The Growth of Enterprise Intangible Investment

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Abstract

Firms can invest in two types of capital good: tangible commodities such as plant and equipment and intangible commodities such as training and staff development, innovation, marketing, management expertise and workplace relations. Compared with the former, the analysis and measurement of the latter has been relatively neglected. This paper is an attempt to measure the relative growth in aggregate intangible capital and investment since the 1950s. One of the measures calculated suggests that intangible enterprise capital as a ratio of all enterprise capital has grown at an average annual rate of 1.3 per cent over the 50 years to 1998.

1. Introduction

Enterprise intangible investments are all forms of enterprise capital expenditure which are not physically embodied in matter. They embrace expenditures on staff training and professional development, innovation, marketing, management expertise and workplace relations. Many of these investments are embodied in incumbent workers and some are directly attributable to synergies between workers within the firm. Others are embodied in legal entities such as patents, registered trademarks or is simply goodwill. All by definition are outlays made in the expectation of future profit.

To date, there is has been no comprehensive attempt to measure the level or temporal change in enterprise intangible capital vis-à-vis traditional tangible forms such as plant and equipment. Only limited and often irregular data series exist for selected types of intangible investment. While several attempts have been made to measure aggregate intangible investment or capital, these estimates have been dominated by household and government expenditures (see Eisner 1989, Kendrick 1994).

This paper is an attempt to measure the growth in intangible enterprise investment or capital over the last four to five decades. It is concerned solely with enterprise intangible investment and thus excludes most expenditures on education, health and social infrastructure.[1] The definition parallels the conventional notion of gross fixed capital formation.

Section 2 discusses why intangible capital (or investment), and accordingly its measurement, is important. Section 3 overviews the approach taken, section 4 presents

[1] According to recent estimates by Kendrick (1994, 1), intangible investment accounted for almost half of US GDP in 1990.

estimates based upon historic stock market data and section 5 presents estimates based upon the employment series. A short conclusion follows

2. Importance of intangible capital

Most early economic theorists, as epitomised by Adam Smith, regarded physical capital as the foremost form of capital and one of the most important sources of wealth and material well-being. Smith regarded human skills and talents as interesting but less central to the dominant analysis.[2] While the role played by the household sector in the provision of human capital has been widely acknowledged since the mid-twentieth century, it has taken longer to explicitly recognise the importance of firms' investment in non-physical forms of capital. In general, the separate strands of intangible investment have been studied under the discrete and unrelated fields of advertising, human capital, industrial relations, management science and industrial economics. Minimal recognition is made of the commonality between them.

Despite the growing awareness of either separate or combined forms of intangible capital, remnants of this early predilection with tangible capital remain. The profession still, for example, regards fixed capital expenditure data as the major indicator of economic growth and future well-being.

Accounting for intangible capital and investment is important for the same reasons that fixed capital and investment are regarded as important.[3] Both forms of investment are

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[2] Smith (1776, 351-2)

[3] It is also an ambiguous and imperfect concept for the same reason that the concept of tangible capital is flawed. For example, as a present value concept it may depend on transient and inconsistent expectations. Further, since it cannot be defined independently from the definition of income, and income cannot be defined without a measure of 'intact capital', then conceptually capital

a source of future productivity growth, to ignore a major part would be to bias statistical work and exclude potential explanatory factors. Both forms of investment are volatile components of expenditure and both forms of investment contribute toward and result from the trade cycle. In addition, both forms of investment are necessary for the health and future existence of a business.

While a knowledge and measurement of intangible investment is required for a comprehensive overview of investment, the distinctive nature of intangible capital makes its study and measurement of intrinsically valuable. A major attribute of intangible capital is its nexus with labour, especially skilled labour. This fusion with labour gives intangible capital four notable qualities. First and obviously, labour cannot be owned, sold and mortgaged. Second, labour is innately heterogeneous. It cannot be uniformly mass-produced like physical capital. Third, humans are more volatile and unpredictable than machines. The laws of physics are more regular than the laws of psychology and sociology. And finally, labour appreciates with usage and is a highly malleable factor of production which can metamorphose in many ways. By contrast, physical capital depreciates with usage and each single entity is usually limited to defined tasks.

