity and Education which rates highest on the proxies used to capture substantive complexity, but which have some of the lowest task discretion scores of all 2-digit occupations. These discrepancies are also generally more likely to be found in areas of employment dominated by the public sector. At the other end of the skill hierarchy there is a group of occupations and more particularly industries for which the mean ranking on task discretion corresponds broadly to that for other dimensions of skill, but other cases, notably within the broader division of Labourers & Associated Workers, where the task discretion scores lie well up towards the middle of the rank order.

Small discrepancies of this kind would not be a reason for concern, given the premise behind this entire analysis that the two dimensions represent complementary but different aspects of a broader construct of skill. If this is the case, then it is entirely understandable that in some circumstances the two sets of indicators may tell different stories. For example, a lack of individual autonomy in a given job could be counterbalanced by a need for higher teamwork or coordination skills to work effectively in that environment, so that the job as a whole ended up just as skilful as one which did allow a high level of autonomous working. This is especially likely given the evidence which has emerged from this chapter that the time control aspect of task discretion is differently distributed from the aspect of control over the content of the job, and hence may well imply a different set of causal influences. However, discrepancies as stark as those revealed here make it necessary to look again at the validity of assuming an association between the two presumed dimensions, and/or between either dimension and skill in a broader sense. This issue is revisited in Chapter 10.

## Chapter 9

### Changes in the distribution of the employed population

This chapter completes the triangulation proposed in Chapter 6 by examining the third of the possible change mechanisms: that the amount of skill deployed in the economy changed as a result of a shift in the balance of economic activity towards sectors with different skill requirements. This would imply that jobs were lost in industries or occupations involving low levels of skill, learning or task discretion and replaced by new ones in higher-skilled industries and occupations; or possibly, in the light of the evidence reviewed in Chapter 7, vice-versa.

In a sense this involves addressing many of the same questions as Chapter 7 but from a different angle. There, the aim was to determine whether there had been any changes affecting the overall skilfulness of Australian jobs, over and above the contribution of changes in the distribution of employment. Thus the set of changes resulting from compositional change had to be treated as if it were a confounding factor to be eliminated. The exercise for this chapter is to scrutinise the latter set of processes for evidence of emerging developments which might affect the amount of skill exercised in the economy as a whole in the longer term, but have yet to produce an identifiable net impact on the aggregate statistics.

Like the previous chapter, this one concentrates on changes that occurred between the two end years of the currently available dataset, 2001 and 2006. As in that chapter, the research question here is a cross-sectional one, and the aim is to compare the configurations of the employed section of the sample at two points in time sufficiently removed from one another to justify some confidence that meaningful and sustained changes in the pattern will have had time to eventuate. Hence the criterion of data quality is different again. It is not crucially important that the same individuals be represented in the sample in both waves, though individual trajectories can certainly tell an important part of the story of how and where distributional changes took place. It is less important than in Chapter 7 that the sample be accurately representative of each industry and occupation. What really matters here, in the interests of valid inference to the population, is that the sample in each of these two waves should accurately represent the composition of the full working population. The advantage of these two years is that they were Census years, and hence that accurate data are available on the actual composition of the working population by industry and occupation. This makes it possible to rebalance the sample in each year to compensate for the known sampling error, by weighting the counts for over- or under-represented categories. The adjusted aggregate scores on the two dimensions of skill will then approximate to the overall change that will have occurred across the economy if the experience of the HILDA sample accurately reflected that of the full population.

The distribution of the sample by industry and occupation is one area in which clear changes are observable across the five years. To list some of the more important changes at the 1-digit level:

- Managers & Administrators fell from 9.5% to 8.4% of the employed sample, a drop of 11.6% in their proportional representation;

- Elementary Clerical, Sales & Service Workers fell from 9.5% to 8.9% (change of -6.3%) and Labourers & Related Workers from 8.8% to 8.0% (change of -9.3%);
- Intermediate Clerical, Sales & Service Workers grew from 15.9% to 17.6% (change of 10.7%);
- Agriculture, Forestry & Fishing fell from 5.8% to 4.2% (change of -27.6%);
- Government Administration & Defence rose from 4.1% to 5.2% (change of 26.8%).

In proportional terms, far more significant shifts occurred at the 2-digit level, with Farmers & Farm Managers losing over half their representation, Textile, Clothing & Footwear Manufacturing (TCF) losing well over half and Health & Welfare Associate Professionals increasing theirs by two-thirds. Most of these major shifts were in industries and occupations with very small sample sizes, where much of the change could be simply the result of variations in the achieved sample from year to year. This likelihood strengthens the argument for looking only at change over the full five years, since some at least of the sample lost in Wave 2 was progressively regained over subsequent years. It could also be the result of sampling error in the original design which may or may not have remained constant over the six years, Agriculture and Professionals being the two largest over-represented categories in Wave 1 which were still over-represented, albeit to a lesser extent, in Wave 6. This highlights the importance of adjusting the findings to take account of the actual balance of employment across industries and occupations as revealed by the Census in each of the end years.

Nevertheless some of the changes, notably the growth in Government Administration, were large enough, and are sufficiently supported by the Census figures, that they might reasonably be expected to make a significant difference to the overall results. Others which it might be tempting to dismiss as numerically or proportionally negligible could still represent symptomatic evidence of longer-run structural change (e.g. the sharp fall in the already small numbers employed in TCF) or of a process of cyclical adjustment to a more prosperous economy (e.g. the 0.2 percentage point growth in Food Retailing).

It should also be kept in mind that this was more than just a matter of employment shifting from more skilled to less skilled industries, or vice-versa. At the same time as workers moved between industries and occupations, many of those industries and occupations were undergoing skill change, both in absolute terms and relative to one another. The change that really affects the skill requirements of the economy as a whole is the combined impact of both processes, which is likely in any case to be affected by interactions between them, e.g. industries adjusting to the different characteristics of the labour they acquire from different areas of the economy. Hence this combined element of outcome change will be examined first. As a subsequent check, and to isolate the contribution of compositional change in the strict sense – i.e. workers moving between industries and occupations – a second set of analyses will be undertaken to establish the change in the employment share between Waves 1 and 6 for those industries which scored best and worst on the dimensions of skill in Wave 6.

## 9.1. Changes in distribution by skill group

In line with the three dimensions of skill that form the basis for the overall methodology of this thesis, three measures are used to map the changes between the two years in the

distribution of the employed sample for the respective year by both occupation and industry at the 2-digit level. These are:

- the proportion employed in the categories with highest and lowest skill-intensity, with the cutoff point set at a quarter of a standard deviation either side of the overall mean. Although ultimately arbitrary, this cutoff reflects the actual distribution of scores, with very few industries or occupations recording mean scores more than half a standard deviation from the mean;
- the proportion employed in those categories with the highest and lowest task discretion, using the same criterion;
- the proportion employed in the top and bottom five industries identified by the composite indicator of skilfulness that was developed in Chapter 8. This indicator is used here primarily to provide an approximate indication of the distribution of substantive job complexity.

For the purposes of this section, the primary interest lies in the movements from year to year in the way the employed sample was distributed across the bands. The findings on each measure show remarkably similar patterns in this respect, each providing evidence of a polarisation in the distributional aspect of skill that is not evident in the aggregate trends in the full sample: that is, on each measure the proportion in the central band of industries and occupations shrank over the five years while the proportion at one or both ends of the spectrum grew. Table 9.1 sets out the raw figures for each group.

**Table 9.1**  
**Proportion of HILDA sample employed in highest- and lowest-skilled categories, Waves 1 and 6 (2-digit ANZSIC 93 and ASCO 96, 0.25 standard deviations or more above or below the mean)**

	Skill-intensity – occupations		Task discretion - occupations	
	W1	W6	W1	W6
Low (>0.25 SD below mean)	25.7	33.7	21.6	29.4
Medium (Mean +0.25 SD)	37.9	30.1	45.2	35.9
High (>0.25 SD above mean)	33.9	36.3	32.7	33.5

	Skill-intensity – industries		Task discretion - industries	
	W1	W6	W1	W6
Low (>0.25 SD below mean)	23.2	25.6	17.4	13.9
Medium (Mean +0.25 SD)	52.3	45.1	66.0	62.6
High (>0.25 SD above mean)	24.8	29.2	16.5	23.4

Figures 9.1 below visualises this trend as it applied to skill-intensity. These two graphs show a difference in distribution between the two classifications, with a far higher proportion of the sample lying in the upper and lower bands when disaggregated by occupation than when disaggregated by industry. While both show a clear shift towards the outer bands, the change for occupation consists almost entirely of an increase in employment in the least skill-intensive categories, while for industry it is more or less evenly distributed between the upper and lower bands, with a slight bias towards the lower (4.4% as against 2.4%).

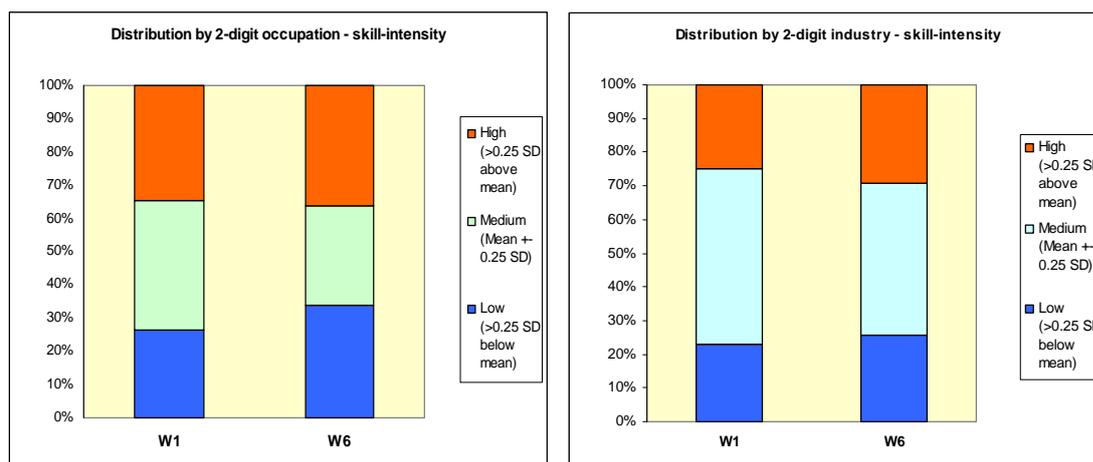


Figure 9.1

### Distribution of employed sample by skill-intensity, Waves 1 and 6

Figure 9.2 shows the situation with task discretion. Predictably, the size of each band is different here, since many of the industries and especially occupations which are high on skill-intensity and account for large percentages of overall employment fall into the middle or lower band on the task discretion scale.

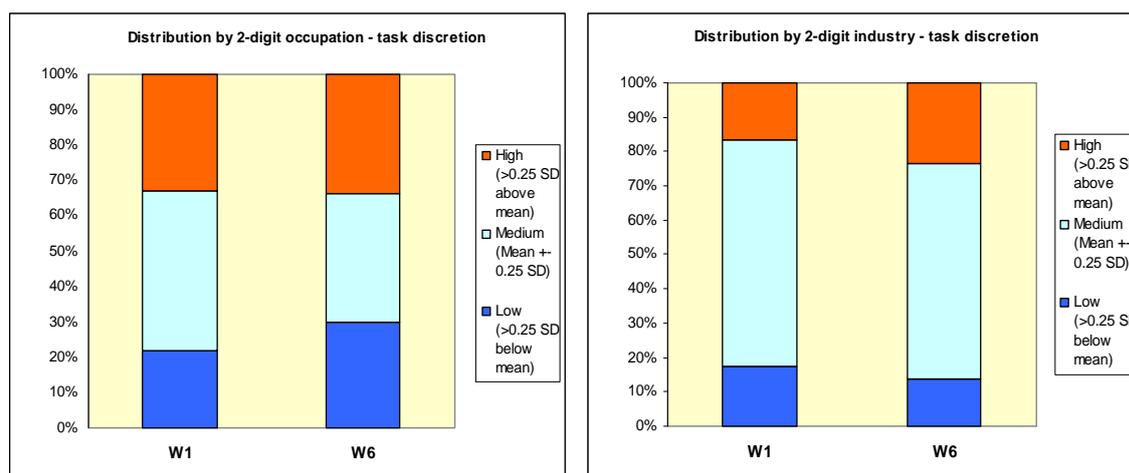


Figure 9.2

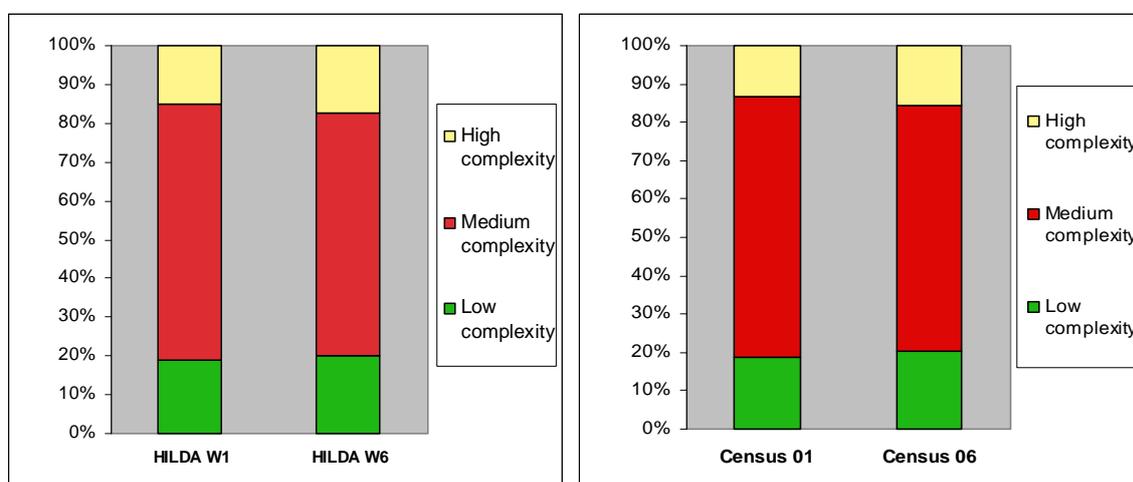
### Distribution of employed sample by mean task discretion, Waves 1 and 6

Here too, the contrast between the distributions by occupation and industry is obvious, with the central band being far larger for industry. In this case the trends also differ. For occupations, the size of the upper band remained virtually stable, while the important change took the form of a large increase in the size of the lower band. For industry, by contrast, the size of the central band remained practically the same, while the upper band grew and the lower band shrank to only 14% of the sample. This is therefore the one disaggregation on which the polarisation trend fails to emerge.

