Welfare traps in Australia: Do they bite?

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Abstract: Minimising disincentives to employment participation that arise as a consequence of providing welfare has been a major objective of the recent welfare reform agenda in Australia. Of particular concern have been the high effective marginal tax rates (EMTRs) and replacement rates (RRs) facing welfare recipients as a result of the interaction of the tax and benefits system. Based on the financial-year income data contained in waves 1 to 4 of the Household, Income and Labour Dynamics in Australia Survey, the first part of this paper presents estimates of EMTRs facing all working-age Australians and of an alternative 'disincentive' measure, participation tax rates (PTRs), for non-working Australians. Significant innovations in the calculation of these measures are the incorporation of the effect of the withdrawal of rental subsidies for public housing tenants, which have not been included in the previous literature, and the allowance for changes in tax liabilities and benefit entitlements for the income unit rather than just for the individual. We find EMTRs and PTRs to have changed very little between 2000-01 and 2003-04, and to be particularly high for recipients of NewStart Allowance. In the second part of the paper we estimate the impact of EMTRs, the PTR and the more commonly used RR on the probability of transitions from non-employment to employment one year later. The PTR and RR are found to be superior to the EMTR in measuring disincentive effects for non-working persons. Second, these effects do matter. High PTRs or RRs have a moderate but significant effect on the probability that women will enter employment from outside the labour force, and a very large (negative) effect on the probability that an unemployed person will find work.

Acknowledgements:

1. The estimates of effective marginal tax rates, participation tax rates and replacement rates used in this paper are derived from the AHURI-3M tax-benefit simulator, which was constructed under the Australian Housing and Urban Research Institute's (AHURI) national research venture "Housing Assistance and Economic Participation". The authors are indebted to Alice Stoakes from RMIT University, who updated the AHURI-3M under AHURI's project "The Implications of Loss of a Partner for Older Renters".
2. This paper uses unit record data form 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, Community Services and Indigenous Affairs (FaCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either FaCSIA or the MIAESR.

1. Introduction

The question of how the availability of welfare benefits affects labour supply is one of ongoing consternation for policy-makers. In Australia, the McClure Report (Reference Group on Welfare Reform 2000) cited 'inadequate incentives for some forms of participation and inadequate rewards for some forms of work' as one of four identified shortcomings of Australia's welfare system. A number of changes to the tax and benefits regime have been implemented or foreshadowed following the McClure Report, including a range of 'welfare to work' measures announced in the 2005-06 Commonwealth Budget designed to increase labour force participation. The disincentive effects created by different tax and benefit regimes are also a major international policy issue (see, for example, OECD 1998).

Two commonly used measures of the disincentives created by the interaction of the welfare and benefits system are effective marginal tax rates (EMTRs) and replacement rates (RRs). The EMTR measures how much of an incremental increase in an individual's earned income is lost due to higher tax liabilities and the withdrawal of benefits. The replacement rate compares the income of an individual when not in work to their income when in work. A related measure is the participation tax rate (PTR), sometimes also referred to as the average tax rate. The PTR is the same as the EMTR, except that the rate is not calculated with respect to a small increment in private income, but rather the increase in income that occurs as the individual moves from the state of non-work to work. Thus an individual facing a high EMTR faces low financial incentives to increase the number of hours they work, while an individual facing a high RR or PTR has a low incentive to choose work rather than non-work. The aim of this paper is, firstly, to provide new estimates on the numerical value of EMTRS and PTRs for Australia from 2000-01 to 2003-04 based on data from the first four waves of the Household, Income and Labour Dynamics in Australia Survey (HILDA). Secondly, we use these two measures, along with the conventionally defined RR, to test whether labour market behaviour of non-working persons is actually affected by such 'disincentives' and which measure best models those effects. To do this, the longitudinal nature of the HILDA data is exploited by matching disincentive measures calculated in waves 1 to 3 to employment status in the following year (waves 2-4).

A large number of studies present EMTR and/or replacement rate estimates for Australia (Barber, Moon and Doolan 1994; Beer 1998; Beer 2003; Beer and Harding 1999; Bradbury 1992; Bradbury 1993a; Bradbury 1993b; Bradbury, Ross and Doyle 1991; Daly 1992; Department of Social Security 1993; Flatau and Wood 2000; Harding, and Polette 1995; Hulse, Randolph, Toohey, Beer, and Lee 2003; Polette 1995; Saunders, Bradbury, and Whiteford 1989; and Whitlock 1994). Few have looked specifically at the PTR, which is a focus of this study. Our approach offers some important innovations over previous Australian estimates. One is that we incorporate the clawback of rental subsidies for persons living in public housing. This is important as Wood, Ong and Dockery (forthcoming) find that relative employment probabilities have declined markedly for those in public housing over the long run. In the case of female public housing tenants, many of whom are sole parents, they suggest that a probable cause of this deterioration in relative employment prospects is the very high replacement rates faced by this group. The EMTRs and PTRs are also calculated on the basis of actual circumstances facing individuals as reported in a

representative household survey (HILDA). This is in contrast to the more commonly used approach of presenting calculations for hypothetical individuals or families across a range of income intervals. The estimates are also modelled from the perspective of the income unit rather than the individual, in the sense that changes in the benefit eligibility of the full income unit that arise from the change in a person's earned income are including when calculating each individual's EMTR and PTR.

A major challenge in estimating the elasticity of labour supply with respect to tax rates faced and benefits withdrawn is endogeneity. By design of the income support and tax system, being unemployed or working part-time with a low income results in individuals receiving more in benefits and paying less in tax than full-time workers with higher incomes. With cross-sectional data it is thus difficult to identify the effect of EMTRs, PTRs or RRs on labour supply. In this paper we exploit the longitudinal nature of the HILDA data to address this issue by modelling the impact of the current replacement rate facing non-employed individuals upon their employment outcomes *one year later*.

The results of this modelling exercise are reported in Section 5 of the paper. Preceding this is a brief background discussion of the theoretical motivation and modelling issues, followed by presentations of the estimates of EMTRs and PTRs derived from the AHURI-3M tax-benefit simulator. The implications of the results for policy and for future research are discussed in Section 6.

2. Background

The theoretical model underlying most micro-economic analyses of labour supply posits that individuals act to maximise their utility (wellbeing), and that their wellbeing is an increasing function of the amount of goods and services (their real disposable income) and the number of hours of leisure they have available to them. If people are free to choose their hours of work each individual will keep offering additional hours of labour so long as the value they place on net income gained, comprised of their hourly wage less taxes and any withdrawal of benefits, is greater than the value they place on the hour of leisure foregone. Thus people strive for a 'utility maximising' point where the marginal return derived from an additional hour of paid work equates to the value placed on an additional hour of non-work time.

This simple framework predicts that higher EMTRs result in a lower incentive to increase the number of hours worked, *all other things held equal*. In reality, most workers do not have the ability to choose the exact number of hours worked, and instead face more limited options such as choosing between working and not working, or between working half-time and full-time. If the decision is one between working or not working, it is the participation tax rate that determines the individual's choice set, rather than the marginal rate associated with an additional earned dollar. Hence PTRs would seem a more appropriate measure of the disincentives facing non-working individuals than EMTRs.