These distinctive qualities mean that a change in the composition of firms' capital should have implications for other aspects of industry and the economy. First, the dominant capitalist form of ownership may not be an efficient ownership structure in industries where a significant part of the capital stock is unalienable from labour and synergies between labour. Second, firms with high levels of intangible capital will tend to

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involves circular reasoning (Hicks, [1946], 1986). Nevertheless, 'capital' does convey, in a practical sense, a measure of productivity and the roundaboutness of production.

encounter difficulties raising debt and this may also artificially limit the investment rate and size of affected firms. Third, if firms regard labour, in part, as raw investment material, then it is expected, given the natural heterogeneity of individuals, that some labour will be highly prized and sought after for jobs that require capital investment while other labour will be considered unsuitable. 'Good' prospects are channelled into jobs, which strengthens their labour market position and 'poor' prospects will be relegated to the remaining jobs where development is not required. Finally, if these labour market processes are systematic and persistent, then there could be repercussions for income distribution. On the one hand, incomes may converge as a growing part of labour income includes capital income and the relative wealth derived from owning tangible capital falls. However, labour incomes may diverge among the employed according to whether one is in job employers regards as part of the firm's capital stock or other sorts of position.

3. Approach taken

Several difficulties immediately present themselves when measuring either intangible investment or intangible capital. First, similar to the measurement of services in general, it is difficult to control for the considerable heterogeneity of the commodity and consequently derive price indices for constant levels of output. Second, a lot of intangible capital will be produced by the firm for itself given the heterogeneous and firm-specific nature of the asset. And finally even if these theoretical problems could be minimised, existing cross-country data series on expenditures on research and development, workplace training, marketing and other forms of workplace investment are either very short, irregular or absent altogether. The OECD research and development data, which

originate from the early 1960s, appears to be the longest time series but research and development is only one aspect of intangible investment.[4] Despite this, and because of its availability, this series has been the main focus of attention in the intangible measurement field.[5]

Because of these deficiencies, two less conventional methods for estimating intangible capital and investment have been chosen, and for practical reasons this has limited measurement to a single country. The first method calculates a capital stock series by using stock market records since the late 1940s to derive an implied level of intangible capital. The second method calculates an investment series from data on the portion of people who are working in a job which produces intangible investment goods, either for sale or for the internal use of their own firm.

Both methods use data from Australia only. Australian stock market data, unlike many other countries, is highly suited for our ends because of the longstanding 'Generally Accepted Accounting Principle' to adjust asset values for inflation and fundamental factors.[6] Accordingly, the high level of inflation during the 1970s and 1980s should not unduly bias the series upwards. In fact there is no evidence that the series exhibits an upward bias arising from the escalation of prices between 1974 and 1990. Instead, it appear that an abnormal drop in the aggregate profit share during the decade following 1974 actually led to a downward bias in our intangible capital series.

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4 The OECD plan to release this series late in 1998.

5 See, for example, Bos *et al* (1992).

6 Asset revaluation has been 'strongly recommended' by Australian accounting bodies since 1978 (OECD 1980, 126). See also Barth and Clinch (1998), Cotter (1998).

4. Stock market series

Accounting principles traditionally comply with economic notions of costs and benefits and until recently, most balance sheet data are records of the accumulation, depreciation and disposal of tangible capital items. In recent years, there has been some attempt to record intangible assets that confer value upon the company from the use of legal rights. These include patents, copyright trademarks, franchises and realised goodwill. However, these are likely to be a small subset of all intangible capital. Our calculations estimate that total intangible capital was from three to four times greater than measured intangible capital in Australia between 1992 and 1997.[7]

The interest in using stock market data arises, however, not from any regard it pays to intangible capital, but from the lack thereof. If the balance sheet is viewed as a record of tangible assets then, the balance of the value of a company must, by definition, be accounted for by intangible capital.

The final intangible capital estimates are derived from two company identities:

$$K_t \quad K_i \equiv K$$

and

$$ps \quad L \equiv K \,.$$

Where

[7] This estimate is based on our ratio of intangible to tangible capital to the respective ratios of 'other assets' to tangible capital for 1992 and 1997 for our sample of listed companies.

K_t = present value of tangible capital.[8]

K_i = present value of intangible capital.

K = total present value of the company (= discounted value of future profit streams)

p = price of ordinary shares

s = number of equivalent ordinary shares on issue

L = value of liabilities.