The two sets of disaggregations support the finding from the analyses undertaken in Chapter 7 that both dimensions of skill vary more widely and consistently across occupations than they do across industries, in other words that occupation is the stronger predictor, especially of skill-intensity outcomes. Perhaps the main surprise which emerges is that occupation appears to be a much better predictor of task discretion than the earlier

findings would suggest. This greater predictive value is understandable considering that the first digit of the occupational classification is explicitly intended to capture at least some part of the third complementary dimension of substantive complexity. The composite indicator that was developed in Chapter 8 attempts to capture the same complementarity for industries by ranking them on their occupational composition as one of the proxies for substantive complexity.

As shown by the left-hand graph in Figure 9.3 below, the pattern of polarisation is evident when this measurement approach is used, though less so than for skill-intensity. In this case the central band has decreased only marginally, from 66% to 62.4%, with the larger increase occurring in the lower skill band. However, most of this difference was the result of turnover of industries in the lower band. Four of the five industries that make up this group were the same in both waves, but Services to Agriculture, a very small employer (0.4% of sample), was displaced from the bottom five in Wave 6 by the much more substantial Personal Services (1.8%). The share of change in this band that is uniquely attributable to compositional shift in the workforce amounted to a net -0.2%, consisting of increases of 0.1 percentage points for Accommodation, Cafes & Restaurants and Personal & Household Goods Retailing and 0.2 percentage points for Food Retailing, offset by a drop of 0.6 percentage points in the proportion of the sample employed in Road Transport. Moreover comparison with the Census figures for each year, to be discussed later in this chapter, shows that even these changes were artefacts of imperfections in the HILDA sample, since the population figures for all four industries moved in the opposite directions to those in the sample. In the top band, by contrast, shifts in the composition of the employed population account for all but half a percentage point of the change over the five years, based on the HILDA sample. Graphs are shown for both HILDA and Census data to illustrate the degree to which the findings are influenced by sample bias.



**Figure 9.3**  
**Distribution of employed sample by substantive complexity ranking**

These difficulties illustrate the risks of relying on a non-scalar, composite metric, as well as the potential for even relatively small errors in the representativeness of the sample to lead to false inferences. For both these reasons, any findings that use this indicator should be treated as tentative until such time as better direct evidence on the substantive complexity dimension becomes available. Nevertheless, the more accurate figures from the Census still show a clear polarisation effect, almost as marked as that which emerges from the HILDA figures. Given the evidence that this indicator behaves differently from the two

scales which address the other aspects of skill, the recurrence of this pattern provides complementary, if inconclusive, evidence that polarisation is a genuine phenomenon affecting skill across its different dimensions. Such a finding incidentally adds to confidence that the three dimensions do in fact provide complementary perspectives on a single construct.

## 9.2. Movement of the sample to higher- and lower-skilled employment categories

The second and perhaps more classical aspect of compositional change is the way the workforce moves between occupations and industries, gaining or losing skill in the process even if no change takes place in the skill profile of the occupations or industries concerned. By isolating movements in the balance of employment towards those categories that show greatest and least skilfulness, it becomes possible to form a different perspective on the skill trajectory of the economy, complementary to that which emerges from the experience of individual employees, but revealing trends that have yet to appear in the aggregate statistics.

The analysis undertaken for this purpose took the same high and low skill bands for Wave 6 that were used in Section 9.1 and tracked how their collective and individual contributions to overall employment in the sample had changed since Wave 1. Growth in the proportional contribution of those industries and occupations that were most skilled by Wave 6, and/or reduction in the representation of those in the lowest skill bracket, could be one indicator of a rising skill trajectory over the longer term even if (as the aggregates suggest) it was offset over this period by a decline in scores in the central band, or across the entire distribution.

For skill-intensity the overall outcome of this analysis was indeed positive. The industries in the top group had increased their contribution to employment in the sample by 2.6 percentage points, a proportional growth rate of 9.85% over the five years, while the low-skilled bracket contributed 0.7 of a percentage point less (-2.75%). Within the upper group the largest contribution came from Health Services, which grew by 1.2 percentage points, followed by Government Administration at a full percentage point and Education at half a percentage point. Insurance recorded the highest percentage growth at 50%, but its representation remained very small, at 0.9% of the sample. Significant negative growth rates were recorded by Finance (-16.67%) and Other Services (-5.56%), but together these two industries only contributed a negative 0.4 percentage points. In the lower band the most significant fall in representation was recorded by Road Transport at 0.6 of a percentage point, but the three largest industries in this segment – Personal and Household Goods Retailing, Food Retailing and Accommodation, Cafes and Restaurants - increased their combined representation by 0.4 of a percentage point. Most of the other movement took place in industries whose representation in the sample was so small that they have been excluded from most of the analyses in this thesis.

A similar pattern was shown by occupations, with the high skill-intensity group increasing its representation by 4.91 percentage points (36.3%) and the low skill-intensity group declining by 0.8 of a percentage point (-2.4%). Of the four largest occupations in the higher group, Social, Arts & Miscellaneous Professionals increased their representation by 0.6 percentage points, Specialist Managers by 0.4 and Business & Information Professionals by the same amount, while Education Professionals remained static as a

proportion of the sample and Health Professionals declined by 0.2 of a percentage point. In the lower group the largest share of growth was contributed by Intermediate Clerical Workers (0.7), which was also the largest contributor to employment in this bracket, while the second most important in employment terms, Elementary Sales Workers, grew by 0.1 of a percentage point. Significant declines were evident for Factory Labourers and Elementary Clerks (-0.4), Cleaners and Elementary Service Workers (-0.3) and Road & Rail Transport Drivers (-0.2). However, some of these negative figures might need to be treated with reserve in view of the evidence, discussed in Chapter 4, that sample loss may have affected the representation of the lowest skill categories disproportionately. (Census figures are not available to check this possibility, because the ABS does not provide figures for 2001 coded to 2-digit ASCO 96.)

The task discretion statistics for industry, on the other hand, reflect the same decline which was apparent in the aggregate scores. The band of industries with high task discretion shrank by 1.9 percentage points (7.5% negative growth), while the lower band grew by an admittedly very modest 0.1 percentage point (7.5% positive). Of the three industries in the top band which accounted for substantial proportions of employment in Wave 6, Business Services (9.3% of sample) had contracted by 0.3 percentage points and Agriculture (3.5%) by 1.4, while Construction Trade Services (4.4%) had grown by 0.3. In the lower group the largest share of employment (5.4% of sample) belonged to Food Retailing, which had grown by 0.2.

The fall in the employment share of the high task discretion band was repeated for occupation. However, there was very little consistent pattern in the overall drop of 1.4 percentage points. The two largest occupations in this group, Business & Information Professionals and Business and Information Associate Professionals, each accounted for 5.1% of their sample but had experienced opposite growth patterns over the five years, the share of the professionals declining by 0.9 of a percentage point and that of the paraprofessionals increasing by 0.8. The change in the lower bracket was again marginal at -0.1. The two largest occupations in the lower group, Elementary Sales Workers (7.1% of sample) and Intermediate Clerical Workers (8.9%), had experienced a combined growth of 0.8 percentage point, but this was offset by declines in the number working in traditional blue-collar occupations. Elementary Clerks had the largest percentage decline, falling from 1% to 0.6% of the sample.

To the extent that any patterns can be identified in these changes, they appear to tell more about the overall trends which affected employment in Australia over this period than they do about the determinants of change in either skill-intensity or task discretion. Some of these movements appear to be the result of cyclical influences, notably the small but continuing growth in lower-skilled retail and hospitality employment as the economy approached the peak of its cycle. Other and more prominent patterns clearly reflect long-run structural change, notably the decline in the blue-collar occupations that traditionally represented much of the lower end of the skill market, and the gradual shift of clerical employment from the "elementary" to the "intermediate" category, presumably as technology takes over most of the basic tasks. The long-run shift of economic activity towards the services is also apparent in many of the changes. Given that most of these structural changes have been in progress for decades, it is arguably surprising to see so much movement in the statistics over a period as short as five years.

At the high end of the scale the most obvious element of change, and the one which most clearly contributed to overall skill-intensity across the labour market in these five years, was the growth in non-market sector employment. Without the large rises in employment that took place in Education, Health Services and especially Government Administration, the overall picture for skill-intensity would have looked even less optimistic than is already apparent in the aggregate trend. Conversely, there is no evidence of any change in the market sector's dominance of the high end of the task discretion spectrum.

One interesting outcome of this analysis, which looks at the same industries in both years, is that it shows much less evidence of polarisation than was apparent when the respective skill bands for each year were compared. This suggests that the phenomenon, if it is genuine, owes more to shifts in the relative skilfulness of different industries and occupations than to the movement of the workforce between them. This could prove a fruitful subject for follow-up analysis once a longer run of data is available.

### 9.3. Adjustment of results for sample variation and bias

The examination of movements in the substantive complexity indicator in Section 9.1. illustrated, among other problems, the extent to which even small biases in the sample can lead to misinterpretation of a dataset like this where the overall movements are relatively small and there is insufficient information to locate them in a longer-term trendline. As noted at in earlier chapters, the sampling method for HILDA has unavoidably resulted in significant over- and under-representation of some industries and occupations for which the weights supplied with the data do not appear to compensate effectively. By picking the two Census years it is possible to rebalance the results in the light of the more accurate figures for the full population, and hence to estimate whether the overall movements in the variables of interest over the five years, and any inferences that can be drawn from them, would have been different had the sample accurately represented the structure of the employed population.

Two cautions need to be voiced in advance about this exercise:

- The impact of this aspect of sampling error is almost certainly reduced by the limited power of either occupation or industry as predictors of skilling outcomes. The regressions undertaken in Chapter 7 make it clear that most of the variation in these outcomes was the result of factors which constitute, at least in the terms of this dataset, unobserved heterogeneity among both workers and firms. Though the correlations demonstrated that at least some part of this heterogeneity must co-vary with occupation and/or industry, it is still conceivable that other methods of rebalancing, including the standard weights supplied, could quite fortuitously capture a more representative picture of the major causal influences and their distribution across the working population;
- Given that the data are only available at a fairly coarse disaggregation, it is quite possible that the exercise could introduce as much error as it eliminates. The aggregate scores represent the full range of variability among individual jobs, and much of this variation is lost by averaging out the results at the 2-digit ASCO/ANZSIC level. This problem is made worse for occupation because no tables are available from the 2001 Census which classify the data by the older 2-

digit ASCO 96 classification used in HILDA, making it necessary to calculate year-to-year changes at the divisional (1-digit) level. To the extent that the unobserved causal factors cut across industry and occupational divisions, restructuring the population estimates along these divisional lines could even serve to mask their impact further. With a sample of this size, and especially on those indicators for which the year-to-year change is very small, even simple rounding error will inevitably bias the estimates to some extent.

Against these reservations it can be argued that these two parameters are the only ones which have been shown conclusively by the analyses in Chapter 7 to have statistically significant predictive power for the skilling outcomes measured by HILDA, and which can be reliably rebalanced using Census figures. Hence the revised estimates based on the Census, like many of the inferential analyses in this thesis, are best viewed not necessarily as more accurate than the original ones, but as alternative though equally indicative ones which are made possible by locating better data on selected parameters. As such they can be expected to provide some indication of the range and order of magnitude of expected error among different methods of estimation, and with lesser confidence, on the direction of those errors. At the same time the qualifications which must be applied to these analyses justify opting for a simple, transparent method rather than resorting to more sophisticated operations (e.g. recalculating the standard errors) which might do little to reduce the error inherent in the basic exercise.