There are a number of competing models which stress the importance of institutional, cultural, life-cycle and other factors in determining individuals' labour supply and labour market outcomes. The relative importance of the variables emphasised in the

neo-classical model of labour supply, and hence their policy significance, is an empirical question. There is a vast international body of empirical research estimating key parameters such as the elasticity of labour supply with respect to wages and the effect of EMTRs and replacement rates. An extensive review of developments in the empirical analyses of labour supply can be found in Blundell and MaCurdy (1999). Much of this empirical research has stemmed from evaluation of 'welfare to work' or 'workfare' policies recently introduced in a range of countries (Cahuc and Zlyberberg 2004: 4), as well as tests of their underlying rationale that the 'passive' design of pre-existing welfare programs created significant disincentives to labour force participation for those disadvantaged in the labour market.

The elasticity of labour supply with respect to wages is likely to change over the distribution of wages and hours earned, and to be very different for groups with different non-wage incomes and preferences. For example, there is evidence that wage elasticities are larger for persons working a low number of hours. As a consequence women and sole parents in particular, who are more likely to be out of the labour force or working part-time, display a stronger elasticity of hours supplied with respect to wage changes (Cahuc and Zlyberberg 2004: 40-41). EMTRs and replacement rates are an important part of this story as they determine the net change in income an individual faces given a change in the number of hours worked or in their hourly wage rate. Indeed the empirical literature has relied heavily upon variations created by taxation and benefits regimes, and thus variations in EMTRs and replacement rates, in order to generate estimates of the elasticity of labour supply.

Again we refer readers to Blundell and MaCurdy (1999) for an extensive review of this literature with respect to both methodological developments and empirical estimates, along with Kalb (2003). There is a broad consensus that higher EMTRs and RRs faced by welfare beneficiaries do create disincentive effects that adversely impact upon labour market outcomes, however, the estimates with respect to the magnitude of such effects fall within a wide range. A common methodology is to estimate a labour supply function across a sample of individuals (cross-section). The estimated elasticity of labour supply can then be used to infer the impact of different EMTRs or RRs on labour supply by calculating the change in earnings (and hence labour supply) under different tax and benefit scenarios. A second standard approach, but requiring longitudinal data, is to estimate the probability of transitions (such as entering employment, exiting unemployment or moving off benefits), conditional upon the EMTR or RR facing the individual and other factors known to influence labour market outcomes. Particularly convincing evidence of the importance of disincentive effects comes from changes in the unemployment hazard rate - the probability of leaving unemployment conditional on duration - in situations in which benefits or unemployment insurance are not open ended. The hazard rate is often observed to increase markedly just prior to the point of benefit exhaustion (see, for example, Card and Levine 2000, Meyer 1990).

A limitation of both these approaches is that individuals' expected earnings and their benefit eligibility are often largely determined by a similar set of individual characteristics. It is therefore difficult to disentangle the effects of differences in EMTRs and RRs from the effects of differences in individual characteristics. In most cases the rules that determine benefit eligibility are based upon characteristics which are observable to the researcher, however many of the characteristics influencing

expected earnings will be unobservable. Availability of longitudinal data on individuals, particularly where there are observations on multiple spells for individuals, has obvious advantages in controlling for unobservable characteristics which are time invariant, but longitudinal data is 'no panacea' (see Heckman and Singer 1985). Methodological difficulties in identifying the impact of policy measures, including changes in EMTRs and RRs, upon labour market outcomes has seen a growing body of contributions based upon natural experiments (sometimes called 'quasi-experiments'). These rely upon exogenous changes to the tax and benefits system that affect only a subset of the population. Natural experiments are often assessed using the 'difference in differences' estimator which computes the pre-policy to post-policy changes in the outcomes for the effected group and compares this change to the change in outcomes for a non-affected group (see Rosenzweig and Wolpin (2000) and Heckman and Smith (1996) for reviews of research based upon natural experiments).

In line with the overseas literature, Australian empirical studies suggest modest disincentive effects facing welfare beneficiaries (see Kalb 2003). Duncan and Harris (2001) estimate that a reduction in the withdrawal rate of the sole parent pension from 50 per cent to 40 per cent would increase the average number of hours worked by sole parents by just 0.6 per cent. Kalb (2000) estimates small decreases in labour supplied by both married women and men resulting from increases in maximum benefit levels and reductions in the taper rate, although women and persons on lower incomes are estimated to be more responsive to these changes. The estimates from both of these studies are derived using a microsimulation model of labour supply now known as the Melbourne Institute Tax and Transfer Simulator (MITTS), which is described in detail in Creedy et al. (2002). Note that Chapman et al. (2000) argue that such models can exaggerate the extent of negative incentive effects by failing to account for future growth in wages that typically arises from work experience.

3. Estimates of EMTRs, Australia, 2000-01 to 2003-04

This section and the following present estimates of EMTRs and PTRs for the Australian working-age population using the first four waves of HILDA. The methodology employed in this study to measure EMTRs accounts not only for the full range of government tax-transfer programs but also incorporates concessional or rebated public housing rents. An increase in income will generally result in an increase in concessional rents for public housing tenants, and the increase in rent is treated as equivalent to a reduction in government transfers (or increase in tax liabilities). This provides a more accurate representation of the work disincentives faced by public housing tenants.

The HILDA survey is completed between August and December[1] of each year and contains detailed financial data for each individual for the preceding financial year. We calculate EMTRs on the basis of this annual financial data, so that the 'base case' earnings (and hence labour supply) relate to actual hours worked and income earned

[1] A small minority of interviews are completed early in the following year.

over that preceding year. The EMTR of person *i* arising from a one-dollar increase in weekly private income (or $52 per annum)[2] is defined as:

$$E_i = 1 - \frac{\Delta Y_i^d}{\Delta Y_i^p} = 1 - \frac{\Delta Y_i^p + \Delta G_i - \Delta T_i}{\Delta Y_i^p} = \frac{(\Delta T_i - \Delta G_i)}{\Delta Y_i^p} \quad (1)$$

Where: E_i = EMTR of person *i*

ΔY_i^d = change in income unit disposable income of person *i*

ΔY_i^p = change in gross private income of person *i*, that is, $52 per year

ΔG_i = change in government benefits payable to person *i's* income unit

ΔT_i = change in tax liabilities of person *i's* income unit

The one-dollar increase in weekly private income is equivalent to an annual increase in wage and salary income of $52, that is ΔY_i^p=$52. The EMTR of person *i* is calculated taking into account the impact of his/her $52 increase in gross private income on his/her income unit's disposable income. This is because the level of government benefit entitlements and direct tax liabilities of each person is not simply dependent on his/her own income, but the income of the income unit to which he/she belongs. For example, the amount of NewStart Allowance (NSA) received by a partnered individual is determined not only by his/her assessable income level but also by the partner's assessable income level.[3] Moreover, the Medicare levy can be reduced by a family reduction amount if a person is partnered or has dependent children. Thus, for any couple income unit two EMTRs are calculated – one for each partner in the couple. Note that the partner's actual income observed for the relevant financial year is used when the EMTR is computed in contrast to some studies that set the income of a partner equal to zero when estimating the EMTR.

The change in private income, ΔY_i^p, is the increase in wage and salary of person *i* of the income unit since the wage and salary of the partner, if there is one, is assumed to remain constant. The change in government benefits, ΔG_i, takes into account the changes in the government benefits paid to all members of the income unit as a result of an increase in person *i*'s weekly wage and salary. The amount of government benefits received will either stay the same if the income unit assessable income does not exceed the income test free area, or decrease if assessable income exceeds the income test free area, that is, $\Delta G_i \leq 0$. While other EMTR studies such as Beer and Harding (1999), Beer (2003) and Hulse et al. (2003) account for the reduction in Commonwealth Rent Assistance in their EMTR calculations, any reduction in public housing rent subsidy is not accounted for as it is in this study.