Formal stock exchange records generally provide enough information to derive a measure of K_i/K for each company. The minimum data requirements include the share price, the number of equivalent ordinary shares on issue, and a measure of tangible capital and liabilities. Our time series is based upon data from publicly listed Australian companies between 1947 to 1998. The sample was based on a random selection of 20 per cent of firms listed in 1947 and 20 per cent of firms listed in 1997. The same firms were traced over time. Efforts were made to follow large companies that had been taken over or underwent a change of name. Given the high birth and death rate, the sample size fell during the intervening years and so an additional 7 per cent of firms, which were listed in 1971, were also included in the full sample. With the exception of 1986 to 1989 when liabilities had to be estimated, the sample size varies between 61 and 113. The sample during 1986 to 1989 constituted 42, predominantly larger, firms.

Price and share data was taken from September of each year (except October in 1989). September was chosen as a month least likely to include abnormal or seasonal

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[8] No distinction is made between the value of a company as a going concern and abnormal profits (as highlighted by Dimbath 1994) due to the overlap between them .

price fluctuations. Each year, except 1986 to 1989, we were able to record information on price per ordinary share, number of equivalent ordinary shares on issue, a measures of net tangible assets (either net tangible assets per share or price per net tangible assets per share) and liabilities (current and long term).[9] Where variation in the presentation of prices occurred over time, the chosen price in most cases was the price that would bias the final series toward not finding a positive trend. Liabilities for 1986 to 1989 were estimated by linear extrapolation between 1985 and 1990. At time of writing, liabilities for 1998 were not available and 1997 values were used instead.

Depending on the available data series we estimate K_t and K_i as:

$$K_t \quad (NTAS \; s + L$$

$$K_i \quad ps - (NTAS \; s$$

$$K_i \quad ps \quad \frac{p}{PNTAS} \; |s \; .$$

Where *NTAS* is net tangible assets per share and *PNTAS* is price per net tangible assets per share. Stock market records will either cite a companies *PNTAS* or *NTAS*.

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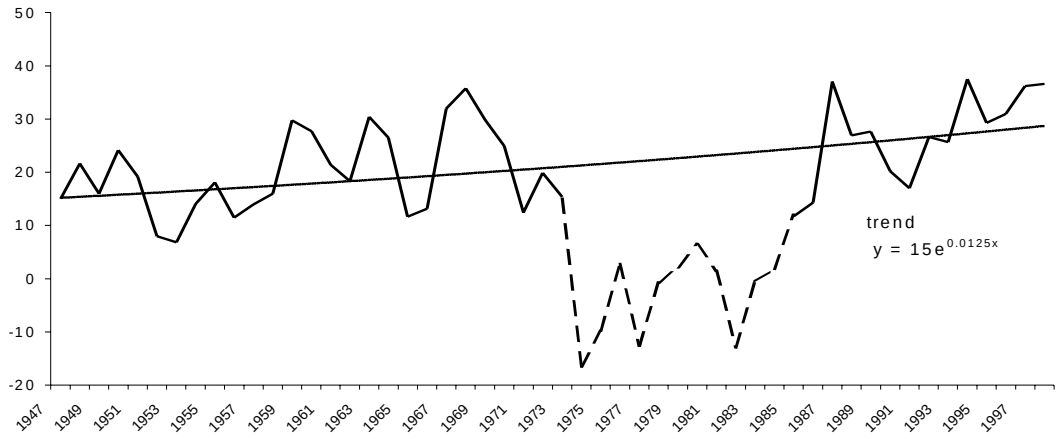
[9] Liabilities were derived from the Official Record of the Stock Exchange of Melbourne, 1947 to 1971, The Australian Graduate School of Management, Centre of Research in Finance Annual Report Record Database 1951 to 1985, and Bloomberg on-line Historical data. Preference shares were not included as they were found in 1956 to increase tangible capital by less than one per cent. Similarly options were not included in the calculations unless they were part of the firms' NTA/Share calculation.

Figure 1 Ratio of intangible capital to all capital, publicly listed companies, Australia, 1947 to 1998



Source: Table A.1

A graph of the ratio of intangible capital to total capital is presented in Figure 1. Stock market price data are a highly volatile series, which can often be dominated by irregular, seasonal and cyclical influences and is not surprising to see considerable variation in the line. Our interest, however, is only with the trend of this line.