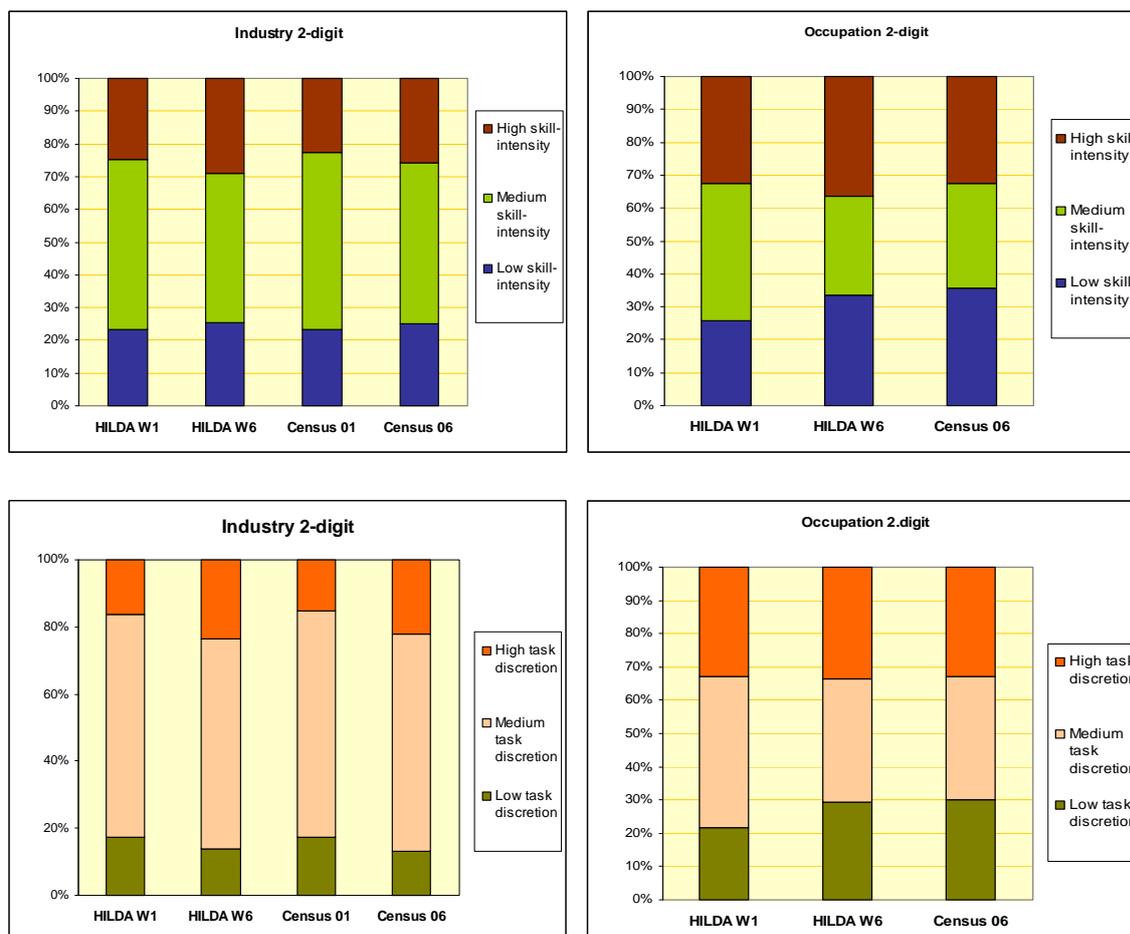
Three kinds of rebalancing have been carried out. The first involves recalculating the size of the upper, lower and middle bands for skill-intensity and task discretion in each year and consequently the extent of change that took place over the five years in the distribution of the employed workforce across these bands (i.e. the same exercise already undertaken for the substantive complexity proxy metric in 9.1). The second is to check whether the extent and direction of population-level changes in the representation of the highest- and lowest-rating industries and occupations over the five years mirrored those for the sample, and whether they support the same inferences. The third involves recalculating the mean scores on the two composite scales for the full sample, based on the proportional representation of each category in the Census as opposed to the sample. All three analyses start from the assumption that the mean scores for each industry and occupation in the dataset reflect those that would have been recorded by same category across the full population, and the results need to be viewed in that light.

### **9.3.1. Distribution by skill bands**

Figure 9.4 on the next page illustrates the distribution on all four disaggregations before and after adjusting for the Census figures. As already noted, the comparison for occupation is shown only for Wave 6 because no 2-digit Census data are available for 2001.

All four graphs make it clear that the revised estimates do not fundamentally contradict the findings already derived from the sample. For skill-intensity, the polarisation effect is still present but somewhat less pronounced in the Census data, showing similar patterns to the sample with growth in the upper band and shrinkage in the lower. The main difference is the smaller size of the upper band in the Census. For task discretion, the polarisation may not be immediately detectable by eye in either industry graph, but is evident in the figures, with both the upper and the lower bands in 2006 slightly smaller in the Census figures but the growth still concentrated in the upper band. The differences between the two

distributions by occupation in Wave 6 are again very small, but with the growth for skill-intensity biased towards the upper band in the sample and the lower in the Census.



**Figure 9.4**  
**Distribution of sample and population by skill bands**

On the basis of these figures it can be concluded with reasonable confidence that imperfections and variability in the sample across waves have not substantially distorted the pattern of change for industry, with the basic conclusion that some polarisation has occurred remaining robust. No conclusion can be substantiated for occupation in the absence of 2001 data, but the negligible difference between the breakdowns for the Wave 6 sample and the 2006 Census, especially on task discretion, gives some cause for confidence that the same conclusion would hold good there.

### 9.3.2. Change since 2001 in employment shares of top and bottom industries for Wave 6

Stronger discrepancies appear when the HILDA and Census percentages are compared for the same industries in both waves. In the high band for skill-intensity, growths and declines were both significantly lower in most cases for the Census than for the sample, with Education growing by 0.28 percentage points as against 0.5 and Health Services by 0.25 as against 1.2. The growth figure for Government Administration was virtually identical for both sources, while Defence recorded growth over the five years in the sample but a slight decline in the Census. Other Services declined as a proportion of the sample

but increased in the Census. As a combined result of these adjustments, the overall growth in the high band is reduced from 2.6 to 1.66 percentage points. Much the same applies to the upper band for task discretion, where the overall change comes out at -1.11 percentage points as opposed to -1.9 for the sample.

The differences are more interesting in the lower band, where the Census and HILDA representation of several industries moved in opposite directions. These included the three largest contributors to employment in this bracket, Food Retailing, Personal and Household Goods Retailing, and Accommodation, Cafes and Restaurants, which grew slightly as a proportion of the sample but fell as a proportion of employment in the population as shown by the Census. On the other hand, Road Transport grew as a proportion of employment but fell as a proportion of the employed sample. As a result, the overall growth of the lower band for skill-intensity was around the same size in both sources, but practically disappeared for task discretion once the figures were recalculated for the Census data.

The overall conclusion is that the optimism about longer-term trends in skill growth which might otherwise have been generated by movements in the distribution of the sample needs to be strongly muted in the light of the better data from the Census. It would appear that the growth industries for high skill are not growing as fast, and the declining low-skilled ones are not declining as fast, as the HILDA findings would suggest. Nevertheless the underlying if inconclusive impression of structural change favouring more skill-intensive industries survives the correction; if anything, the realism contributed by the Census data simply restores the change to the level that might reasonably be expected over five years for trends that are taking effect over decades.

Some doubts nevertheless remain because of the evidence cited earlier that sample attrition has had its largest impact on the representation of lower-skilled and more precarious types of work. Assuming that the Wave 1 sample was as close to an accurate representation of the employed population as HILDA has so far come, one would intuitively expect the overall proportion of employment recorded in lower-skilled industries, individually as well as collectively, to have fallen faster than in the Census because of the impact of sample loss after Wave 1. This would appear to have occurred for Road Transport, but the positive movement for several other large low-skilled industries appears anomalous at first sight.

One possible explanation which has not yet been raised is that the discrepancies between the two sources could have less to do with sample-related error than with the fact that the two data collections take place at different times of the year. The HILDA surveys are mostly administered towards the end of the calendar year or over the Christmas period when seasonal and vacation employment are at or approaching their peak, not only in the retail and hospitality sectors, but in many areas of agriculture where harvesting or other types of seasonal activity requiring the employment of temporary labour are in full swing. By contrast, Census night falls in winter when the demand for temporary and seasonal labour is generally at its lowest in the south-eastern States. If this factor is important, then one would expect HILDA to capture a higher proportion than the Census of the temporary work that takes place in the economy over the full year. Assuming that this seasonal employment mostly occurs towards the lower end of the skill spectrum, this factor might help to offset the under-representation of lower-skilled jobs that results from the combined effects of sample design and differential attrition. More importantly in the context of tracking change, it could mean that the makeup of the HILDA sample is more likely than that of the Census to reflect cyclical influences, on the argument that the increased

discretionary spending power available at the top of the business cycle will result in higher seasonal employment at those times of the year when consumption activity is at its strongest.

### **9.3.3. Change in mean aggregate scores adjusted for Census data**

This could be seen as the least methodologically compelling of the three analyses. It makes intuitive sense to argue that since the aggregate mean scores are affected by the way the sample is distributed between higher-and lower-skilled industries and occupations, any inaccuracy in the proportional representation of these categories must bias the sample to some extent. However, because these parameters have been shown by the regressions described in Chapter 7 to have only a minor independent influence on skill-intensity, and a near-trivial one on task discretion, it is uncertain how much of this overall bias can be eliminated simply by rebalancing the sample to correct inaccuracies in these respects alone. The reason for doing so is that these are known, relevant and readily calculable errors in the representativeness of the sample, and modelling their impact on the aggregate scores should at least provide some impression of the scope that exists for any type of imperfection in the sample to distort the results.

The method employed was to take the mean individual score recorded in HILDA for each industry and occupation on each of the two main composite scales in the year concerned and multiply it by the number of persons shown by the Census to have been working in that category in the year concerned, in order to produce a gross score for each category. These gross scores were then summed and the result divided by the number shown in the relevant Census table for the full working population to produce an estimate of the population mean score.

Unlike the previous two analyses, this one excluded categories which recorded fewer than 20 observations in either year, since this analysis involves extrapolating scores to the full population, and it was judged unsafe to infer that such small samples were representative of the population in that category. The counts and scores for these categories were therefore excluded from both the HILDA and the Census data, as were the Census counts for non-classifiable and non-responding individuals. The total population figure used as the denominator was adjusted accordingly.

This analysis was carried out at the 2-digit level for industry in both waves, and for occupation in Wave 6. Because of the missing 2-digit Census data for 2001, the exercise was then repeated at the 1-digit level, partly to gain an indication of the extent and direction of change by occupation, and partly to establish how far the estimates were affected by reverting to that level of disaggregation. Differences between the two sets of estimates provide some impression of the amount of accuracy that is lost by averaging out individual results by broad category, as a reminder that any exercise of this kind necessarily introduces its own error. The results are shown in Table 9.2. Note that the estimated changes in mean score listed in column 4 are expressed as percentages of the Wave 1 score, rather than as movements in the raw scores.

All four rebalancing exercises produce higher estimates than the aggregate means for Wave 1 on both dimensions, but in Wave 6 the estimates for skill-intensity are lower, while three out of the four for task discretion are higher, substantially so for the rebalancing by industry. Recalculation at the 2-digit level, which can be assumed to be somewhat more accurate in

capturing the true variation, results in greater differences from the aggregate means, except for skill-intensity by industry in Wave 6, where the 1- and 2-digit analyses produce the same estimate. Rebalancing by occupation, the parameter which has been shown to have greater predictive value, produces higher estimates of change over the two years than either the rebalancing by industry or the aggregate means, though this finding must be viewed as tentative in the absence of 2-digit data for Wave 1.

**Table 9.2**  
**Aggregate means scores for skill-intensity and task discretion, Waves 1 and 6**  
**Recalculated using Census data for industry and occupation shares of the employed population**

	W1	W6	% change
<b>Skill-intensity</b>			
Mean score, full sample	13.99	13.68	-2.22
Rebalanced by 1-digit occupation	14.01	13.56	-3.21
Rebalanced by 2-digit occupation	n/a	13.51	n/a
Rebalanced by 1-digit industry	14.01	13.60	-2.88
Rebalanced by 2-digit industry	14.03	13.60	-3.07
<b>Task discretion</b>			
Mean score, full sample	12.97	12.72	-1.93
Rebalanced by 1-digit occupation	13.00	12.72	-2.16
Rebalanced by 2-digit occupation	n/a	12.73	n/a
Rebalanced by 1-digit industry	13.01	12.77	-1.85
Rebalanced by 2-digit industry	13.02	12.85	-1.31

Even once due allowances are made for the limited reliability of these findings, it is clear that rebalancing at either level of disaggregation increases rather than eliminates the drop in mean scores evident in the aggregate findings for both dimensions of skill. The only exception is task discretion by industry, where the drop remains but is somewhat less pronounced than in the aggregate. This analysis therefore provides no evidence to suggest that the fall in mean scores over the five years is an artefact of either the sampling method or sample variability.

## 9.4. Summary and conclusions

This chapter has examined the third possible area of change in the skilfulness of the economy, shifts in the composition of employment between higher- and lower-skilled industries and occupations. Compositional change provides a different perspective on the skills trajectory of the economy by capturing a dynamic element that is not present in the aggregate experience of individuals over the same period. The growth of higher-skilled industries or occupations and the decline of lower-skilled ones has implications for the future skill trajectories of those people who work in them which extend well beyond the limited period so far covered by the HILDA data, and can be seen as a leading indicator of changes that will affect the average experience of the employed population in coming decades. It also casts particular light on the way changing demand for different types and levels of skill is affecting the NSS.