The change in direct tax liabilities, ΔT_i, takes into account the changes in the income unit's personal income tax, Medicare levy, superannuation surcharge and tax offsets.

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[2] Most EMTR studies assume a one-dollar increase in weekly private income (Podger et al. 1980, Gallagher and Ryan 1992, Whitlock 1994, Polette 1995, Beer and Harding 1999).

[3] For the years studied, an individual's NewStart Allowance entitlement decreased by 70 cents for every dollar that his/her partner's income exceeds the partner's cut out point.

When the wage and salary of person *i* increases, the level of direct tax liabilities of person *i* will either stay the same if each component of the direct tax liabilities does not exceed its respective tax free threshold, or increase if the rise in private income subjects the income unit to higher levels of income tax, Medicare levy or superannuation surcharge or reductions in tax offsets. Thus, $\Delta T_i \geq 0$.[4]

Table 1 presents data on the distribution of EMTRs for selected groups based on the HILDA files for Waves 1-4. Therefore, they relate to financial years 2000-01, 2001-02, 2002-03 and 2003-04. Along with the mean and median EMTR, we also present the proportion of individuals facing an EMTR in excess of 47 per cent and the proportion facing an EMTR in excess of 60 per cent. The 47 per cent benchmark represented the top marginal tax rate during waves 1-4, while an EMTR in excess of 60 per cent is a commonly used benchmark for 'high' EMTRs in such studies.

The results suggest that the 'typical' working-age Australian faced an EMTR of around 30 per cent in the years from 2000-01 to 2003-04, and only around 5 per cent faced EMTRs in excess of 60 per cent. There were only very small changes in the mean and median rates over the four years, despite the increase in the tax rate thresholds in the 2003-04 financial year.

Persons who reported receiving unemployment benefits (NSA) at some time in the financial year faced particularly high EMTRs. The mean EMTR for this group is comparable to that of persons overall who reported earnings. However, twice as many NSA recipients faced an EMTR of 47 per cent or higher than was the case for persons with earnings and around 40 per cent of NSA recipients face EMTRs greater than 60 per cent compared to around 6 per cent of waged persons.[5] Many NSA recipients receive part-time earnings. Hence, an increase in earned income of a dollar in the week reduces their NSA entitlement by 50 cents if they were in the income range of between $31 and $71 during the week, and 70 cents if their income range was over $71. Moreover, on each measure, the extent of the disincentives facing NSA recipients had worsened between 2000-01 and 2003-04.

Persons without earnings face relatively low EMTRs, as would be expected. When earned income increases by one dollar in the week, the increase is not sufficient to push the individual above the benefit income test free and tax free income levels. However, like NSA recipients, other groups which typically have low income, namely sole parents and public housing tenants, face much higher work disincentives. Again, a higher proportion of sole parents and public renters face very high EMTRs than do persons with earnings. Wood et al. (forthcoming) show that in fact sole parents represent an increasing proportion of the public housing tenancy population and broadly confirm the results in Table 1 for 2000-01 using data from an alternative source, the Australian Bureau of Statistics' Survey of Income and Housing Costs.

[4] See Appendix Table A2 of Wood, Ong, Dockery and Flatau (2005) for details on the tax-benefit modeling assumptions for using Wave 1 of HILDA. A comparable methodology is used for Waves 2-4.

[5] Recall that many NSA recipients will also have reported earnings and thus be included among both sub-samples.

Table 1: EMTR estimates for all working age persons, financial year estimates, 2000-01 to 2003-04

	2000-01	2001-02	2002-03	2003-04
Mean EMTR (%)				
With earnings	34.7	35.3	35.6	35.7
Without earnings	11.1	11.1	8.6	12.7
Sole parents	29.4	29.9	31.1	33.1
Public renters	31.5	32.7	30.9	31.5
NSA recipients	32.4	35.4	38.2	35.5
All	**29.1**	**29.8**	**29.5**	**30.5**
Median EMTR (%)				
With earnings	30.3	30.2	30.2	30.2
Without earnings	0.0	0.0	0.0	0.0
Sole parents	30.1	30.0	30.2	30.2
Public renters	25.0	25.0	25.0	25.0
NSA recipients	16.3	25.0	25.0	25.0
All	**30.3**	**30.2**	**30.2**	**30.2**
Percentage with EMTR>47%				
With earnings	18.2	20.0	20.1	20.7
Without earnings	4.2	5.1	5.3	5.6
Sole parents	29.9	28.6	29.8	32.5
Public renters	17.5	15.8	15.1	16.6
NSA recipients	37.6	40.8	46.0	42.5
All	**14.9**	**16.6**	**16.8**	**17.3**
Percentage with EMTR>60%				
With earnings	5.6	6.3	6.8	6.2
Without earnings	2.3	2.4	2.3	2.3
Sole parents	11.9	13.1	15.6	15.3
Public renters	9.4	9.6	8.2	8.3
NSA recipients	36.1	40.0	45.1	42.0
All	**4.8**	**5.4**	**5.8**	**5.3**
Population ('000s)				
With earnings	8690.8	8780.5	8830.0	8937.6
Without earnings	2665.3	2583.4	2582.0	2604.4
Sole parents	581.5	576.3	613.3	653.2
Public renters	451.0	454.6	412.5	398.6
NSA recipients	313.9	357.3	341.7	296.7
All	**11356.1**	**11363.9**	**11412.0**	**11542.0**

Note: the results are calculated using the person weights available in HILDA.

4. Estimates of Participation Tax Rates, Australia, 2000-01 to 2003-04

In the literature the replacement rate is typically defined for persons who are unemployed and measures the disposable income of a person when not employed relative to the disposable income of that person were they in employment, after taking account of changes in tax liabilities and benefit entitlements. The higher is the replacement rate the weaker is the financial incentive to seek employment. A measure related to both effective marginal tax rates and replacement rates is the PTR. Although the RR is the more commonly used, we focus here on the PTR as we believe it to be the more appropriate measure for the purposes of modelling disincentive effects facing unemployed persons. This is because, in our case, other

dimensions captured by the RR can be incorporated though the inclusion of additional variables on unearned income, as explained below.

The PTR statistic used in this analysis has also been referred to as the 'average tax rate' (see Adam, Brewer and Shephard 2006). Its calculation is the same as that given in equation (1) above for the EMTR, with two exceptions:

1. The changes in income, benefits and taxes refer not to changes associated with an incremental change in earned income of $1 per week, but rather to changes associated with an increase in earned income for individual *i* from $0 to the amount they would earn in employment.
2. The earnings of person *i* in employment are now unknown and an estimate must be imputed. This is done by estimating separate wage equations for employed males and females (by wave) and incorporating the standard augmented human capital variables.[6] The estimated coefficients are then used to predict earnings in employment for each non-working individual based on their observable characteristics. The samples used in estimating the wage equations include those in full- and part-time paid employment to account for differences in both the number of hours worked and the hourly rates of pay received across individuals.

The PTR concept employed here differs in a number of important respects from that used in many other studies of PTRs or, more commonly RRs. First, we calculate PTRs for individuals in both of the non-work states (unemployment and not in the labour force (NILF)) rather than just for those in unemployment (as was the case in Bradbury's 1992; 1993a; 1993b path-breaking work). Second, we account for the likelihood that in making the transition from non-work to work, individuals may enter either part-time or full-time employment. This is by dint of both part-time and full-time workers being included in the wage equations. Third, the estimates account for the full income unit ramifications of a transition from one labour force status position to another for the individual under consideration. The earned income of a partner and any unearned income other than benefits are assumed to remain unchanged as a result of the reference person entering employment.[7] Finally, this study computes PTRs taking public housing rent subsidies into account. So, for example, the reduction in rent subsidy (ie. increase in payable rent) a tenant receives upon entering paid employment is treated as equivalent to the withdrawal of benefits. An unemployed or economically inactive tenant who gains paid employment will have their rent increased to the lesser of market rent[8] or 25 per cent of household assessable income.