Figure.2 Gross Operating Surplus as a proportion of Domestic Factor Income, Australia, June 1960 to June 1997

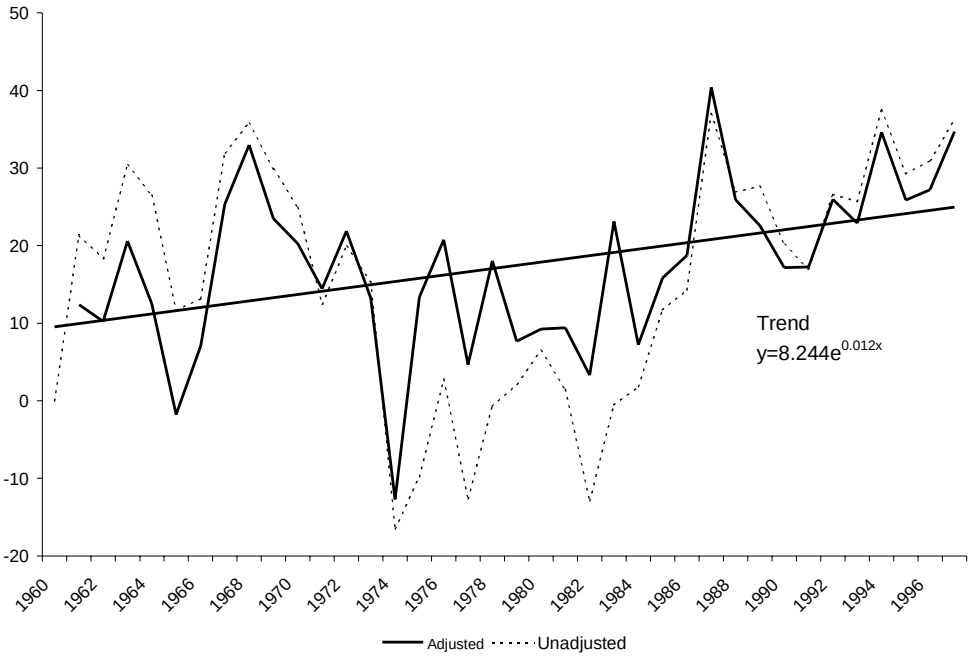
Source: ABS Ausstats.

1974 and 1984 stand out as an aberration from the rest of the data series. From 1975 to 1987, excluding 1980, Gross Operating Surplus as a proportion of Domestic Factor Income was considerably below other years between 1960 and 1997 (Figure 2). During this period, subdued profits were reflected in abnormally low real share prices. Accordingly we may justify our exclusion of this 10-year period as being an anomaly arising from an unusual combination of policy, institutional and overseas influences. Excluding these years, the proportion of intangible capital in listed companies grew at an annual rate of 1.25 per cent from 1947 to 1998. If we include the 1974 to 1984 period in our trend calculation, the average annual rate of increase in the proportion of intangible capital is reduced to 0.2 per cent. Under the higher estimate, intangible capital as a

proportion of total capital has been rising by 2.5 percentage points every decade. Under the lower estimate, it increases by 1 percentage point.

Alternately, the original stock market series presented in Figure 1 can be adjusted for variations in the aggregate profit share. Figure 3 presents the adjusted data. The ratio of tangible capital has been weighted by an index of the profit share (Gross Operating Surplus 1998 = 100). This adjusted series gives an annual rate 1.2 per cent between 1960 and 1997.

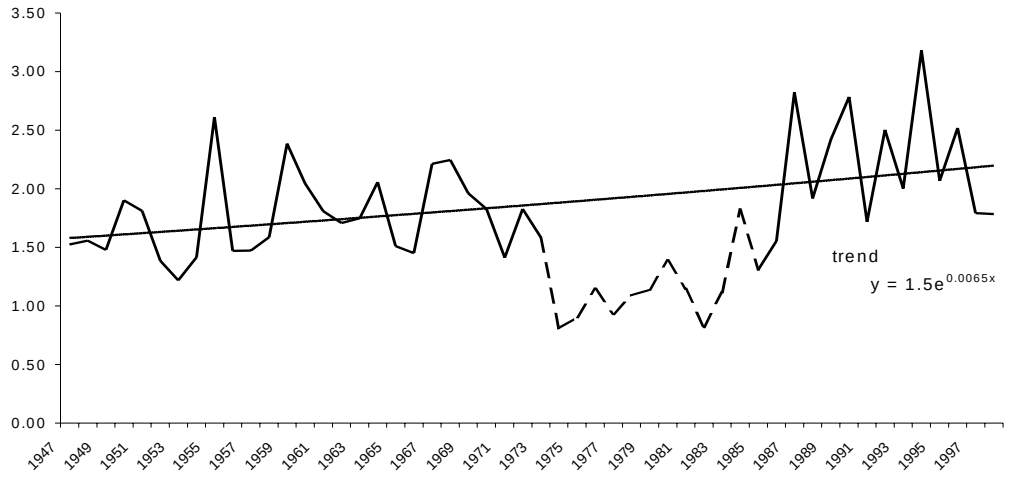
Figure 3. Adjusted ratio of intangible capital of all capital, publicly listed companies, Australia, 1960 to 1997.