The first analysis of this change involved calculating the proportions of the employed sample that fell within the high, low and intermediate bands for skill-intensity and task discretion in each year, defined by whether or not the mean score for their occupation or industry of employment fell within a quarter of a standard deviation either side of the overall mean. This method, which takes account of changes in the relative skilfulness of industries and occupations as well as the distribution of employment between them, is predictive of the experience of the average individual in the workforce.

The strongest pattern to emerge from this analysis was evidence of skill polarisation, i.e. a tendency for employment to shift away from the middle of the skill spectrum and towards the higher or lower bands. This pattern was most evident for skill-intensity, where the growth was shared between the high and low bands for both industry and occupation, with a bias towards the lower. For task discretion it was present for occupation, with most growth once again appearing in the low band. For substantive complexity it is much more apparent when the findings are adjusted to reflect the counts for each industry in the Census for both years, showing the same slight bias towards the lower skill band. Taken together, these findings suggest there is a compositional element to the fall in overall skilfulness across the economy over this period which did not emerge from the analyses in Chapter 7.

A different perspective emerges from the second analysis which looked at the industries and occupations in the high and low bands for Wave 6 to see whether they had grown or declined over the five years. On this basis the findings are positive for skill-intensity at least, with the high band showing strong growth for both occupations and industries and the low band in overall if marginal decline. However, most of the growth took place in industries dominated by the public sector, suggesting that future trends will be shaped more by the resources and policy settings of government than by the dynamics of the market. If the contribution of the non-market sector is excluded, the overall picture for the private sector looks markedly less positive, with such growth in skilfulness as has occurred taking place in industries that employ relatively little labour.

The final exercise in this chapter was to determine how the findings in this and previous chapters had been affected by the most easily calculated kind of sample-related error which was known to be relevant, namely the over- and under-representation of industries and occupations in the sample. By choosing a period bounded by two Census years, it was possible to calculate how the findings would have differed had the representation of each

category in the HILDA sample accurately reflected its contribution to employment at the population level as recorded by the Census.

Three sets of findings were subjected to this kind of correction: the distribution of the workforce by skill bands, the growth or decline since Wave 1 of the top and bottom industries in Wave 6, and the aggregate mean scores for the full sample on the two main composite scales. The first of these showed the same pattern of polarisation as for the sample, albeit with reduced magnitude and a stronger bias towards the lower end of the skill spectrum. The second showed some interesting discrepancies between the sample and the Census, with employment in the key high-skilled industries still rising but by much smaller margins, resulting in a smaller overall bias of growth towards the higher-skilled end, while several of the key low-skilled industries which had increased their share of the sample declined as a proportion of employment in the Census; however, the latter may be partly a result of the HILDA survey, because of its timing, capturing a larger element of lower-skilled seasonal employment than the Census. On the final analysis, the adjusted scores were higher than the aggregate means in Wave 1 for both dimensions, but lower in Wave 6, leading to a higher drop in both skill-intensity and task discretion than occurred in the sample means.

All three analyses have methodological weaknesses which limit the reliance that can be placed on their findings. Even when these allowances are made, however, the impression which remains is that the overall patterns of change identified in the sample are not fundamentally altered by this correction, even though their magnitude may be. The adjusted scores support and if anything strengthen the general finding that both skill-intensity and task discretion across the economy declined between 2001 and 2006, and there is no reason on this basis to suspect that any of these findings are artefacts of the sample.

## Chapter 10

### Conclusions and Implications

This thesis has involved revisiting issues which were at the forefront of the research agenda and public controversy twenty or thirty years ago, but with the kind of data those earlier researchers could only dream of having at their disposal. The question of whether skill increases or decreases over time with change in technology and work organisation is centuries old, and heroic attempts were made to answer it in the 1980s. If the subject has been largely off the quantitative research agenda in Australia over the last two decades, it has probably not been for lack of interest, but rather because there were no suitable data to carry research to the next stage.

Two developments have made it possible to carry the debate forward again. The first is the advent of HILDA, which represents a first step to filling the data gap for Australia. The second is the construction of a conceptual model which, while building entirely on existing scholarship, provides a synoptic framework within which a wider range of contributory factors can be empirically coordinated than was possible in the earlier research.

The structure of the thesis means that the two themes, conceptual and empirical, have been explored more or less at arm's length from one another. One of the main purposes of this concluding chapter is to draw the two themes back together and map out areas where the model could provide the basis for new analyses addressing the unexplained findings which have emerged from the empirical evidence. At the same time, it sets out the ways in which the new evidence has already affected understanding of some of the key issues in the debate, and points to challenges which have been posed to the existing policy directions, both by the model and by the findings of the research undertaken here.

#### **10.1. The contribution of the NSS model**

The National Skilling System model, as was made clear at the beginning of the thesis, uses ideas, concepts and assumptions which have individually been current in academic and even policy discussion for as long as twenty years. Its intended contribution is to provide a clearer framework relating those constructs, processes and constituent theories to one another. One of its most powerful features is its potential to build links between a number of active discourses in economics, industrial relations, management and innovation studies which have often seemed to be proceeding in isolation from one another if not even at cross purposes. In particular, it builds productive links between the discipline of economics, which too often ignores the complexity and uniqueness of local situations in the cause of stylised mechanisms and generic behavioural assumptions capable of explaining large-scale, long-run trends, and management studies which concentrate on the enterprise level at the expense of the bigger picture. By providing an opportunity for these different disciplines to cross-fertilise and locate themselves in an additional context, it potentially expands the explanatory power of those

discourses, compensates for their individual weaknesses and blind spots, and exposes conceptual or logical flaws which are not always apparent to someone working wholly within the individual disciplinary paradigm.

In a strictly practical sense, the model is valuable in that it counteracts assumptions that the skills problem is simple, unidimensional or a matter of one-way causation. It shows how there are multiple drivers: demand for skill is not something fixed or given to which the other elements need to adjust. Neither is supply, nor deployment. Each is in constant, often asynchronous adjustment to both the others; whichever target one chooses, it is a moving one. Each of these key driving processes, in turn, is made up of multiple elements which are interdependent but reflect different sets of causal factors. On the positive side, this implies that the options open to policymakers are not confined to a single area of intervention (e.g. the financing of VET) but can involve interventions across a spectrum of economic and social phenomena, some of which may well be easier or less costly for governments to influence. On the negative side, it greatly complicates the policy task. However, this very complication can reduce the risk of wasting public money on specious but poorly conceived attempts at a solution, just as it can encourage greater clarity and transparency in defining the objectives of policy.

Another way in which the NSS approach makes the task of policymakers more difficult is that it shows there is no such thing as a generic problem, and hence no such thing as a generic solution which works in all cases. A given problem is the result of a complex and unique history which demands a fresh analysis each time a government comes to address it. Often that history goes back to decisions made decades earlier, or to the collateral effects of processes which have been underway for a long time, sometimes without awareness that they would have an impact on skill requirements, supply or use. Because of this history, the main factors that underlie the problem may be difficult to reverse, creating a need for innovative or non-obvious policy solutions.

A special case of irreversibility on which this model lays particular stress is the degree to which national institutions affect both the strengths of the current system and the kinds of problem that arise, and hence the options open to policymakers for addressing them. By helping to clarify where institutions are involved in the causal process, and which institutions are involved, the model can help identify cases where an apparently obvious remedy would be difficult to apply sustainably and/or would create significant collateral impacts. Conversely, where an institution has become so dysfunctional in its consequences that it constitutes a barrier to the continuing workability of the system, this approach makes it clearer when hard decisions need to be taken, but also points towards potential avenues of institutional change through the identification of institutional agents, a category not present in any other known institutionalist model.

Discussion thus far has concentrated on the value of the NSS model as a tool for creating awareness. Its particular strength in this regard is that the core “triangle of forces” structure is simple and easily explained, and an explanatory model can be built in stages moving out from the central triangle, much as was done with the generic model in section 2.2. An added advantage when used as a tool of participatory policy analysis or stakeholder involvement is that the framework lends itself to elucidation and exploration through diagrams, animations

and other non-discursive methods. The same strengths make it equally useful as a tool of planning and policy development. Faced with a particular strategic problem in which skills are involved, a team of analysts can start from the question “What does our current skilling system look like? How well does it fit together? What’s working? What isn’t?”, and the model can provide the basis of a toolkit of materials for visualising the problem in its context, devising possible solutions and understanding their likely impacts, intended and unintended.

Of course, this list of relatively straightforward applications of the conceptual core of the model does not exclude its potential to support more sophisticated, data-based technical modelling of the kind associated with the systems dynamics field. Over time and in more knowledgeable hands than the present author’s, it should also provide a basis for the design of mathematical simulations, bringing the promise of greater predictive power or at least more rigorous scenario-building. It may also respond well to analytical methods more attuned to core systems assumptions such as non-linear causality than the simple, classical inferential techniques which have been used in this thesis. All this can be seen as part of the agenda for follow-up research, which will be revisited in the last part of this chapter.

## **10.2. Summary of empirical findings**

The limitations of the empirical research in this thesis, and of the data on which it is based, have been spelt out in detail in the earlier chapters. In spite of these, it seems fair to claim that some real progress has been made. It is now possible to be much clearer about what happened to the application of skill, across the full range of Australian jobs, over the five years for which HILDA so far provides data. The most important limitation on the potential of the findings to support inference about the overall trend in Australia’s NSS is the short run of data so far available. Yet when one compares these findings with the lack of conclusiveness in the quantitative research conducted before 1990, the surprise is rather how *much* reliable evidence of change has emerged over a mere five years – a period so short that most other users of the relevant HILDA data have so far seen no harm in sacrificing the chance of longitudinal inference to the attractions of a pooled sample.

Some of the news is good. Assuming the HILDA response can be extrapolated to the population, three quarters of all working Australians believe that their jobs make good use of their existing skills, with serious overskilling reported by fewer than one in eleven. Well over half see their workplaces as places of learning. A substantial majority (around 60%) feel they have reasonable control over the way they go about their own work<sup>1</sup>. The proportion of the sample employed in industries with high skill-intensity grew by 4.6 percentage points over the five years, and those in industries with high task discretion by nearly seven. The trends remain, though they are significantly smaller, when the calculations are adjusted on the basis of the more accurate Census figures for employment in each industry.

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<sup>1</sup> The estimates here are based on the counts for individual response categories on each of the main variables across the six waves. “Agreement” as used in these paragraphs means a score of 5 or better. “Disagreement” means a score of 3 or less, while serious disagreement (as in “serious overskilling”) means a score of 2 or below. “High” and “low” skill-intensity and task discretion indicate a mean score for the industry at least a quarter of a standard deviation above or below the all-industries mean for Wave 1 and Wave 6.

But there are also negative messages which offset and perhaps even outweigh the positive ones. The most important is that on average, jobs were less skill-intensive in 2006 than in 2001, and on two out of the three measurement methods used, they also involved lower task discretion, albeit only marginally so. Around one in three workers do not feel they have a lot of say over what happens in their job, and around half feel they have little control over the timing of their work. Perhaps most alarmingly, the decline in task discretion over the five years was most marked in the most skill-intensive areas of employment.

The growth of employment in industries with high skill-intensity was actually evidence of polarisation rather than overall growth, since rising a rising proportion of employment in the higher band was accompanied by a rising proportion in the lower band. In the distribution by occupations, the lower band grew more than the upper for both skill-intensity and task discretion. Using a proxy metric which is admittedly only capable of providing indicative results at best, the same polarisation was evident for the third key dimension, substantive complexity.

Compositional change in the distribution of the workforce across industries and occupations appears to be the most important driver of overall change in the skilfulness of jobs, at least over this timeframe. The level of mobility across industries, occupations and sectors was unexpectedly high for such a short period, and constitutes the largest element of reliably identifiable change in the labour market over the five years. By contrast, the overall fall in skill-intensity and task discretion was shared fairly evenly across industries, with relativities between occupational divisions remaining largely unchanged and no noteworthy gain or fall in skill-intensity recorded in any industry or occupation of a size sufficient to affect the overall average. This finding is consistent with those of the historical analyses summarised in Chapter 5.

The importance of compositional change is reinforced by the evidence about individuals' experience over this period. Job change was the most important identified factor behind improvements in an individual's skill utilisation and development. The *t*-tests reported in Chapter 7 show that individuals who changed jobs between labour market categories at any time over the five years typically experienced rises in skill-intensity, while those who remained in their original categories experienced decline. However, the compositional changes which had the greatest apparent influence on change at this level went beyond the normal categories of industry and occupation. The largest mean difference, over a full point on the skill-intensity scale, occurred between those who had changed the form of their employment contract, e.g. from casual to permanent, and those who had not. This said, respondents who had changed industry, occupation or sector of employment (public to private or vice-versa) also did better. The same pattern was repeated in task discretion, except in shifts between sectors, where the effect was non-significant.

Against this evidence must be set the failure of compositional factors to emerge as strong independent predictors of change in individuals' scores in the two regressions. The explanation for this discrepancy is unclear. It may simply conceal more interesting and meaningful patterns at a finer level of disaggregation than the 1- or 2-digit classifications used in the HILDA general access dataset. Alternatively, it may indicate that the apparent influence of industry and occupation is the result of chance covariance with some kind of unobserved

heterogeneity in either workers or workplaces, a covariance which was not equally captured by the regressions. This issue is examined further in 10.4 below.