As with the EMTR estimates, the PTR estimates are calculated on the basis of the income unit data for the preceding financial year for waves 1 to 4 of HILDA. The results, presented in Table 2, confirm the high work disincentives facing individuals who reported receiving unemployment benefits in the preceding financial year. A significant number face PTRs in excess of 75 per cent. This benchmark is selected in recognition that the calculations do not take into account the full costs of entering the

[6] The wage regression estimates and diagnostics are found in Appendix Tables A1 to A4.

[7] Note that unearned income of person *i* is excluded from both the numerator and denominator in calculating the participation tax rate, in contrast to the calculation of replacement rates.

[8] Market rent is predicted using a hedonic rent regression. Refer to Appendix Tables A5 to A8 for details.

workforce. If the individual is left with an increase in their income unit disposal income of 25 per cent or less of their gross wage, this remaining portion may easily be eaten up by the work related expenses such as child-care and transport. In 2000-01 and 2001-02 there are a handful of public renters and NSA recipients who faced PTRs in excess of 100 per cent, meaning that their household would end up with lower disposable income as a result of the individual entering the paid workforce.

Consistent with the findings with respect to EMTRs, the PTR results offer no suggestion of any alleviation of work disincentives as a result of the 2003-04 tax cuts or the so called welfare reform agenda. Under the personal income tax system, the upper income limit for the 17 per cent marginal income tax rate was raised from $20,000 to $21,600, the upper income limit of the 30 per cent rate was raised from $50,000 to $52,000, and the upper income limit of the 42 per cent rate was raised from $60,000 to $62,500. The low income tax offset income free limit was lifted so that withdrawal would occur with each dollar earned over $21,600, not $20,700.

Table 2: Participation tax rate estimates for unwaged working age persons, financial year estimates, 2000-01 to 2003-04, per cent

	2000-01	2001-02	2002-03	2003-04
Mean RR				
Sole parents	30.9	30.7	33.8	30.4
Public renters	48.3	47.7	51.3	45.4
NSA recipients	61.9	62.5	63.3	63.0
All	**32.6**	**32.1**	**34.3**	**32.8**
Median RR				
Sole parents	32.9	31.8	34.4	26.8
Public renters	50.7	47.0	52.5	48.1
NSA recipients	64.7	64.0	66.3	67.0
All	**30.3**	**31.9**	**33.1**	**30.6**
Percentage with RR>75%				
Sole parents	1.2	1.7	0.7	0.6
Public renters	6.4	9.7	12.5	7.3
NSA recipients	14.5	17.1	12.5	17.5
All	**2.0**	**2.8**	**2.4**	**2.2**
Percentage with RR>100%				
Sole parents	0.0	0.0	0.0	0.0
Public renters	0.3	0.3	0.0	0.0
NSA recipients	1.2	0.6	0.0	0.0
All	**0.3**	**0.4**	**0.1**	**0.3**
Population ('000s)				
Sole parents	236.8	235.7	236.4	243.8
Public renters	252.7	269.6	247.6	228.3
NSA recipients	172.4	180.0	174.7	141.7
All	2573.0	2488.8	2475.3	2515.4

5. The Impact on Labour Supply

Calibrating the numerical value of EMTRs and PTRs facing working-age Australians represents only part of the story. From a policy perspective the critical question is whether or not higher rates of such measures really do influence individuals'

behaviour and, if so, the extent to which they impact upon labour supply. EMTRs, PTRs and RRs are all alternative measures of disincentive effects but each capture subtly different aspects. PTRs and RRs relate to a large change in income associated with a change in status from non-employment to employment, whereas EMTRs relate to a marginal increase in earnings. Hence either the PTR or RR could be considered more applicable measures than the EMTR when modelling disincentives facing the unemployed or persons not in the labour force. The relationship between the PTR and RR is that the latter takes account of income *levels* (both earned and non-earned), which of course may capture income effects as well as substitution effects. However, with the HILDA data, both the individual's unearned income and their partner's income can be observed and modelled directly to capture income effects. Thus, we focused above on generating estimates of the PTR.

This section presents estimates of the elasticity between the 'current' EMTR and PTR facing a non-employed individual, as well as the more commonly used RR, and the likelihood that they will have entered paid employment one year later. In calculating the RR the same innovations noted above for PTRs apply – namely incorporation of the effect on rent subsidies for public housing tenants and of full income-unit effects. As with the PTR, the methodology for calculating the RR accounts for the likelihood of entering part-time as well as full-time employment.

For the disincentive measures used in the transition models, an important modification to the methodology described above is necessary. Individuals' labour force status is recorded for each wave of the HILDA survey. This allows us to select all working-age persons who are not employed at time t and observe their labour force status at time $t+1$. However, the rates calculated in the preceding sections relate to the immediate past financial year. These need to be recalculated to reflect the individual's circumstances at the time of the survey. In doing this we assume earnings to be zero (by definition of the individual's non-employment) and that unearned income and partner income remain as reported for the previous financial year, and then calculate benefit entitlements and tax liabilities in the employed and non-employed states. As coding of the AHURI-3M tax-benefit simulator to incorporate the tax and benefit parameters for the 2004-05 financial year is still underway, it is only possible to calculate current EMTRs, PTRs and RRs for Waves 1 to 3 of HILDA.

Each of the measures has also been 'bottom coded' to zero and 'top coded' to a value of one. A small proportion of observations have negative RRs and these have been omitted in the models using the RR as an independent variable[9]. There are also instances in which individuals have negative PTRs and EMTRs, and instances in which the values of the measures exceed one. Although such values are quite feasible, a significant proportion of the negative cases and those above unity are also extreme in absolute value. The results presented below are unaffected by this bottom/top coding to any consequential degree.

Data for individuals from the three waves are pooled, along with their employment outcomes observed one year later (from Waves 2-4). A standard logistic regression

[9] This arises because in the state of non-employment, the individual has losses on investments which result in a negative net income, but are estimated to have a positive net income once employed.

model is estimated where the dependent variable is whether or not the individual is in paid employment at time *t+1* and incorporating the main demographic and human capital variables. Dummy variables are included as controls for the wave of the survey but a formal panel model is not attempted. This is because the data is not in the form of a classic panel as individuals cannot be included in the analysis in years in which they are observed to be in employment. Although modelling approaches which would make greater use of the longitudinal nature of HILDA can be envisaged, they are unlikely to offer much value at this stage given that the number of observations on each individual is currently very small (at most 3)[10].

Before reporting the results of the logit models, it is interesting to first consider some more direct evidence on disincentive effects that is contained within the HILDA survey. Persons who are not working and not looking for work, but who indicated that they would like a job, are asked their reasons for not looking for one. One of the potential responses is 'welfare payment/pension may be affected'. The proportion of applicable respondents who indicated that this was a factor is only 2.2 per cent. However, it is higher for those with higher PTRs and RRs. As can be seen in Table 3, the proportion citing this as a reason for not wanting to look for work rises monotonically from 1.7 per cent (0.2 per cent) for individuals facing PTRs (RRs) of between zero and 0.25; to 8.7 per cent (3.4 per cent) of those facing PTRs (RRs) of between 0.75 and 1. The relationship is not so apparent in the case of EMTRs. All people who indicated that they would like to work are also asked their hourly reservation wage rate – 'Assuming work was available, what is the lowest wage per hour, before any tax is taken out, that you would accept'. If EMTRs, PTRs or RRs do reduce incentives, it would be expected that people facing higher rates would set a higher reservation wage. In simple bi-variate analyses, this is borne out only in the case of RRs, for which there is a -0.05 correlation with the reservation wage (significant at the one percent level).