A third measure of the change in intangible capital is the average share price divided by the NTA per share. This series which excludes liabilities, increased by 0.65 per cent per annum over the period 1947 to 1973 and 1985 to 1998 (see Figure 4).

As mentioned above, there is little evidence that the significant price rises experienced following the OPEC oil increases during 1973–74 and 1979 led to an overstatement of prices relative to firms' NTA and thus an over-statement of the proportion of intangible capital. The trend rise in intangible capital was evident before 1974 and has continued through the low inflation 1990s.

Figure 4 Share price over Net Tangible Asset per share, weighted average of listed companies, Australia, 1947 to 1998



5. Employment series

The second estimation series uses the (international) principles underlying the definition of the conventional gross fixed (intangible) capital expenditures to create a parallel series for intangibles. Outlay and input–output table data from firms are not clear enough to enable an expenditure based series to be derived and instead the estimates below mimic it with an employment series. Gross intangible capital expenditure is

defined as all outlays incurred by organisations (enterprises, general government bodies and private non-profit organisations) in acquiring intangible assets, whether these are purchased in the market or produced on own account. The purchasing firm may use these assets for their own profit or for the benefit of the general public. They include:

Outlays associated with the development of intangible capital such as the skills, knowledge and useful talents of the workforce, market and technical knowledge, goodwill and brandnames, developed channels of access to markets, usable research and development and an efficient workplace.

Outlays which significantly extends the productive lives of existing intangible assets.

Work-in-progress.

Gross intangible capital expenditure does not include improvements to tangible buildings, constructions, plant and equipment. However, it does include byproducts of this process, improvements to the skills, knowledge and useful talents of a responsible workforce which arise from learning-by-doing. For example, the services of architects are not included because they are embodied in a tangible form, but the contribution their work makes to skill accumulation is.

While Gross Fixed Capital Expenditure excludes depreciation due to the use of tangible capital, our intangible counterpart includes appreciation associated with the use, application and refinement of intangible capital. Capital appreciation and in-house production are very much one and the same thing. Like services in general, where statisticians have difficulty defining a constant commodity, it is difficult to distinguish

between an improvement or expansion of intangible capital. Unlike tangible capital, most intangible capital by its very nature is malleable and continuous.

A large portion of intangible capital is likely to be produced in-house rather than bought from outside. Intangible capital tends to be more heterogeneous and firm-specific than tangible capital. When the nature of the work undertaken is non-standardised, informal and innovative, then a direct interactive mode of production is required. Before the 'American system' of interchangeable parts was invented in the 1850s, skilled tradespeople were required on-site to individually tailor and manufacture replacement parts (Best 1990, Ch 1). Personal contact was integral to production. Skill production (acquisition) has similar traits. According to Douglas ([1921], 1968, 18–19) '[w]henever a trade, craft or profession has developed to such a stage the general principles and scientific causation can be abstracted from personal contact, then apprenticeship . . . declines. That which was an art becomes a science with more or less fixed rules and generalized method of procedures'. The development of informal work skills and knowledge, brand names and distribution networks, like the apprenticeable trades, is still an art and thus still mainly produced in-house.

For reasons discussed by Marshall ([1890], 1920, 76–8), household expenditures are deemed consumption items even though many are undertaken with a view toward long term ends and benefits. Accordingly, the home production of education and welfare should be excluded even though their contribution to societies' intangible capital is probably large.

Military sector production is also excluded for consistency with the measure of gross fixed capital expenditure.

Table 1 Production sectors

Production sector		
I. Organisations and enterprises	a. Private enterprises *	
	b. Public organisations	(i). Public Enterprises*
		(ii). Other (administration, defence, schools)
	c. Non-profit	(i). Schools, education
		(ii). Community, welfare
II. Households		

Note: * Indicates the for-profit sector

Enterprise gross intangible capital expenditure is the sub-section of all capital expenditures. It excludes intangible investment expenditure produced by the non-profit government and organisation sectors. Only the intangible assets produced by private (I.a.) and public enterprises (I.b.(i).) are included (see Table 1).