Within the industry distribution, the clearest finding is the disproportionately large contribution which the non-market sector makes to the aggregate level of skill exercised across the economy. Without the growth in the proportion of the workforce employed in the high-skilled areas of Health and Community Services, Education and Government Administration, the overall trend in skill-intensity over this period would have been much more unequivocally negative. This finding is remarkably parallel to that made by Wright and Singelmann a quarter of a century earlier, and raises a similar concern that the overall skill level of the Australian economy could fall if governments reduce their activity in these areas.

On the supply side, one of the main contributions of the research is to confirm the importance of work itself as a source of learning in the Australian NSS. From Wave 3 of HILDA onwards, a sequence of questions has been asked on whether a respondent undertook work-based or related training. This variable shows a positive correlation with scores on NUSKILLS in all waves for which data are available, but the correlation falls in the range .260-.285, indicating that a high proportion of work-based learning takes place independently of anything that can be classified as training. This finding is highly consistent with those from the UK surveys on the importance of on-the-job learning, and with data from the ABS training surveys showing that the average employee is around twice as likely to undertake informal kinds of learning as to receive formal training.

Once again it must be stressed that any trends over time emerging from such a limited run of data need to be treated with caution. The noisiness of the data themselves, together with the small range of movement in most indicators from year to year, makes it hard to accept with any confidence most of the observed year-on-year change, especially without any hard information on the longer historical context. The significance of much of the movement observed over these first six years should become clearer once ten or fifteen years of data are available and more significant trends appear which can be traced back to origins in this period.

### ***10.3. Implications for key theoretical issues affecting skill***

#### **10.3.1. The deskilling issue**

If the key question is whether Australia as a whole is becoming a higher-skilled labour market, then the answer, over this short period at least, has to be that it is not. It is even open to conclude that some deskilling took place in the aggregate, though such an inference cannot be made with any great confidence given the lack of consistent year-on-year trends and the likely contribution of non-response, response instability and panel conditioning to the overall figures. Nevertheless, the overall trend over the six waves seems robust to a variety of assumptions and measurement methods, and most of the known sources of error could be expected to bias the results in the opposite direction, towards an overestimate of growth in the amount of skill exercised. Consequently it seems reasonable to conclude that at least part of the observed decline is real, though its magnitude must be treated as uncertain.

The picture is clearer if one focuses only on the market sector of the economy. Without the proportional growth of employment in education, health, defence and government administration, the aggregate decline in skill-intensity would have been much more clear-cut. However, the performance of these industries remained relatively static over the period, while shifts in skill-intensity, in either direction, were most evident in the market sector. The largest falls over the full six waves (ranging between 6.54% and 15.66% of their Wave 1 score) were recorded by industries falling entirely within the market sector and mostly towards or at the bottom end of the distribution both on skill-intensity and on the proxy substantive complexity ranking. By contrast, the few market-sector industries that recorded rises in average skill-intensity were small or declining contributors to employment and their increases much smaller on average. It would thus appear that the market sector, taken as a whole, does have a deskilling problem, and in some industries it is surprisingly large. This is an important finding, as it is the first clear statistical evidence of deskilling to have appeared anywhere for many years.

The other important aspect of this core debate addressed by this research is that it appears to provide strong confirmation for the polarisation hypothesis. Skill polarisation, at least as evidenced by the industry and occupational distribution of the employed workforce, grew over this period to a degree that appears remarkable for a mere five years, and suggests a different story going on behind the aggregate trends. As was argued in Chapter 9, this trend may have more long-term implications than the aggregate change.

One confounding factor which has not been noted in any previous research is that when HILDA respondents think about the characteristics of their job, skill utilisation does not appear to be a very salient criterion. The broad-based factor analyses carried out in 6.4.1 suggest that the main criterion on which they discriminate between jobs is the amount of task discretion they can exercise, and more specifically discretion in the use of their work time. After that criterion comes job stress, then job security and finally skill-intensity, with some of the constituents of that construct loading practically as well on the stress factor. If the order of factor loadings simply reflected the relative salience of each construct (of course it is only part of the story), then it could be argued that skill as a component of work in Australia was generally less important, at least from the employee's point of view, than the raw figures might suggest.

These results also seem to confirm the original thrust of the early Labour Process literature, which saw deskilling as being manifested primarily in a loss of worker autonomy. The picture that comes out of HILDA is less clear-cut in this regard, with a flatter or by some measurements slightly rising trend for task discretion across the board. However, this aggregate trend is mostly the result of a gradual rise in the mean score for time control, the lowest-scoring of the three constituent variables. The other two variables show a declining trend closer to that for the skill-intensity scale.

So far as the second element of the debate goes, i.e. whether a decline in overall skilfulness results from generic influences affecting the nature of work or from changes in the composition of employment, the evidence here comes strongly down on the side of compositional change. Without the movement of individual respondents to different jobs, industries, sectors or occupations, very little change would have been evident in the aggregate scores on either scale.

This applies in particular to the evidence of polarisation, which is only apparent when one moves from the average scores across the full employed sample to looking at the distribution by industry and occupation. The only qualification to this conclusion is that clearer trends appear within occupations and industries when the results are disaggregated, notably a steady growth since Wave 2 in the average skill-intensity of trades jobs, a slight falling trend in the task discretion of managerial jobs and some marked shifts in the skill-intensity rankings of 2-digit industries. This suggests that some changes were still happening in both skill-intensity and task discretion within individual industries or occupations, but that their impacts tended to cancel one another out in the aggregate.

Overall, the evidence appears to support the original thesis that changes in the average skill requirement of jobs across an economy reflect changes in its structure, as some kinds of job cease to be viable and are replaced by others which are more suited to the changing competitive environment. However, the relatively small industry and occupation effects which showed up in the regressions suggest a need for some caution in accepting the traditional definition of compositional change. Some of the apparent industry effect could actually stem from the adoption of new work practices or forms of work organisation which were not in themselves industry-specific, but were adopted earlier or more widely in some industries than others. Some of it could be the result of dynamics confined to specific regions that took effect across industries, but within a local pattern of economic activity in which some industries were represented well above or below their national level of representation. Some of it could be due to the winnowing effect of competitive pressures being felt more strongly in some industries, supply chains or locations than in others.

If meaningful patterns of this kind are eventually identified, and are found to be the real sources of variation, it seems inevitable that issues will sooner or later arise about where the boundary lies between generic change (employers across a spectrum of industries adopting different practices) and compositional change (one kind of work displacing another). To start with a possible distinction already raised above, are full-time permanent jobs a different kind of work from casual jobs? A categorisation that distinguishes jobs in small business from jobs in large firms with complex internal labour markets, or diversified conglomerates from firms operating within single industries, or trade-exposed jobs from those sheltered from international markets, would probably seem to many people a fair basis for mapping compositional change. But could it not equally be argued, for example, that firms with a high propensity to innovate belong in a different category from non-innovating ones? And where firms share a generic approach to market strategy, does this mean that they constitute a particular type of firm, which may over time supplant other firms pursuing different strategic models, as Porter's (1980: 129) and De Sarbo and Grewal's (2008) concept of "strategic groups" might suggest? Or is strategy (however generic or derivative) simply a pragmatic choice which individual firms can vary at their will? Such dilemmas suggest that as understanding grows about the drivers of skilling change, so the traditional distinction between generic and compositional change in skill requirements may eventually either lose its meaning or need to be fundamentally reconceptualised.

### 10.3.2. Skill and autonomy: Is Spenner's hypothesis still valid?

Much of the evidence in this thesis has raised questions about the sustainability of Spenner's "pragmatic hypothesis" (1990: 402) that autonomy/control is a core dimension of skill complementary to the more content-related dimensions. In one sense this hypothesis has been difficult to test with the HILDA data because they provide no really useful information on substantive complexity, the dimension of skill which Spenner specifically associated with autonomy/control. Instead the analyses here have had to confine themselves to investigating the association between task discretion and skill-intensity, a dimension that does not specifically feature in Spenner's model or any of the earlier literature on which it was based. However, if it is accepted that skill-intensity is a core dimension of skill with a similar status to substantive complexity – as has been the underlying assumption of the methodology used here – then any unexplained discrepancy between findings for skill-intensity and task discretion would appear to cast the relation with substantive complexity into the same kind of doubt.

The evidence from HILDA is ambiguous on this relationship. The aggregate correlation between the two scales is fairly modest at around the .2 level, certainly nowhere near Spenner's reported .6-.7 for substantive complexity and autonomy/control, but still stronger than that between either of the HILDA-based skill scales and any of the other obvious exogenous predictors. Many 2-digit industries and occupations show a high level of congruence between the two. On the other hand, large discrepancies occur in the experience of several occupational groups between the two dimensions, notably in the cases of some professionals who are in or near the top rank for skill-intensity but well towards the bottom of the ranking on task discretion, and Advanced Clerical & Service Workers who are in the lower band for skill-intensity but above Professionals in the upper band for task discretion.

This leaves the question open: should one ignore the strong arguments of Spenner, Kohn and Schooler, Karasek, the Labour Process school and even Adam Smith and conclude on the basis of this evidence that task discretion, though possibly important in determining whether skill can be exercised, is not in itself a dimension of skill?

There are a number of ways one could interpret these findings:

- (i) Task discretion is indeed part of skill, and a decline in task discretion represents deskilling even if it is not accompanied by evidence of reduced skill-intensity or substantive complexity. (This is Spenner's original hypothesis.) Large discrepancies between task discretion and skill-intensity, such as have been identified in several professions, represent Type 1 system failure (see 2.1.2) and entail a loss of potential productivity.
- (ii) Task discretion is not a dimension of skill but a product of power relationships (Form 1987; Lowry et al 2008: 17). It may well be very important to productivity and the welfare of the workforce, but no useful purpose is served by assimilating it to skill.
- (iii) Task discretion is an aspect of deployment but not of skill itself. It has nothing to do with the potential capability of the worker to work more autonomously, or with the scope that exists for the job to be done more efficiently with more (or less) devolved decision-

making, but is simply a reflection of contingent practice. As such, it helps to determine the amount of skill actually exercised across the economy, rather than the amount of skill present in the labour force.

- (iv) Task discretion is something inherent in the nature of the work and the circumstances in which it has to be carried out. Thus managerial jobs, regardless of how difficult they are to perform, have a relatively greater content of task discretion because the managerial role involves decision-making, whereas work in tightly regulated environments or highly interdependent teams, no matter how skilful, necessarily entails some sacrifice of individual autonomy or scope for personal creativity.
- (v) There are two aspects to the task discretion involved in any job, one imposed by the categorical imperatives of the work and the context (explanation iv above), and one varying in accordance with the skilfulness of the job and practitioner (explanation i). It is important to separate the two dimensions empirically before one can reach meaningful conclusions on whether a rise (or fall) in task discretion indicates upskilling (or deskilling).

The evidence available from HILDA does not make it possible to judge conclusively which of these explanations is the best fit. It should not be forgotten that the scales used here to track each construct are not methodologically optimal ones devised in advance for the purpose, but ad-hoc ones based on the data actually available. A scale using a wider range of indicators could well shed different light on the relationship between the two constructs, much as occurred for Government Administration in Chapter 8 when the more sensitive extended task discretion scale was used to determine the rank order instead of the basic task discretion scale.

In any event, the most important new insight into this issue which has emerged from this research is that it may be misleading to view task discretion as a unitary construct. If respondents distinguish so sharply between control over what they do at work and control over how they allocate their time at work, it may be sensible for future research to investigate a metric of skill based on four components rather than three. The time discretion element itself has dimensions which were not covered by any of the HILDA variables, notably that of control over the sequence in which tasks are performed. Given the importance given to task sequence as an element of complexity by such influential authors as Polanyi and Nelson and Winter, and given its relevance to the “integration” element in Spenner’s earlier definition of substantive complexity, a priority task for future research should be to disentangle the construct into meaningful sub-dimensions and test their relationship to one another and to the other dimensions of skill.

### **10.3.3. The alignment and deepening models: which better describes skill?**

The rivalry between these two models of skill development, discussed in 3.2.1, has considerable relevance both to skilling policy and to the way skill is measured. Whether the level of skill exercised in a job, or possessed by an individual, rises more or less in line with the level of qualification (the alignment model), or whether two individuals who start at different points on the ladder of formal skills have comparable opportunities to develop their skills over the course of a career (the skill deepening model) has central and obvious relevance to such practical issues as skill-based career paths, the design of internal labour markets,

transfer of credit between levels of education, recognition of prior (including informal) learning and the most appropriate split of responsibility for work-relevant learning between formal VET and the workplace. If the alignment model is reasonably accurate, then one can safely assume that skill levels as measured by hierarchical measurement schemes such as ANZSCO capture substantive complexity well enough for most practical purposes. If the skill deepening model is the only accurate one, then approaches based on content measurement, such as O\*net, will be needed to get informative results.

It should be remembered that HILDA provides little or no evidence on the question of how the quantum of skill, viewed as a static concept, varies between levels in the qualifications hierarchy. This is because the skill-intensity scale measures only the match between expectations and experience. When a cleaner reports that his skills are fully utilised, or that he has to keep learning new things, it is generally reasonable to assume that this implies something less arduous, in an objective sense, than when a computer engineer reports the same thing. The only way to resolve such issues of comparability would be through data on substantive complexity, which are so far lacking in HILDA.