Table 3: Proportion of relevant population indicating that they were not seeking work because 'their welfare/pensions may be affected'.

Range	Effective marginal tax rate	Participation Tax rate	Replacement Rate
$0 \leq r \leq 0.25$	2.3%	1.7%	0.2%
$0.25 < r \leq 0.5$	1.3%	1.8%	1.7%
$0.5 < r \leq 0.75$	5.7%	3.2%	2.8%
$0.75 < r \leq 1$	0.0%	8.7%	3.4%
All	2.2%	2.2%	2.2%

The logit models are estimated separately by gender and for persons who are not in the labour force and persons who are unemployed to allow for the fact that the effects of financial disincentives and other covariates are likely to differ between these groups. Included among the explanatory variables are variables to capture age, marital status, the presence of resident children, labour market history, English language proficiency, health status, level of education, the individual's unearned

[10] It could also be argued that the predicted wage from the wages equation should be included in the models. As it happens, doing so has no substantial effect on the results reported below relating to the effects of EMTRs, PTRs or RRs.

income, their partner's income (earned and unearned) and, of course, the disincentive measures. The sample for estimation is restricted to persons aged 25 and over for two reasons. The first is to abstract from movements in and out of education and training that characterise the labour market for young people. Much of the 'non-participation' among this cohort is quite different in nature to non-participation that occurs among older cohorts and is motivated by different factors. Second, labour market history is known to be a powerful predictor of labour market outcomes and captures important individual effects that would otherwise be unobservable, hence reducing scope for omitted variable bias. In testing various specifications in the models the ratio of time in paid employment to total time since leaving full-time education returned the most robust results. For young people with a very limited history, however, the value of such labour market history variables is questionable.

Table 4 presents the results for persons who were not in the labour force in waves 1, 2 or 3. After allowing for missing values for the dependent and explanatory variables, there are just over 3,700 females (Table 4a) and 1,500 males (Table 4b) available for estimation in the pooled sample. Thirteen per cent of the females and 12 per cent of the males were observed to be employed at the time of the following survey. By and large the variables have the expected signs: non-participants who are older, have young resident children, have a long-term health condition and come from a non-English speaking background are less likely to enter employment. Those with university degrees and diplomas are much more likely to become employed. The largest effect is with respect to labour market history. Those who have spent a high proportion of their time since leaving full-time education in employment are also much more likely to re-enter employment. For males a positive effect of being married is observed. The level of an individual's own income from other (non-earned) income and of the income of their partner have small and statistically insignificant effects.[11]

Turning to the 'disincentive' measures, the estimated effect of the PTR and RR is negative and of similar magnitude for both women and men, though the estimates are significant only in the case of females. Against expectations, the estimated coefficient on the EMTR is positive in the models for both sexes, but the results are not statistically significant. To illustrate the economic significance of the estimates, the predicted probability of an individual entering employment is calculated with the various disincentive rates set at 0, 0.25, 0.5, 0.75 and 1; and with all other variables set at their mean values (Table 6a). The means and standard deviations of each disincentive measure are also included to allow an appreciation of the magnitude of such changes in the context of the actual distribution of EMTRs, PTRs and RRs for the sample. It can be seen that the predicted probability of entering employment for the 'average' non-participant female with a PTR or RR of zero is around 6.6 percentage points higher than for women with a PTR or RR of 100 per cent. The difference may not seem great, but does represent around a 40 per cent lower transition probability. For males the corresponding calculation returns around a 5 percentage point difference, equal to a 35 per cent lower transition probability. Recall however, that the coefficients on the PTR and RR are not significant in the models for males.

[11] Where the person is not partnered, partner's income is set to zero.

Table 4: Logistic regression estimates of the probability of entering employment; persons aged 25-64 and not in the labour force, HILDA waves 1-3
(a) Females

Parameter	β		Odds Ratio	β		Odds Ratio	β		Odds Ratio
Intercept	-2.555	***		-2.275	***		-2.168	***	
Not in labour force in:									
wave1	-0.049		0.95	-0.063		0.94	-0.046		0.96
wave2	-0.072		0.93	-0.085		0.92	-0.054		0.95
wave3	—			—			—		
Age (years):									
25_34	0.299	**	1.35	0.281	**	1.32	0.316	**	1.37
35_44	—			—			—		
45_54	-0.501	***	0.61	-0.502	***	0.61	-0.535	***	0.59
55_64	-1.501	***	0.22	-1.489	***	0.23	-1.401	***	0.25
Family status:									
Single, no kids	—			—			—		
married, no kids	-0.063		0.94	-0.110		0.90	-0.153		0.86
married with kids	0.289		1.34	0.283		1.33	0.315		1.37
& youngest< 4 yrs	-0.595	***	0.55	-0.560	***	0.57	-0.516	***	0.60
Sole parent	0.062		1.06	0.058		1.06	0.158		1.17
& youngest< 4 yrs	-0.592	*	0.55	-0.638	**	0.53	-0.549	*	0.58
Prop. time in work [0-1]	1.757	***	5.80	1.746	***	5.73	1.587	***	4.89
Indigenous	-0.514		0.60	-0.492		0.61	-0.442		0.64
English is 1st language	—			—			—		
English not 1st language &:									
English good	-0.330	*	0.72	-0.331	*	0.72	-0.318	*	0.73
English poor	-1.312	***	0.27	-1.292	***	0.28	-1.271	***	0.28
Has long-term disability	-0.460	***	0.63	-0.458	***	0.63	-0.405	***	0.67
Highest level of education:									
University degree	0.919	***	2.51	0.908	***	2.48	0.842	***	2.32
Diploma	0.412	**	1.51	0.409	**	1.51	0.363	**	1.44
Trade	0.020		1.02	0.028		1.03	0.021		1.02
Certificate	0.109		1.12	0.071		1.07	0.052		1.05
Completed Year 12	0.202		1.22	0.214		1.24	0.209		1.23
No Yr 12 or other qual	—			—			—		
EMTR	0.401		1.49						
Participation tax rate				-0.608	**	0.55			
Replacement rate							-0.564	**	0.57
Unearned income ($000)	-0.007		0.99	-0.005		1.00	0.000		1.00
Partner's income ($000)	0.002		1.00	0.001		1.00	0.000		1.00
Observations	3726			3724			3706		
Degrees of freedom	23			23			23		
Likelihood ratio (X^2)	387.8			390.7			382.9		

Table 4: Logistic regression estimates of the probability of entering employment; persons aged 25-64 and not in the labour force, HILDA waves 1-3
(b) Males