Our estimates of both total and enterprise gross intangible capital expenditure have been derived from historic census data on the distribution of employment according to whether the implied job contributes directly or indirectly to the growth of firms' intangible capital bases and whether they are produced by specialist investment firms for sale to end-using firms or whether they are produced within the using firm.

Employment data from the full enumeration of the Australian Bureau of Statistics Censuses of Population and Housing 1971, 1981, 1986, 1991 and 1996 is given in Table 2.

Five industry divisions are provided.

1. Firms involved in the direct production of research and development, advertising, marketing and promotion of production, the industry or the firm, workplace and financial reform and improvement for profit.
2. Other enterprises producing for profit.
3. Non-profit sector (government and other) involved in the production of education, training, data collection and dissemination.
4. Other non-profit sector establishments.
5. Defence.

Occupations are classified into

1. Those that directly produce products which embody intangible assets in other people or other intangible forms. These include teachers, trainers, sales and marketing workers, management consultants, research and development staff, financial advisors and people involved in the collection, retrieval and dissemination of information and knowledge.
2. Those who as a byproduct of their work experience, acquire useful and relevant skills, knowledge and talents that contribute towards the goodwill, marketing and process efficiency of the enterprise or establishment.
3. Other occupations.

Details of the industry and occupational classifications are provided in the appendix at the end of this chapter.

Table 2 Examples of occupations from the cross-classified employment data

Sector	Industry sector 1.	Industry sector 2.	Industry sector 3.	Industry sector 4.	Industry sector 5.
Occupation Sector 1.	A Marketing consult.	B Bank economist	C School teacher	D Gov't data processor	Military trainer
Occupation Sector 2.	E	F Industrial engineer	G University nurse	H Hospital surgeon	Army dentist
Occupation Sector 3.	I Unskilled worker	J Unskilled worker	K Unskilled worker	L Unskilled worker	Unskilled worker

Gross intangible capital employment includes all workers in occupations which are (mainly) dedicated to the production of intangible assets (A, B, C, D) and, in addition, workers in industries which mainly produce intangible assets (E, I, G, K) and a skill appreciation part of occupations whose work leads to significant learning-by-doing (F and H) (see Table 2). The latter represents the rate at which work contributes toward the skills and other forms of intangible capital of the firm. Enterprise gross intangible capital employment includes only that part produced by enterprises (for profit), which are the first two industry sectors (A, E, I, B and a portion of F).

Results from the census data are presented below in Figures 4 and 5.

Using our definitions, the proportion of the labour force involved in the direct production of intangible capital rose from 16.9 per cent in 1971 to 31.0 per cent in 1996

(Figure 4). The proportion of the labour force engaged in the direct production of *enterprise* intangible capital rose from 11.0 per cent in 1971 to 22.1 per cent in 1996. By contrast, there has been little clear trend in the proportion of the workforce who contribute toward intangible investment as a process of learning-by-doing. Over the last 25 years, the proportion of the labour force employed in the intangible capital sector, both enterprise and non-profit, has doubled.

These employment proportions would translate into exchange values if Australia was a completely vertically integrated economy and we weighted hours by wages. However, Australia is a small economy relatively dominated by the rural sector and it has a less complete manufacturing base than the US or EU. As such, we should regard these data as only indicative of trends elsewhere.

Figure 4 Proportion of employment in the direct production of intangible capital, Australia, 1971 to 1996