Where HILDA can provide evidence is on the dynamic element, i.e. how far workers at each level get the chance to develop their skills after their initial qualification. Here the experience appears to vary between occupational divisions, suggesting that different processes are at work. The experience of professionals shows a high degree of complementarity between their extensive pre-employment training and the amount of continuous learning they do even over extended periods in their job (with the qualification that this skill growth does not seem to be paralleled by any growth in task discretion). At lower levels in the hierarchy, however, the evidence points towards the opposite process of substitution, operating in both directions. For the trades, learning seems to tail off very early in an individual's career, suggesting that the traditional apprenticeship with its emphasis on directly work-related skills acquired in a real-work context has its downside in a lack of opportunities for mid-career learning. On the other hand, low-skilled service sector employees appear to experience more continuing learning than other categories of worker, at least so long as they stay in their occupation longer than a couple of years, suggesting that in their case on-the-job learning substitutes for formal pre-employment training.

#### **10.3.4. How did environmental factors affect the skill content of jobs?**

One of the main issues on which it was hoped this research might shed new light was whether, and if so how, the average skill content of jobs had been affected by the trends in the national and global economy which were generally seen as having a particularly marked impact on the market for skills over this period: the rise in globalisation, the emergence of serious skill shortages in some areas, and a boom in consumer demand unprecedented for several decades.

The impact of a rapidly globalising labour market might be expected to have driven out a growing proportion of the lower-skilled jobs in the economy, leading to a rise in the average skill level of the jobs that remained. Any such effect would presumably have been amplified by the final winding-down of virtually all tariff protection in Australia and by the new trend towards international outsourcing of many services.

The rise of major skill shortages could foreseeably have led to more effective use of the skills that were available, and/or to an improvement in working conditions (including task discretion) for those who possessed the scarce skills and whom employers were unwilling to lose. Alternatively, the difficulty of finding new skilled labour could have led to an intensification of work for skilled employees in those areas most affected. A third possibility is that the more protracted skill shortages could have led some businesses to withdraw from more skill-intensive types of production or adjust their processes to a less skilled workforce, resulting in an overall decline in the amount of skill exercised.

The overall impact of the boom conditions is harder to theorise. On the one hand, they must have been responsible for some of the skill shortages and exacerbated the impact of others that already existed, with the kind of flow-on impacts just suggested. On the other hand, the easier trading conditions resulting from excess consumer demand may have allowed the survival of many businesses which would have succumbed in a tighter market. Such a survival of the less fit may have slowed any longer-term shift towards a more skill-based economy and work practices better able to make productive use of a higher-skilled workforce.

In the event, this set of questions has proved to be the least successful aspect of the research so far. Practically no clear evidence was found to link any of these environmental influences to changes in the skilfulness of jobs over the five years. The only detectable change which can be linked to the unusual strength of the economy is a shift in the balance of employment from casual towards permanent full-time work, which was found to be a significant predictor of rising skill-intensity for individuals. Despite this, neither skill-intensity nor task discretion moved in the aggregate in a way that would confirm any of the hypothesised trends. At best, the slight rising trend in skill-intensity reported by trades workers from Wave 2 onwards could be interpreted as a sign of more intensive utilisation of their skills, since many of the most publicised shortages concerned trades. However, even this was not accompanied by the kind of rise in task discretion which might have been expected if it was a response to growing scarcity of skilled labour. Where work intensification is concerned, it is too early to tell, since there are only two waves of data so far available on the relevant variable.

Once again, this absence of meaningful results can be explained partly by data limitations. Skill shortages were very unevenly distributed across industries and occupations, and the data on their incidence mostly list them at the 3- or 4-digit level (Australian Industry Group 2004: 5; DEST 2006). It is possible that real movements at this level were concealed at the 2-digit level which was the finest disaggregation available for HILDA. Both the skill shortages and globalisation took place over a much longer period than these five years, and in the absence of any data earlier than 2001 it is impossible to tell whether the strongest impact of either occurred in the period of interest<sup>2</sup>.

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<sup>2</sup> The DEWR Skilled Vacancy Index, which had shown an overall rising trend since the recession of the early 1990s and had been rising steadily since the last quarter of 1996, peaked in the June quarter of 2000 and was falling or relatively flat over the period covered by these data. The drop in vacancies between 2000 and 2002 was confined to trades-level vacancies, which then rose back to above their 2002 level by 2004, whereas professionals maintained their growth for another year and then showed a continuous decline in vacancies through to 2005.

Another possible confounding factor is that both the skills shortages and the consequences of globalisation were less evenly distributed, and their impact less consistent, than is commonly believed. The case of globalisation has already been discussed in 2.3. Where skills shortages are concerned, they appear to have reflected a great variety of causes. Based on the Commonwealth government's 2006 National Industry Skills Report (DEST 2006), some of the current or emerging shortages were in occupations (chefs, hairdressers) which have been listed as "in shortage" for immigration purposes ever since the 1960s. Others appear to reflect shortfalls in the respective industries' own skill development effort going back over a decade (Road Transport, Personal Services, private health providers, Food Manufacturing, Accommodation, Cafes & Restaurants, Construction) (Fraser 1996: 117). In others a retention problem appears to have either exacerbated the shortage or been the main factor behind it.<sup>3</sup> In others again, allocation appears to have been the point of failure; this applies in particular to the shortages that occurred in non-metropolitan locations. In the case of transport drivers, the problem related to an ageing workforce and a lack of recruits to fill the jobs of those expected to retire (DEST 2006). To these supply-driven shortages must be added those (notably construction trades) which were almost certainly the result of abnormal demand conditions. Given such a diverse set of causal mechanisms, it would once again be optimistic to expect a consistent response to show up in the HILDA indicators.

At least so far as the overall impact of the boom goes, history may provide a counterfactual. The best guide to how skilling practice in Australia reacted to boom conditions could be to see how it changes in a contracting economy, just as its distinctive response to skill shortages and a tight labour market may only be possible to identify if the economy reverts to conditions of labour oversupply more typical of those to which industry become accustomed over the decades before 2000. At the time of writing, however, it is unclear when or if such movements will be reflected in future waves of HILDA, as corrective policies have so far forestalled much of the expected impact of the financial crisis on employment.

#### **10.4. Implications for public policy**

The empirical findings of this research pose a challenge for policy-makers. It would be premature to call this a warning when only six annual waves of data were available at the time of writing, the period they covered was arguably an atypical one, and there was no real indication of the longer-term trend against which these findings can be set. On their face, however, they send a less than encouraging message about the efficacy of the current directions in skilling policy. It would appear that despite growing expenditure on VET, a growing incidence of formal qualifications in the workforce, almost two decades of reforms aimed at increasing the efficiency and responsiveness of VET, and the emergence of skill as one of the most critical and contested issues on the Australian political agenda, no increase in the average skilfulness of Australian jobs occurred over the five years to 2006.

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<sup>3</sup> In 1996 under a third of qualified hairdressers and food tradespersons were still employed in their respective areas of qualification, and among Wood, Electrical, Automotive and Mechanical & Fabrication Engineering trades (identified in the Australian Industry Group's 2004 report as among those experiencing the most critical shortages of skilled labour), roughly equal proportions of the qualified workforce who were still employed were working in and out of their trades, though around half the latter had moved to more skilled occupations which may well have used their skills (Smith 2002: 23).

In this case the model has the best chance of answering the questions raised by the empirical results. The primary lesson from this model is one already made in 10.2 above: the options of government are not confined simply to increasing the funding of VET or controlling the behaviour of VET providers. If there are failures, they are at least as likely to be found on the demand or deployment sides as on the supply side. Whatever the case, such problems as exist at present are best seen as the result of a complex of interacting factors more or less unique to the present situation, unlikely to resemble precisely the set of factors that contributed to any problem in the past, unlikely to be repeated in the future, but still having their roots in history which often cannot be undone easily if at all.

Given this premise, the time would seem right to revisit some of the evidence provided in the set of NCVER studies which was summarised in 1.3. Even without corroborative evidence, such as that summarised in 5.3, these studies demonstrate the need to focus on demand-side constraints such as the failure of Australian businesses to take up high-productivity work practices, the predominance of cost-cutting over strategic business development, the apparent neglect of technical competence in favour of interpersonal or presentational skills, and the growth in short-term employment contracts which minimise opportunities for both formal training and on-the-job learning (albeit the evidence from HILDA shows that this growth was reversed over the specific period in question). All these are areas where a properly targeted incentive program might lead to improvements in the use of, and consequently the demand for, skill in Australian industry.

One obvious implication which crosses the supply and demand sides is that governments have every reason to resist pressures from employers to provide them at public expense with a workforce which will be fully productive from Day 1 and perfectly tailored to each business's immediate skill requirements. The findings of this research make it clear that a large proportion of the learning required to do any job occurs outside the context of formal training, and should be read in the context of the UK findings which show that most workers require anything between three months and two years to become fully competent in their jobs, aside from any formal training requirements. Such evidence demands a new focus on the best way to demarcate the responsibility of the state from that of industry, a topic largely missing from the public agenda in the fifteen years since the Commonwealth sent a strong negative signal by pre-emptively discontinuing the Training Guarantee just at the time when evidence was beginning to come out on its unexpected effectiveness (Fraser 2005).

A review of this kind might need to extend to the principles which have underlain the reform agenda for Australian VET since the early 1990s. The core emphasis on creating a market, where none would have arisen spontaneously in the absence of government intervention, has fragmented not just the structure of the training industry but its offerings, with a growing pressure to concentrate on short, task-specific stand-alone modules which take little investment of time or knowledge to prepare, offer a quick return on that small investment, and thus lie within the capacity of small under-resourced independent training providers. The price of this "responsiveness" has been to set back the coherence which was once seen as a strategic objective of VET reform and to hamper public TAFE, not only in its capacity for strategic forward planning but in its potential to become a common resource of knowledge on training

with a synoptic perspective that crosses occupations and industries, as pseudo-market financing arrangements force it increasingly into the same short-term “competitive” mould.

Perhaps a higher price of this model of “responsiveness” has been to make the system less future-compatible. To use a distinction introduced in 2.3.1, the system that has grown out of these reforms is increasingly focused on threshold skills, at the expense of developing the kinds of future-oriented skill – skills of learning, adaptation and reflection, of knowing-why rather than just knowing-how – which allow individual firms to develop their unique competitive skill profiles, and which are essential to the economy as a whole if it is to remain resilient in a world where change seems unlikely to stop soon.

Some of the debate about generic employability skills is an acknowledgement of this growing gap. However, it is not realistic simply to treat such skills as “competencies” which can be taught in modules and ticked off in tests before a new entrant is let anywhere near a workplace. Experience shows they can be developed through initial pre-employment education and training, but only through the kind of long-cycle VET which contains a serious theoretical element alongside real workplace experience and aims to create a broad, evolving skill profile (Tether et al 2005: 104). Even with that background, they are unlikely to be maintained except through the continuing experience of learning in the workplace. The differences revealed by this research between the experience of tradespeople and professionals in this regard suggest that this is one area which deserves the attention of policy-makers.

Thus, a response to the weaknesses of present supply-side policy would need to have two main thrusts. One is to discontinue the marketisation of public TAFE and replace it with a more strategic model emphasising long-term investment for long-term payoffs, cumulative cross-specialty learning on the provider side and the creation of versatile competency profiles grounded on a rigorous theoretical base. Some current innovations in school-based VET, notably the Tasmanian Polytechnic, offer potential for the development of such model, provided they are encouraged and funded to evolve beyond simple cosmetic rebranding. The experience of countries with a dual system, such as Germany and Austria, shows that it is possible to strike a workable balance between breadth, theoretical depth, currency and relevance to industry requirements provided the right governance arrangements are used; it bears repeating that the arrangements which work in those countries are unlikely to work if simply lifted out of context and transferred to the different Australian institutional context. Such a reprofiling of the publicly funded core would still leave plenty of space for a competitive fringe of independent providers catering to ad-hoc upgrading and updating requirements in a genuine market framework, free from the distorting influences of government subsidy.

The second element is a much stronger emphasis on learning workplaces, how they develop and work in a range of contexts, and what policy incentives work best to enable and maintain them. One enabling factor already mentioned is the encouragement of longer-term attachments between employees and firms. Where the structure or market circumstances of an industry make that difficult, there may be opportunities to experiment with the transformation of labour hire firms into virtual learning enterprises which help their contract employees to share, combine, reflect on, and where possible gain formal recognition for what they have learned in successive placements. On other aspects of learning organisation design, the literature is

extensive and well-known, but most of it dates back to the 90s and earlier, and little of it appears to have been taken up in any sustained way in Australia, except perhaps at the top end of the labour market. This suggests a need for more case studies of examples that have actually worked in Australia, with a view to developing models which are applicable in current Australian contexts, disseminating them and identifying the policy settings most likely to encourage and support them.