Parameter	β		Odds Ratio	β		Odds Ratio	β		Odds Ratio
Intercept	-3.128	***		-2.932	***		-2.694	***	
Not in labour force in:									
wave1	-0.199		0.82	-0.191		0.83	-0.205		0.82
wave2	-0.041		0.96	-0.039		0.96	-0.014		0.99
wave3	—			—			—		
Age (years):									
25_34	0.864	***	2.37	0.823	***	2.28	0.794	***	2.21
35_44	—			—			—		
45_54	-1.098	***	0.33	-1.106	***	0.33	-1.156	***	0.32
55_64	-2.095	***	0.12	-2.116	***	0.12	-2.089	***	0.12
Family status:									
Single, no kids	—			—			—		
married, no kids	0.347		1.42	0.321		1.38	0.350		1.42
married with kids	0.881	***	2.41	0.872	***	2.39	0.913	***	2.49
& youngest< 4 yrs	-1.145	***	0.32	-1.108	***	0.33	-1.076	***	0.34
Sole parent	0.080		1.08	0.070		1.07	-0.053		0.95
& youngest< 4 yrs	-0.382		0.68	-0.422		0.66	-0.172		0.84
Prop. time in work [0-1]	2.675	***	14.51	2.711	***	15.05	2.498	***	12.16
Indigenous	0.362		1.44	0.361		1.44	0.374		1.45
English is 1st language	—			—			—		
English not 1st language &:									
English good	-0.153		0.86	-0.156		0.86	-0.182		0.83
English poor	-1.081		0.34	-1.087		0.34	-1.114		0.33
Has long-term disability	-0.619	***	0.54	-0.602	***	0.55	-0.598	***	0.55
Highest level of education:									
University degree	0.806	***	2.24	0.789	***	2.20	0.715	**	2.04
Diploma	0.544	*	1.72	0.529	*	1.70	0.504	*	1.66
Trade	-0.161		0.85	-0.163		0.85	-0.222		0.80
Certificate	0.190		1.21	0.177		1.19	0.141		1.15
Completed Year 12	0.660	**	1.94	0.632	**	1.88	0.608	*	1.84
No Yr 12 or other qual	—			—			—		
EMTR	0.180		1.20						
Participation tax rate				-0.464		0.63			
Replacement rate							-0.514		0.60
Unearned income ($000)	0.001		1.00	0.000		1.00	0.005		1.01
Partner's income ($000)	0.000		1.00	0.000		1.00	-0.002		1.00
Observations	1505			1504			1501		
Degrees of freedom	23			23			23		
Likelihood ratio (X^2)	187.2			188.0			190.4		

Table 5: Logistic regression estimates of the probability of entering employment; persons aged 25-64 and unemployed, HILDA waves 1-3
(a) Females

Parameter	β		Odds Ratio	β		Odds Ratio	β		Odds Ratio
Intercept	-0.717			-0.563			0.379		
Unemployed in:									
wave1	-0.381		0.68	-0.349		0.71	-0.274		0.76
wave2	-0.042		0.96	-0.025		0.98	0.075		1.08
wave3	—			—			—		
Age (years):									
25_34	-0.311		0.73	-0.336		0.72	-0.301		0.74
35_44									
45_54	-0.213		0.81	-0.231		0.79	-0.356		0.70
55_64	-1.213	**	0.30	-1.147	*	0.32	-1.385	**	0.25
Family status:									
Single, no kids	—			—			—		
Married	-0.604		0.55	-0.741	*	0.48	-0.594		0.55
Sole parent	-0.104		0.90	-0.243		0.78	0.004		1.00
Prop. time in work [0-1]	2.369	***	10.68	2.335	***	10.33	1.701	***	5.48
Indigenous	-1.054		0.35	-1.198		0.30	-1.202		0.30
English not 1st language	-0.726	**	0.48	-0.676	*	0.51	-0.683	*	0.51
Has long-term disability	-0.536	*	0.59	-0.507		0.60	-0.414		0.66
Highest level of education:									
University degree	1.204	***	3.33	1.309	***	3.70	1.194	***	3.30
Diploma	0.330		1.39	0.373		1.45	0.342		1.41
Trade	0.352		1.42	0.433		1.54	0.420		1.52
Certificate	-0.746		0.47	-0.632		0.53	-0.912		0.40
Completed Year 12	0.209		1.23	0.266		1.31	0.270		1.31
No Yr 12 or other qual	—			—			—		
EMTR	-1.693	*	0.18						
Participation tax rate				-0.569		0.57			
Replacement rate							-1.536	***	0.22
Unearned income ($000)	0.028		1.03	0.009		1.01	0.018		1.02
Partner's income ($000)	-0.001		1.00	-0.003		1.00	-0.012		0.99
Observations	313			313			311		
Degrees of freedom	19			19			19		
Likelihood ratio (X^2)	70.8			68.0			75.0		

Table 5: Logistic regression estimates of the probability of entering employment; persons aged 25-64 and unemployed, HILDA waves 1-3
(b) Males

Parameter	β		Odds Ratio	β		Odds Ratio	β		Odds Ratio
Intercept	-2.311	***		-1.525	**		-0.690		
Unemployed in:									
wave1	-0.029		0.97	-0.088		0.92	-0.101		0.90
wave2	0.263		1.30	0.220		1.25	0.202		1.22
wave3	—			—			—		
Age (years):									
25_34	0.734	**	2.08	0.722	**	2.06	0.676	**	1.97
35_44	—			—			—		
45_54	-0.758	**	0.47	-0.756	**	0.47	-0.775	**	0.46
55_64	-2.148	***	0.12	-2.186	***	0.11	-2.195	***	0.11
Family status:									
Single, no kids	—			—			—		
Married	0.235		1.26	0.308		1.36	0.448		1.57
Sole parent	-1.105	*	0.33	-1.163	*	0.31	-0.944		0.39
Prop. time in work [0-1]	2.626	***	13.82	2.529	***	12.54	1.627	**	5.09
Indigenous	-0.196		0.82	-0.258		0.77	-0.338		0.71
English not 1st language	-0.284		0.75	-0.243		0.78	-0.287		0.75
Has long-term disability	-0.444	*	0.64	-0.396		0.67	-0.273		0.76
Highest level of education:									
University degree	0.583		1.79	0.507		1.66	0.280		1.32
Diploma	0.766		2.15	0.575		1.78	0.432		1.54
Trade	0.531	*	1.70	0.431		1.54	0.447		1.56
Certificate	-0.201		0.82	-0.243		0.79	-0.201		0.82
Completed Year 12	0.569		1.77	0.585		1.79	0.494		1.64
No Yr 12 or other qual	—			—			—		
EMTR	0.408		1.50						
Participation tax rate				-1.284	**	0.28			
Replacement rate							-1.550	***	0.21
Unearned income ($000)	0.035		1.04	0.036		1.04	0.048	*	1.05
Partner's income ($000)	0.010		1.01	0.006		1.01	0.002		1.00
Observations	361			361			360		
Degrees of freedom	19			19			19		
Likelihood ratio (X^2)	88.0			93.0			96.6		

For estimating transitions from unemployment the sample size is considerably smaller, and several variables with low significance and magnitude have been dropped. Again the results on other variables concord with expectations, and we reserve discussion for the results pertaining to the disincentive measures. The coefficient on the EMTR is significant only in the case of females – its sign is again contrary to expectations for unemployed males. The estimated coefficients on the PTR and RR are negative in all four cases, indicating that higher PTRs and RRs do create work disincentives for the unemployed. The estimate is statistically significant in each case except the PTR in the model for females. As shown in Table 6(b), the magnitude of the effects implied by these estimates is very large. Unemployed males facing a zero PTR or RR are predicted to be around twice as likely to enter employment as those who face a PTR or RR of 100 per cent (a 30 to 37 percentage point difference). The actual mean PTR (RR) for this group is 0.47 (0.52), with a standard deviation of 0.22 (0.30). This means that around two-thirds of unemployed men aged 25-64 faced PTRs (RRs) lying between 0.25 and 0.69 (0.22 and 0.82).