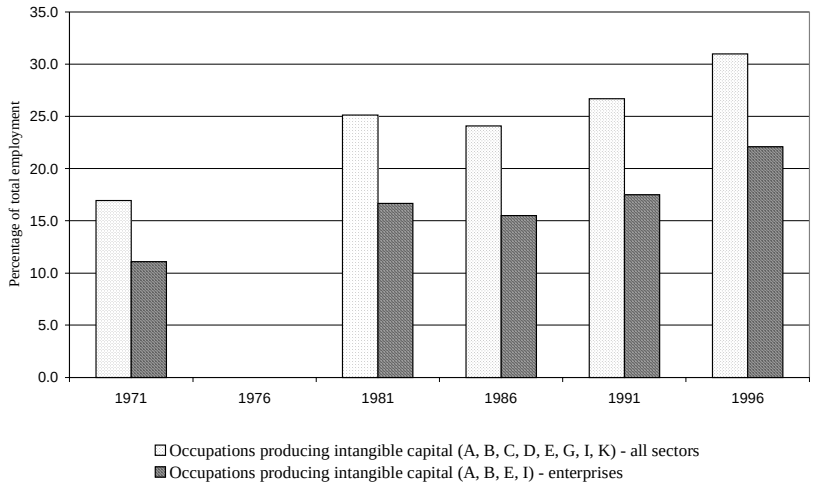
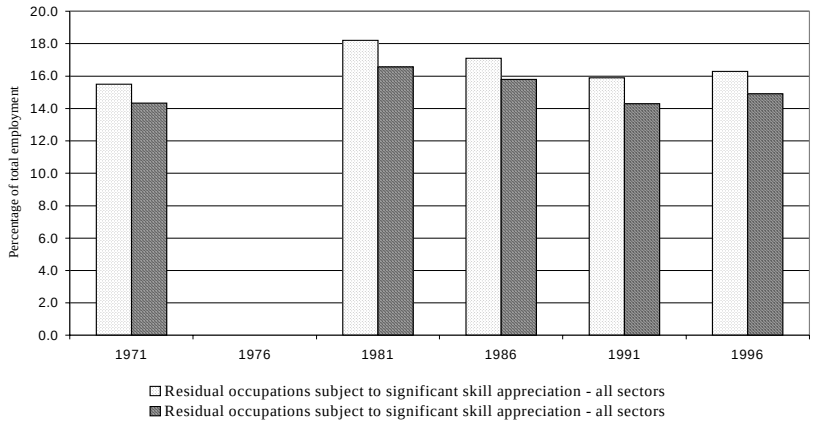


Figure 5 Proportion of employment in the indirect production of residual intangible capital (learning-by-doing), Australia, 1971 to 1996



6. Conclusion

This paper represents an attempt to measure the level and growth rate of enterprise intangible capital and investment in Australia. These estimates are intended to be indicative rather than precise due to the difficulties of measurement. Calculations based upon stock market data find that intangible enterprise capital as a ratio of all enterprise capital has grown at an average annual rate of 1.3 per cent over the 50 years to 1998. Enterprise intangible investment as a ratio of all production rose by 2.8 per cent per annum in the 25 years to 1996 according to detailed employment data. The comparative (employment) growth rate for all intangible investment (including the not-for-profit and household sectors) was 2.5 per cent. If these ratios imply an annual rate of increase of

enterprise capital of 4.0 per cent[10] and employment growth rates of 4.4 and 4.1 for the enterprise and all sectors respectively.

The enterprise-based rates of growth presented in this paper are slightly higher than estimates made for the OECD. Deiaco *et. al.* (1990, 4) estimate that enterprise intangible investment within the seven largest OECD countries grew by 3.6 per cent per annum in the decade to 1984. This estimate excluded investment in training and organisational reform. Their ratio of intangible investment to GDP was 3.7 per cent in 1984 compared with our employment-based estimate of 15.5 in 1986. This difference arises because we have included intangible investment undertaken by firms for their own account. Expenditure based methods, such as those used by the OECD, are most likely restricted to investment products which have been openly transacted through the market. The difference is too large to arise solely from differing expenditure to employment ratios between sectors.

Published OECD research and development data indicate that in the two decades to 1996, research and development expenditure, both private and public, rose between 6.0 and 6.4 per cent per annum (OECD, 1979, 1997).

US studies on the level of intangible investment from all sectors, enterprise and non-profit, produce much higher levels but considerably smaller rates of growth than our estimates for Australia. Kendrick (1994, p3) calculated that all intangible investment as a ratio of GDP rose by only 0.5 per cent for the 60 years to 1990 and actually fell at an average annual rate of 0.2 per cent between 1973 and 1990. Similarly, Eisner (1989, p26)

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[10] This is based on a trend rate of increase of aggregate expenditure of 3.7 per cent (From real expenditure on home produced non-inventory goods, Australia, September 1959 to December 1997, ABS AUSSTATS).

estimated that the ratio of all intangible investment activity to GDP fell by 0.3 per cent per annum in the 35 year to 1981. However, both Kendrick and Eisner's figures are based on real values of output, not employment levels as in the Australian case. Consequently, the US estimates are subject to the general difficulties associated with deriving price indices for services and heterogeneous commodities. Eisner believes, that the deficiencies of his price indices probably led him to understate the 'true' level of growth of intangible investments. Furthermore, both Eisner and Kendrick include health expenditures, which we do not.

Finally, while the range of estimates given above provide a perspective of the size of intangible investment, it also highlights the need for a standardised definition for the purposes of future data collection.