One issue raised by learning workplaces is the role of various kinds of industrial democracy. The evidence from this research suggesting that task discretion is the most salient issue on which employees rate their jobs makes this all the more important, even leaving aside the more theoretical question of whether task discretion is a part of skill. Over the last decade or so the debate on industrial relations has focused almost exclusively on what could be called third-order industrial democracy, i.e. the ability of workers to influence decisions affecting their jobs through the intermediary of a union. The evidence here indicates that it may be time to give more attention to second-order (whether employees in a workplace can exercise collective discretion and/or have direct collective input into decisions concerning the nature of their work and how they do it) and first-order (individuals' choice about what they do, how and when) industrial democracy. Equally important is the relationship between the three orders. The researchers who reported on the UK surveys suggest at one point that the second order may take place at the expense of the first (Gallie, Felstead and Green 2004). In Australia, whenever legislation is introduced to restrict or restore union rights, it is common for employer interests to argue that the presence of unions detracts from trust-based workplace relations and hence from the practicality of devolving decision-making to the shop floor; this runs contrary to much of the evidence from North European countries, where the key mechanism of second-order industrial democracy consists of works councils where unions have a guaranteed seat at the table. It will take more research on the dynamics of such interactions in the Australian context, or at any rate a meta-analysis of the existing literature, before it becomes clear exactly what are the implications for effective deployment of skill, and hence for policy.

In one respect, however, the evidence from HILDA does point to a need for immediate corrective action in an area which lies completely within the governments' control and legitimate sphere of action. This is the alarmingly low average task discretion scores recorded for some of the most skilled employees in the government sector. Even if these are not seen as deskilling in the strict sense, it is hard to believe they do not indicate a serious loss of potential productivity, or at the very least of staff morale and commitment, in some of the most essential and costly areas of government activity. These data are so far at variance from those for correspondingly skilled occupations in the market sector as to call into question the appropriateness of the managerialist styles of governance which have dominated public service provision over the last two decades. In the light of what is known about the kind of work arrangements that make the most effective use of professional skills, they raise in particular the question of why, among the four paradigms of governance for public service delivery listed by Le Grand (2007, cited in Marsh 2009: 34) – trust, target-based performance management, user voice and quasi-markets – only the first has been missing from the public sector reform agenda over that period.

In other respects, the NSS model can be used in conjunction with data, either from this research or elsewhere, to help target both existing and new government initiatives more

accurately. One case in point is the analysis in 10.3.4 above of the different causes of the skill shortages listed by DEST in 2006. In cases such as those which have been on the “in shortage” list for over four decades, it is clear that the real problem lies in the attractiveness of those occupations to potential recruits, suggesting fundamental deficiencies in remuneration and/or working conditions which need to be addressed before any improvement in supply can be expected. In such cases, as in those where the problem stems from the inability of the occupation to retain qualified workers, any investment by government in additional training to address the shortage is likely to mean throwing good money after bad unless the real underlying problem is addressed in the process.

Another example concerns the findings summarised in 10.3.3 about the differences between occupational divisions in their experience of work-based learning. These suggest, for example, that training investment in lower-skilled service occupations should be concentrated in the period after initial entry to the workforce, and coupled with incentives to retain employees longer in the one job or occupation. Conversely, additional expenditure on post-trade training is unlikely to show any great returns without identifying and addressing whatever it is in the nature or conditions of trades work that leads to so little continuous learning after the initial qualification is gained.

A different kind of example shows how the mindset generated by the NSS model (if not necessarily the model itself) can help identify opportunities and weaknesses in the system. A number of industries which lie at the bottom of the scales and show no sign of improving might still have both the potential and a good case for increasing their skill profile because of their role in supply chains. An example would be the worst overall performer on both scales in both 2001 and 2006, Food Retailing. A strong current focus in industry policy lies on Australia's potential to increase its competitiveness in value-added agrifood by moving to a strategy based on specification rather than price (West 2009). One of the important prerequisites to higher specification is the discipline imposed on local producers by a knowledgeable and discriminating domestic consumer base (Tether et al 2005: 69, 107). The most obvious place to educate consumers is at the point of purchase. This indicates that both Food Retailing and Accommodation, Cafes and Restaurants (another industry apparently secure in its position towards the bottom of the rankings) could provide a useful service to the upstream parts of their supply chain, with implications for international as well as local competitiveness, by training their front-line employees to educate their customers in what to expect and to act as ambassadors for quality Australian produce, in much the same way as sommeliers already do for the wine industry. Once again it should be stressed that this implies more than simply making the training available: the contribution will not come about unless wages, working conditions and in most cases status are changed to make it attractive for employees to remain in their jobs long enough to develop both the necessary expertise and the confidence of customers.

None of the above should be taken at this point as firm policy recommendations. With the possible exception of the task discretion problem among public sector professionals, none of the premises has yet been established with sufficient certainty to provide a justification for policy change in its own right. They have been outlined rather as illustrations of how the kinds of insight that can be drawn from the kind of research carried out in this thesis can be used

through the lens of the NSS model to target areas which warrant more detailed research as a basis for new policy directions.

### **10.5. Opportunities and priorities for future research**

The earlier parts of this chapter have already mapped out an agenda for research following out of the questions left unanswered by this thesis. To reiterate, this agenda includes investigations into

- how the trends identified in the period 2001-06 measure up against longer-term trends;
- whether the trends apparent at the 2-digit level of disaggregation appear different, or conversely become easier to explain, when the same or other data are analysed at higher levels of disaggregation;
- the role of time control (including the element of control over task sequencing which is not covered by the HILDA variables), and how it relates to other elements of task discretion;
- whether it is possible to distinguish empirically between the contingent (job-related) and skill-related elements of task discretion, and how separate data on the two might affect the kind of findings listed here;
- whether the substantive complexity of jobs can be measured in the same population, and if so how such data would affect the results of the present research, and in particular the validity of Spenner's hypothesis;
- how much on-the-job learning Australian workers need before they become fully competent in their jobs;
- how the specific skill shortages experienced in Australia over this period actually affected the utilisation of skill;
- whether successful models exist of learning workplaces in the current Australian context, and how easily they might be generalised or adopted by other firms;
- the precise interactions that occur between union representation, participatory industrial democracy and individual worker or work group autonomy, especially in the Australian context, and their strategic implications for skill development and utilisation.

Most of these questions will be difficult or impossible to answer without new data. It is hoped that the headline findings from this research will encourage other researchers to develop new data sources, identify existing ones or undertake new on-ground research with a view to clarifying such issues.

In addition to these and other loose ends left by the research so far, follow-up research may need to follow new directions that were not attempted here, whether for lack of data, because of limitations on the analytical resources available to the author, or simply in the interests of keeping the project within manageable proportions. Some examples are suggested below, some of them involving redefinitions of the research problem, and some involving the application of different methodologies.

### 10.5.1. New hypotheses and focus areas

One of the obvious limitations of the empirical analysis in this thesis is that it confines itself to a traditional concept of compositional change, drawn largely from the deskilling debate, which sees the primary sources of variation in skilling as the industry, firm size and occupational category in which each job is located. While significant interactions have been demonstrated between these parameters and skilling outcomes, the analyses in Chapter 7 have shown that a high proportion of the variation cannot be accounted for purely in those terms. Any follow-up analysis will need to assess the impact of other sources of variation experienced at the level of individual firms and compare it against those traditional explanations.

An argument could be made out that the intrinsic skill differentials between industries and occupations remain fairly stable over periods of up to a decade because of the institutional forces which drive them, but most year-to-year variation occurs between the firms and employers of labour in each category, within a range of skill characteristic of each industry or occupation. The technological, systemic and market factors determining the mix of skills in each industry, and the labour markets and skilling conventions of each occupation, allow for a range of variation, and within this range the decisive factors are firm strategy and the market. Markets are generally much more fluid than the other institutions which influence the skill requirements of occupations and industries, notably educational structures and the split of training between the workplace and external formal training providers, which show strong path-dependence. Hence this market-driven change at the firm level might well be the dominant influence on the aggregate skill requirement of the economy over relatively short periods such as that covered by the existing run of HILDA data.

This represents a kind of alternative hypothesis to the traditional model of compositional change, and can be hypothesised as occurring at two levels. The simpler assumption is that the important source of variation lies in circumstances or behaviours which represent common change factors across firms, e.g. the adoption of particular work practices or kinds of work organisation, the degree of exposure to competitive pressure, or whether a firm engages in various kinds of innovation. This is essentially the same as the original concept of generic change in the deskilling literature, and should be reasonably straightforward to test by normal inferential methods once relevant data are available.

The more complex version of the hypothesis follows the resource-based model in assuming that each firm is more or less unique, and that the important differences between them reflect that unique history, in particular the legacy of initial conditions, unique events and chance combinations of factors. In this case the most important explanation for the aggregate effects lies in the combination of individual but interacting firm trajectories. As pointed out in Chapter 2, meaningful and even generalisable patterns may well be found in such trajectories (indeed, the whole systems approach is built on such a premise), but they are unlikely to occur

within a common timeframe, and hence unlikely to emerge from cross-sectional analysis even over many points in time. Such dynamic patterns can only be identified by truly longitudinal analysis using much more sophisticated methods than were applied in this thesis. These methods are foreshadowed in the next subsection.

A second alternative hypothesis lies on the borderline between research focus and methodology, and arises out of the somewhat ambiguous results of the more broad-ranging principal component analyses described in section 6.4. If employees do not clearly perceive the application of skill in their jobs as a separate and unitary construct, the question arises whether their responses to the relevant questions were in fact treating these questions as proxies for some broader or different construct of job quality. The same question must logically be asked about task discretion, especially given the obvious difference in responses between the time-related and content-related elements of discretion. The presence of such an underlying construct might help to explain some of the more striking discrepancies that emerged between skill-intensity and task discretion scores, especially among professionals.

Attempts were in fact made in the early stage of this research to identify some kind of job quality scale as a basis for triangulation with the skill-related scales, but without success, as none of the combinations tried achieved satisfactory reliability statistics. It would probably require different questions to reveal such a construct if it exists, suggesting that the task belongs to new, initially smaller-scale research. It also seems unlikely that any uniform metric could be found for job quality along the lines attempted here for skill, given that the factors perceived as contributing to quality work, as well as the balance between them, could be expected to vary according to type and level of work, the respondent's education, experience and expectations of work, and individual preference.

If such a true underlying construct were to be identified, it would be a setback for research into skilling issues that used worker self-report as the basis for measurement. At the same time, it would open up different paths for the deskilling debate, possibly with interesting consequences for research in the fields of industrial relations and HRM.

### **10.5.2. New methodologies and data sources**

The empirical part of the thesis, so far as is known, is the first research anywhere in the world to study issues of growth and decline in generic skill across the employed workforce of an entire nation using annually refreshed microdata. In the long run the use of this type of data promises an advance in clarity and precision comparable to that which took place when the first purpose-designed, multidimensional time-series surveys of skill utilisation were developed in the UK, replacing the ad-hoc and proxy evidence which had hitherto provided a basis for largely inconclusive research. The analytical potential provided by such an unprecedentedly frequent refresh rate of the data is amplified by the use of a panel sample which permits tracking of gross as well as cross-sectional change.

In practice, as was anticipated from the start, the short run of data so far available has made it difficult to realise much of this potential. The noisiness of the data themselves, together with the small range of movement in most indicators from year to year, makes it hard to accept with any confidence most of the observed year-on-year change, especially without any hard

information on the longer historical context. The significance of much of the movement observed over these first six years should become clearer once ten or fifteen years of data are available and more significant trends appear which can be traced back to origins in this period. For this reason many of the findings in this thesis need to be treated as provisional.

Another constraint on what can currently be learned from HILDA derives not from the database itself but from a lack of complementary data of the same quality and sample size which could shed light on other aspects of the NSS. In particular, better national-scale data on business characteristics and behaviour might have made it possible to establish some kind of links between workers' experience of skill use and potentially relevant firm-level variables such as business strategy, market position, work organisation, employment practices and innovation. While some triangulation using industry/location/ firm size cells would have been possible at one or two points in time with individual ABS series, notably that on innovation (Cat. no. 8158.0), it was judged that such comparative exercises were best left until a few years of data from the Business Longitudinal Dataset have been released.

The other limitations on the analysis in this thesis reflect the two specific purposes which the empirical element was meant to fulfil. The first of these was simply to illustrate that the concept of a skill trajectory was meaningful and could be operationalised and traced using a common metric. So long as this could be established, there was no immediate need to go further and undertake a detailed forensic analysis or exploit the potential of the data for more ambitious modelling of the other elements of the NSS model; such exercises were intentionally left to future research, in the interests of keeping the thesis project within manageable bounds. The second purpose, which it is important to stress once again, was to demonstrate the usefulness of the HILDA data for investigating questions of practical relevance to skilling policy using the kind of simple analytical tools which can be mastered by an average social researcher or policy analyst without an advanced background in statistics. Since the author himself falls within that category, a conscious decision was made to leave the task of more sophisticated analyses to others with more comprehensive expertise in inferential statistics.

Together these restrictions meant that the thesis could provide only a first taste of the kinds of understanding which are achievable, either now or in the longer term, using both HILDA and the skilling system model. In addition to the new focus areas and hypotheses covered in the previous sub-section, several applications of more advanced methodology suggest themselves as steps forward from the analysis undertaken here.

Perhaps the most obvious gap to be filled involves making proper use of the potential information offered by a longitudinal panel. The analysis in this thesis has been longitudinal in the broad sense that it compares the experience of the same *population* over six points in time, as it was reflected in averages or distribution among categories (cross-sectional change). In system terms, this kind of analysis makes it possible to draw inferences about the behaviour of a system by comparing its *state* at different points in time. But it was noted in 6.3 how one of the most important advantages of using panel data is that they allow identification of gross change, i.e. how the experience of individual respondents has changed over time, and thus make it possible to map individual *trajectories*. In this way generalisations can be made about system behaviour by comparing a large number of individual trajectories to identify common patterns, even if they occur within different timeframes.