Table 6: Predicted probability of entering employment, conditional upon selected values of the EMTR, PTR and RR

(a) From not in the labour force

	Females			Males		
Reference Rate	EMTRs	PTRs	RRs	EMTRs	PTRs	RRs
Zero	12.7%	15.7%	17.0%	11.4%	13.7%	14.8%
0.25	13.9%	13.8%	15.1%	11.9%	12.3%	13.3%
0.5	15.1%	12.1%	13.4%	12.4%	11.1%	11.9%
0.75	16.4%	10.5%	11.8%	12.9%	10.0%	10.6%
1	17.8%	9.2%	10.4%	13.4%	9.0%	9.4%
mean (rate)	13.5%	31.4%	53.8%	14.8%	38.1%	53.6%
std dev	18.0%	19.6%	28.4%	20.3%	20.1%	25.1%

(b) From unemployment

	Females			Males		
Reference Rate	EMTRs	PTRs	RRs	EMTRs	PTRs	RRs
Zero	46.8%	47.3%	62.9%	43.9%	59.7%	64.3%
0.25	36.6%	43.8%	53.6%	46.4%	51.8%	55.0%
0.5	27.4%	40.3%	44.0%	49.0%	43.9%	45.3%
0.75	19.8%	37.0%	34.9%	51.5%	36.2%	36.0%
1	13.9%	33.7%	26.7%	54.1%	29.1%	27.6%
mean (rate)	11.2%	36.6%	55.0%	9.6%	46.8%	51.6%
std dev	17.4%	23.7%	32.3%	21.0%	22.5%	30.0%

Notes: calculated from the relevant logit models presented in Tables 4 and 5; with all other variables evaluated at their means; shaded columns indicate that the estimated coefficient for the EMTR/PTR/RR upon which the calculations are based is statistically significant.

For females, the estimated effect of the RR is of similar magnitude to that for males, but the effect of the PTR is considerably smaller and statistically insigificant. It is unclear why the PTR and RR should offer such similar results in the case of unemployed males, but not in the case of unemployed females. The modelled effect of the EMTR for unemployed women is also large; though note the lower mean and dispersion of this measure relative to the PTR and RR.

6. Conclusion

For some time reforming the welfare system has been a priority due to the belief that the interaction between the tax and benefit system created welfare traps which potentially confined the unemployed and those with low incomes to extended periods of poverty and welfare dependency. Increasing the labour force participation more generally has also now become a priority as a result of the very tight labour market conditions in Australia and concerns about the implications of the aging of the population for future labour supply.

In this paper we have presented estimates, in the form of EMTRs and PTRs, of how Australians' financial circumstances would change as a result of increasing their participation in the paid labour force. A significant proportion of people who receive unemployment benefits face EMTRs in excess of 60 per cent and PTRs in excess of 75 per cent. Sole parents are also confirmed as a group facing EMTRs and PTRs above the norm. Whether these measured rates can be considered high depends critically upon the degree to which individuals respond to them by adjusting their labour supply, and this is also critical to what improvement in participation the government can expect from various welfare-to-work measures.

The analysis of transitions from non-employment to employment suggests that financial disincentives as measured by PTRs or RRs do have a moderate and significant effect on the likelihood that women who are not in the labour force will enter paid employment. The implied effect is small in terms of the percentage point change in participation, but quite large in relative terms as it relates to a small baseline rate of transition from NILF to paid employment. The estimated elasticity is similar in magnitude for males who are not in the labour force, but not significantly different from zero in statistical terms. The impact for women is probably the parameter of greatest policy significance — women have much lower participation rates than men and hence women outside the labour force offer a very large latent labour supply. Both the PTR and RR appear to provide superior results to EMTRs in modelling the disincentive effects of the tax and benefit system for persons not participating in the labour market.

For unemployed persons aged 25 to 64, we find very strong evidence of the presence of unemployment traps. These are captured most strongly through the RR, though the PTR returns very similar results for men. Given that these individuals have, by definition, chosen to actively search for work, then the problem is not one of disincentives to participation, but rather of a lower likelihood of finding a job given the decision to participate. This would therefore seem to imply that the financial disincentives influence their willingness to accept jobs on offer, and an initial investigation did show some evidence of a relationship between the RR facing unemployed individuals and their reservation wage. It should also be noted that these estimates of work disincentives relate only to static effects. Labour market history is known, and confirmed here, to have a very strong association with future labour market outcomes. The effect of high EMTRs, PTRs or RRs will therefore accumulate

over time to the extent that they contribute to individuals' accumulated time in unemployment and absence from the labour force.

While effective marginal tax rates are the measure most commonly used to signify the extent of welfare traps, the results here suggest that either RRs or PTRs should be used in preference to EMTRs when measuring and modelling disincentives facing persons out of work; particularly in the case of males. Some caution should be exercised in accepting this result. Courtesy of the longitudinal nature of the HILDA data, the methodology offers some improvement on many other such empirical studies in dealing with endogeneity, but we cannot claim to have eliminated it altogether. Note also that the results for the PTR and RR are partly driven by the wage equation used for predicting earnings in employment. A contentious element of our approach is the inclusion of both full-time and part-time workers in generating the wage equation in order to account for the probability of individuals entering either part-time or full-time employment when they secure work. These issues do not apply to the EMTR, which is constant irrespective of potential earnings (and human capital levels).

The analysis presented is based on data from the years 2000-01 to 2003-04. There were relatively few reforms to the tax and benefits system over this time and accordingly the estimates show little change in EMTRs or PTRs over the period. As the most important of the current welfare-to-work reforms were implemented in July of 2006, including significant changes relating to the Disability Support Pension and Parenting Payments, actual empirical evaluation of those changes using the HILDA data will not be possible until the release of Waves 6 and 7. The ongoing development of the AHURI-3M tax-benefit simulator to incorporate policy changes will provide a ready basis for measuring the impact of these policy initiatives upon alternative measures of financial disincentives, and for predicting the likely labour supply responses. The updating of the tax and benefit parameters for Waves 4 and 5 of HILDA and the availability of further waves of survey data should also permit a more sophisticated modelling approach to identifying labour supply responses, including the potential for natural experiments created by the July 2006 policy changes. And while this paper has focussed on persons who are not working, an intended extension of the analysis is to look at how financial disincentives affect the hours of labour supplied by those in work, particularly those in part-time work.