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Appendix

Table A.1 Data for Figure 1

Year	Intangible capital/all capital (%)	Sample size	Year	Intangible capital/all capital (%)	Sample size
1947	15	76	1973	15	84
1948	22	69	1974	–17	82
1949	16	76	1975	–10	81
1950	24	80	1976	3	79
1951	19	79	1977	–13	83
1952	8	83	1978	–1	77
1953	7	82	1979	2	80
1954	14	79	1980	6	83
1955	18	69	1981	1	75
1956	11	74	1982	–13	70
1957	14	80	1983	–1	69
1958	16	77	1984	2	68
1959	30	81	1985	12	64
1960	28	83	1986	14	42
1961	21	80	1987	37	42
1962	18	79	1988	27	43
1963	30	78	1989	28	41
1964	27	78	1990	20	61
1965	12	87	1991	17	97
1966	13	78	1992	27	69
1967	32	88	1993	26	89
1968	36	82	1994	38	91
1969	30	79	1995	29	79
1970	25	70	1996	31	113
1971	12	73	1997	36	101
1972	20	62	1998	37	94

Table A.2 Classifications for Figures 4 and 5

Industry classification.

ANZIC	ASIC	CCLI	ASIC Industry title
Sector 1. Firms involved in the direct production of research and development, advertising, marketing and promotion of production, the industry or the firm, workplace and financial reform and improvement for profit.			
151	161	088, 086	Mineral exploration
7519	6172	609	Services to finance and investment nec
7520	6240	590	Services to insurance
7842	6372	742	Accounting services
7831, 7832	6381	746	Data processing services, information storage and retrieval
7851, 7852, 7853	6382	745	Advertising services
7854, 7855	6383	749	Market and business consultancy services
7810,	8461		Research and scientific institutions
962	847	744	Business and professional associations, Labour associations
7861	8491	609	Employment services
Sector 2. Other enterprises producing for profit.			
			All other codes not listed elsewhere
Sector 3. Non-profit sector (government and other) involved in the production of education, training, data collection and dissemination.			
841, 842	823	730	School education
843, 844	824	731, 732, 733, 734	Post school education
921, 922	825	739, 735, 739	Libraries, museums and art galleries
Sector 4. Other non-profit sector establishments.			
811	711	650, 651	Government administration
812	712		Justice
813	713	652	Foreign government representation
961	830	690, 691,	Welfare and religious

		692	institutions
7829	8462		Research and meteorological services
	848		Other community organisations
9631	8492	680	Police
9632	8493	681	Prisons and reformatories
9633	8494	683	Fire brigades
9634	8495		Sanitary and garbage disposal services
923	9141	758	Parks and zoological gardens
Sector 5. Defence.			
820	720	660, 661, 662, 669, 670, 671, 672, 679	Defence

Occupational Classification

ASCO 2nd Ed (1997)	ASCO 1st Ed (1986)	ASCO 1st Ed title
Occupational group 1. Those that directly produce products which embody intangible assets in other people or other intangible forms. These include teachers, trainers, sales and marketing workers, management consultants, research and development staff, financial advisors and people involved in the collection, retrieval and dissemination of information and knowledge.		
24	24	School teachers
	25	Other teachers and instructors
11	12	General managers
12	13	Specialist managers
22, 32	27	Business professionals
253	28	Artists and related professionals
2522	2901	Economists
	2905	Educational researchers and related professionals
2523, 2529	2907	Other social scientists
	2909	Mathematicians, statisticians and actuaries
	2911	Librarians

	2999	Other professionals
591, 599, 614, 615, 619	52, 53, 54, 55, 59	Clerical workers
6211	6201	Sales representatives
Occupational group 2. Those who as a byproduct of their work experience acquire useful and relevant skills, knowledge and talents that contribute towards the goodwill, marketing and process efficiency of the enterprise or establishment.		
13	14	Farmers and farm managers
33	15	Managing supervisors (sales and service)
	16	Managing supervisors (other business)
21	21	Natural scientists
	22	Building professional
23	23	Health diagnosis and treatment practitioners
2500, 251, 2520, 2521, 254	26	Social professionals
31	31	Medical and science technical officers and technicians
	32	Engineering and building associates and technicians
	33	Air and sea transport technical workers
34	34	Registered nurses
39	39	Miscellaneous para-professionals
Occupational group 3. Other occupations.		
		All other codes not listed elsewhere