The most effective way of identifying and making sense of gross change lies in the application of a new generation of longitudinal analysis methods such as individual and multi-level growth models and survival analysis (Singer and Willett 2003). While such approaches require fairly advanced statistical knowledge to perform and the findings much more difficult to communicate than those of the more conventional analyses, they provide insights into dynamic change processes which simply cannot be captured by traditional inferential methods. Since dynamic change of this kind is at the core of the systems concept, such approaches offer the best prospect of operationalising a skilling system model in ways that permit modelling of its behaviour from quantitative evidence. In addition, such methods provide an insight into asynchronous processes, notably feedback loops whose length can vary according to circumstances. Such processes are central to analyses of system dynamics, as are non-linear and discontinuous change. Some of the methods listed above are also useful for identifying and mapping this kind of change, since they make it possible to locate the points in time when an effect takes off and tails off.

Staying with more traditional methods, one of the more promising ways to gather insights into dynamic change is cohort analysis. By comparing the experience of age cohorts spaced several years apart, it becomes possible to uncover evidence of whether and how the system may be changing its behaviour, as reflected in the experience of representative members of the workforce. Selecting multiple age cohorts at each starting point, e.g. school leavers, prime working age and late career, makes it possible to identify how the changes are taking effect at different points in the workforce lifecycle. Several attempts were made in the research for this thesis to identify and follow such cohorts, but in each case the cohorts selected for the experiment were either too small to permit reliable extrapolation or too closely spaced for actual differences in their common experience to be distinguishable from other sources of annual variation. Once again, it will need a few more waves of data before this technique can begin to fulfil its potential, and even then the sample size will make it a challenge to construct cohorts narrow enough to pick up short-term change and guarantee commonality in the dimension of interest, while still containing enough respondents to allow reliable generalisation at any level of disaggregation.

Another obvious step forward which would not require any sophisticated methods is to experiment with weighting of the annual data files to compensate for differential sample attrition. It has been pointed out in 4.3.2 that the published data files include weights for this purpose, but since these appear to be calculated primarily to replicate the original demographic balance of the full population sample (i.e. a representative sample of *households*), their application cannot be guaranteed by itself to produce a sample that accurately represents the profile of *employment* in Australia in any given year. Given these uncertainties attaching to the use of the standard weights, they were not applied to the data used in this thesis.

A promising alternative method is to weight those categories based on their representation in the ABS Labour Force sample for the most relevant quarter. The rebalancing exercise described in 9.3 was a first step towards such a weighting method, and exposed discrepancies between the employment profiles of the sample and the population of sufficient magnitude to justify a more fine-grained adjustment using quarterly data. It should be remembered, however, that this method depends on the assumption that these are indeed the parameters primarily

associated with variation. If the most important sources of variation are different, and especially if they constitute unobserved heterogeneity in terms of the variables measured by HILDA, this process could well preserve or even amplify the error. The most practical course is probably to experiment with a range of alternative weights based on different parameters and assumptions and see how each option affects the findings. As in 9.3, the main benefit of this exercise would be to increase understanding of the extent to which the findings are sensitive both to the sampling method and to various kinds of differential sample attrition.

A final application of improved methods which has been discussed in Chapter 6 is the use of models derived from item response theory to re-score the Likert items and combine them into scales. The highly skewed response to certain of the key variables of interest to this research, notably USESKILL and WORKFLOW, suggests a strong possibility that these questions are respectively much less and much more “difficult” than the others in the relevant sequence, and consequently that different thresholds should be chosen for classifying a given score on either of them as indicating a positive or a negative opinion. On the other hand, it could just be true that a very high proportion of Australian jobs use most or all of their occupants’ skills, or that very few jobs in Australia today offer much scope for control over one’s use of time. IRT-based methods – notably in this instance the Rasch Unfolding Model (Bayley 2001) - are designed to distinguish better than traditional methods between these two explanations, and hence can help to develop composite scales which more accurately reflect the true extent of movement in the underlying construct than ones based on summed raw scores. It should be noted, however, that most of the literature on such models discusses them primarily in the context of developing new items rather than scoring the responses to existing ones. Hence the technique might justify the effort better if it were to be applied in the context of revising some of the existing items on the HILDA questionnaire, or else of developing supplementary ones. This issue is the subject of the next sub-section.

The suggestions listed above represent unfinished business from the present research. They are not intended as exhaustive or even representative of the range of options that exist for new methodological approaches, either to the analysis of the HILDA data, or to the modelling of the NSS, its component processes and its behaviour. It is hoped that as the model and the dataset become better known in the research community, new researchers will come to both with different competency sets and disciplinary perspectives to arrive at kinds of understanding which are not even anticipated in this thesis. In particular the discipline of systems dynamics, barely even mentioned in Chapter 2, offers a set of increasingly sophisticated mathematical modelling tools which are available either for scenario-building or to help understand past and present change processes, once the general parameters and drivers of a system are sufficiently understood to develop appropriate assumptions and identify the most appropriate data to feed in.

Before that point is reached, however, it will be necessary to expand the range of data sources well beyond HILDA, even if the suggestions for its enhancement in the next sub-section are taken up. In particular, the investigation of interactions between skill use and development and workplace practice, which have an influence on all three key mechanisms, will ultimately require matched worker-employer surveys permitting the two to be linked, preferably, down to the individual workplace level.

Precedents exist for this in Australia, notably the two Australian Workplace Industrial Relations Surveys carried out in the 1990s (Callus et al 1991) and the program of smaller-scale follow-up surveys undertaken by the Workplace Research Centre since 2006 under the Australia at Work Project (van Wanrooy, Oxenbridge, Buchanan and Jakubauskas 2007; Considine and Buchanan 2007). These offer only limited potential for the kinds of analysis initiated in this thesis because aside from the issue of the employment relationship, their focus lies more on indirect industrial democracy achieved through union representation than on task discretion at the individual and workgroup level. What they have demonstrated, however, is the enormous effort and cost involved in developing and fielding this kind of research instrument.

At a time when even the future of long-running key national statistical collections is under threat from financial stringency at the Commonwealth level, it seems improbable that much new research of this kind will eventuate in the near future. Moreover, in Australia's institutional culture of government-business relations where cooperation is relatively uncommon and almost invariably one-way, it is only realistic to expect that the sample for such studies, if and when they eventuate, will be small and largely if not entirely self-selected, and as such less than ideally representative of what is happening across the economy. This implies that the results will not lend themselves to confident extrapolation in the same way as a collection on the scale of HILDA or the Business Longitudinal Dataset. Instead they should provide evidence, at least part of it quantitative, on change processes that apply in particular circumstances and appear to offer an explanation for trends which cannot be fully explained from larger, more representative but less detailed datasets. This evidence in turn should form a basis for new hypotheses and models which can be tested on the larger datasets to determine how far those processes apply across the full spectrum of workplaces. In this sense such small-scale detailed surveys represent a vital link between qualitative and full-scale quantitative research.

Above all it must be remembered that quantitative data can go only so far in explaining the workings of the NSS, especially at this early stage in the development of the model. The analyses in this thesis have raised questions which in the immediate future need to be investigated through case studies and other qualitative methods, both as a guide to short-term policy responses, and to provide a deeper base of process understanding to support the development of better focused quantitative data collections and more informative hypotheses which can be tested on them. This new research could well draw on the concrete experience of smaller-scale skilling systems in Australia which was accumulated under the Skill Ecosystem Program.

### **10.5.3. Implications for future runs of HILDA**

Anyone who has read this far will have their own ideas on how HILDA could have been made more useful for present purposes. It must be remembered, however, that these purposes are altogether subsidiary to the main purposes for which HILDA was developed and continues to be funded. Hence it needs to be recognised that any changes or additions which the managers of the survey might be prepared to make to the questionnaires to support further research in this area, especially without a contribution to the funding of the survey, will almost inevitably be minor.

It should also be remembered that the survey has so far been funded for a total of twelve annual waves, and there is no guarantee that it will be continued beyond that point. This means that it is already two thirds of the way through its assured lifecycle. If substantial changes were to be made at this stage to the wording, scoring or focus of any of the key questions used here, the loss of information from the break in data continuity would almost certainly outweigh the gain from better targeted or phrased questions. This consideration is especially important in view of the expectation, voiced several times in this thesis, that it will require at least ten successive waves of data for any confident identification of trends standing out from normal annual variation. This means that any future gains in informativeness will need to come from the addition of new questions to the existing sequences, perhaps through the deletion of current questions which have proved to be poorly designed, have yet to provide useful information or show significant trends, or are declining in their relevance because of subsequent developments in the policy environment (notably that on paid maternity leave).

Given these realistic constraints, the recommendations which follow are intended as minimalist and achievable rather than ideal, and even then there can be no confidence that they will be acted on. Nevertheless, when the likely cost of alternative new data sources and their probable low priority in the eyes of funding bodies are taken into consideration, there seem to be few realistic options other than an enhanced HILDA questionnaire to carry much of the present research forward.

The most important addition that could be made for these purposes is the inclusion of questions on substantive job complexity. It is almost certainly not realistic to expect these to follow the British example by asking for even a simplified listing of the generic competencies involved in the respondent's job. But even two or three broad questions, similar to those introduced in Wave 5 about variety, repetitiveness and initiative and field-tested to ensure that they interact with them to make up robust constructs, would go a long way towards filling the gap. In particular, questions similar to those in the UK surveys on how long it took respondents to become competent in their job, and how much training it required, would appear (subject to actual testing with this sample) to be a very robust proxy, aside from their value in their own right for creating greater awareness of the essential role of the workplace in creating usable skills.

The second most important priority is to expand the set of questions on task discretion to gather more data on aspects of time control. The main gap that needs to be filled concerns the freedom employees have to decide the sequence in which they perform tasks. So far as the content-related aspects of task discretion are concerned, one or two further questions might be valuable to tease out the presence of collective as well as individual autonomy and distinguish this construct from participatory or representative industrial democracy, which is really a separate issue.

A final set of new questions would aim to provide an explanatory context for these findings by giving a broad picture of relevant areas of management practice. The relevant sequence already includes some questions on management practices seen as progressive in terms of the conventional industrial relations agenda, e.g. home-based work and paid maternity leave, but no significant relations have been found between these and the key constructs of interest.

More informative might be a small sequence of questions probing for the existence of recognised high-productivity work practices, e.g. teamwork, quality circles and non-hierarchical communication, but worded in more general terms to make them relevant to areas and levels of work where such concepts are not part of the normal language. Such quantitative data would be especially relevant to policy in view of the alarming findings of Martin and Healy's (2008) review of the qualitative evidence.

A second major area of concern involves the declining representativeness of the sample, at any rate for the purposes of labour market analysis. It would be difficult to counteract the sampling bias completely because it originates in the sample design, which needs to remain unchanged in the interests of data continuity. However, in the light of the survey managers' own acknowledgement that attrition has had a disproportionate impact on the representation of the lower end of the labour market and the marginally attached, some correction is needed to restore the fundamental confidence that gives a panel sample its value, namely that the same population is being reflected in successive waves. The relative smallness of the wave-on-wave changes recorded so far in the key variables of interest makes this all the more important if genuine trends are to be confidently distinguished from artefacts of sample variability. While the efforts of the survey team to bring dropouts back into the panel are to be commended, there is no guarantee that this piecemeal restoration will lead to a panel which accurately reflects either the original composition of the panel or the current composition of the population. For this reason it is difficult to see how the survey can proceed much further without drawing a properly structured refresher sample designed to restore something closer to the intended balance of representation.

## **10.6. Conclusion**

This thesis has developed a new conceptual model of the way skill is created and used in the Australian economy. The model is centred on a dynamic interaction between the three key processes of supply, demand and deployment, and develops the premise that each nation has a distinctive skilling system, largely shaped by national institutions, which determines the kinds of skill it is best able to develop and apply productively. This system has the potential to be a source of hard-to-imitate national competitiveness, counteracting trends towards the globalisation of labour markets.

As a first step towards operationalising the model, the thesis has tracked the most important output of the system, the amount of skill actually deployed for productive purposes across the Australian economy, over the period 2001-2006. So far as is known, this is the first time a generic measure has been used in Australia to capture this construct. The empirical research has been made possible by the availability of the first six annual waves of data from HILDA, a large multi-purpose panel survey with a sample designed to be representative of the full Australian population. One purpose of this research has been to demonstrate the usefulness of HILDA in types of labour market analysis for which no other suitable high-quality data source exists so far in this country.

While the empirical analysis in this thesis has been only a first step, and is limited in its conclusiveness by the short run of data, it has already identified some findings which should be

of concern to policy-makers. The most significant is that over a period when the need for skills as a prerequisite of national competitiveness was generally recognised and skill was one of the dominant items on the policy agenda, the average skill content of Australian jobs, at least in the market sector, actually went down. Within the non-market sector, the most striking finding is that some of Australia's best-skilled professionals experience levels of control over their jobs well below what would normally be associated with the level of skill they exercise, and their situation shows every sign of deteriorating. This suggests the presence of a productivity problem which demands a review of the practices followed in the management of public-sector professionals.

At this point the data leave a great many questions unanswered about the reason for these counter-intuitive trends. For just that reason, the analyses carried out in this thesis set a new agenda for policy-relevant research to which both HILDA and the NSS model have an important contribution to make.

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