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Appendix

Table A1: Wage regression, wave 1

Explanatory variables		Males			Females		
		Coef.	Std. error	Sig.	Coef.	Std. error	Sig.
Constant		8.857	0.276	0.000	8.811	0.393	0.000
Marital status	Married	0.288	0.050	0.000	0.006	0.084	0.947
(never married omitted)	Divorced/Separated/ Widowed	-0.013	0.072	0.861	-0.050	0.100	0.615
	Year 12	0.273	0.089	0.002	0.344	0.141	0.014
	Certificate not defined	0.260	0.120	0.030	0.220	0.092	0.017
	Certificate I or II	0.405	0.127	0.001	0.282	0.136	0.038
	Certificate III or IV	0.298	0.061	0.000	0.348	0.128	0.006
	Diploma/Advanced diploma	0.454	0.090	0.000	0.467	0.140	0.001
	Bachelor degree	0.698	0.101	0.000	0.804	0.174	0.000
	Graduate diploma	0.777	0.138	0.000	0.905	0.209	0.000
	Postgraduate degree	0.752	0.104	0.000	0.944	0.227	0.000
Work experience	Years in paid work	0.104	0.008	0.000	0.100	0.019	0.000
	Years in paid work squared	-0.002	0.000	0.000	-0.002	0.000	0.000
	Years unemployed	-0.180	0.028	0.000	-0.141	0.020	0.000
English proficiency	Good	-0.425	0.108	0.000	-0.111	0.088	0.205
(Australian-born omitted)	Poor	-0.778	0.245	0.002	-0.334	0.299	0.263
State/Capital city	Rest of New South Wales	-0.302	0.058	0.000	-0.233	0.061	0.000
(Sydney omitted)	Melbourne	-0.037	0.052	0.479	-0.093	0.054	0.084
	Rest of Victoria	-0.405	0.063	0.000	-0.267	0.076	0.000
	Brisbane	-0.150	0.066	0.023	-0.115	0.074	0.120
	Rest of Queensland	-0.372	0.054	0.000	-0.375	0.063	0.000
	Adelaide	-0.238	0.066	0.000	-0.163	0.077	0.035
	Rest of South Australia	-0.677	0.138	0.000	-0.319	0.114	0.005
	Perth	-0.191	0.060	0.001	-0.201	0.070	0.004
	Rest of Western Australia	-0.179	0.086	0.037	-0.280	0.108	0.010
	Tasmania	-0.264	0.090	0.003	-0.138	0.115	0.229
	Northern Territory	-0.243	0.178	0.172	0.076	0.209	0.716
	Australian Capital Territory	0.255	0.121	0.036	0.074	0.119	0.534
Number of children	Aged 0-2	0.063	0.037	0.093	-0.424	0.072	0.000
	Aged 3-4	-0.059	0.048	0.222	-0.372	0.087	0.000
	Aged 5-9	-0.028	0.027	0.293	-0.199	0.038	0.000
	Aged 10-12	-0.110	0.042	0.009	-0.156	0.041	0.000
	Aged 13-14	-0.022	0.048	0.643	-0.150	0.060	0.012
Disabled		-0.605	0.163	0.000	-0.396	0.128	0.002
Lambda		1.155	0.491	0.019	0.361	0.396	0.362
Observations		3655			3359		
Adjusted R-square		0.272			0.229		
F		41.106		0.000	30.338		0.000

Table A2: Wage regression, wave 2

Explanatory variables		Males			Females		
		Coef.	Std. error	Sig.	Coef.	Std. error	Sig.
Constant		8.980	0.178	0.000	9.103	0.366	0.000
Marital status (never married omitted)	Married	0.276	0.045	0.000	0.055	0.089	0.534
	Divorced/Separated/ Widowed	-0.076	0.074	0.301	0.035	0.113	0.756
	Year 12	0.251	0.071	0.000	0.281	0.134	0.036
	Certificate not defined	0.058	0.091	0.524	0.238	0.109	0.029
	Certificate I or II	0.185	0.103	0.072	0.133	0.115	0.247
	Certificate III or IV	0.269	0.065	0.000	0.280	0.128	0.029
	Diploma/Advanced diploma	0.395	0.080	0.000	0.469	0.128	0.000
	Bachelor degree	0.611	0.085	0.000	0.757	0.175	0.000
	Graduate diploma	0.734	0.112	0.000	0.689	0.199	0.001
	Postgraduate degree	0.733	0.101	0.000	0.877	0.213	0.000
Work experience	Years in paid work	0.106	0.006	0.000	0.089	0.019	0.000
	Years in paid work squared	-0.002	0.000	0.000	-0.002	0.000	0.000
	Years unemployed	-0.203	0.021	0.000	-0.118	0.019	0.000
English proficiency (Australian-born omitted)	Good	-0.346	0.083	0.000	-0.056	0.079	0.479
	Poor	-1.172	0.267	0.000	-0.217	0.326	0.505
State/Capital city (Sydney omitted)	Rest of New South Wales	-0.332	0.067	0.000	-0.214	0.071	0.003
	Melbourne	-0.031	0.046	0.501	-0.152	0.060	0.011
	Rest of Victoria	-0.353	0.080	0.000	-0.226	0.089	0.012
	Brisbane	-0.190	0.055	0.001	-0.138	0.073	0.058
	Rest of Queensland	-0.318	0.064	0.000	-0.304	0.070	0.000
	Adelaide	-0.263	0.067	0.000	-0.120	0.085	0.156
	Rest of South Australia	-0.641	0.144	0.000	-0.259	0.122	0.033
	Perth	-0.176	0.067	0.009	-0.182	0.078	0.020
	Rest of Western Australia	-0.086	0.095	0.363	-0.434	0.129	0.001
	Tasmania	-0.517	0.110	0.000	-0.326	0.116	0.005
	Northern Territory	-0.121	0.169	0.476	0.233	0.214	0.276
	Australian Capital Territory	0.295	0.109	0.007	-0.149	0.129	0.246
Number of children	Aged 0-2	0.031	0.036	0.382	-0.390	0.092	0.000
	Aged 3-4	-0.040	0.047	0.399	-0.405	0.080	0.000
	Aged 5-9	-0.062	0.028	0.029	-0.224	0.041	0.000
	Aged 10-12	-0.002	0.037	0.955	-0.150	0.045	0.001
	Aged 13-14	-0.123	0.048	0.011	-0.106	0.060	0.079
Disabled		-0.809	0.178	0.000	-0.393	0.154	0.011
Lambda		1.374	0.433	0.002	0.000	0.392	1.000
Observations		3407			3208		
Adjusted R-square		0.292			0.215		
F		42.330		0.000	26.825		0.000

Table A3: Wage regression, wave 3

Explanatory variables		Males			Females		
		Coef.	Std. error	Sig.	Coef.	Std. error	Sig.
Constant		9.140	0.163	0.000	9.052	0.283	0.000
Marital status (never married omitted)	Married	0.435	0.044	0.000	0.047	0.075	0.533
	Divorced/Separated/ Widowed	0.130	0.065	0.047	0.072	0.097	0.456
	Year 12	0.270	0.076	0.000	0.348	0.132	0.008
	Certificate not defined	-0.204	0.327	0.533	0.086	0.231	0.711
	Certificate I or II	-0.206	0.164	0.208	-0.453	0.183	0.013
	Certificate III or IV	0.321	0.058	0.000	0.371	0.103	0.000
	Diploma/Advanced diploma	0.420	0.083	0.000	0.473	0.116	0.000
	Bachelor degree	0.678	0.100	0.000	0.780	0.169	0.000
	Graduate diploma	0.784	0.123	0.000	0.884	0.195	0.000
	Postgraduate degree	0.845	0.121	0.000	1.028	0.207	0.000
Work experience	Years in paid work	0.086	0.006	0.000	0.080	0.012	0.000
	Years in paid work squared	-0.002	0.000	0.000	-0.002	0.000	0.000
	Years unemployed	-0.182	0.017	0.000	-0.141	0.020	0.000
English proficiency (Australian-born omitted)	Good	-0.266	0.064	0.000	-0.138	0.092	0.132
	Poor	-0.840	0.218	0.000	-0.602	0.354	0.089
State/Capital city (Sydney omitted)	Rest of New South Wales	-0.378	0.071	0.000	-0.218	0.079	0.006
	Melbourne	-0.181	0.052	0.001	-0.166	0.057	0.004
	Rest of Victoria	-0.536	0.080	0.000	-0.388	0.100	0.000
	Brisbane	-0.315	0.059	0.000	-0.143	0.068	0.036
	Rest of Queensland	-0.391	0.063	0.000	-0.228	0.067	0.001
	Adelaide	-0.452	0.075	0.000	-0.292	0.078	0.000
	Rest of South Australia	-0.702	0.113	0.000	-0.568	0.135	0.000
	Perth	-0.210	0.072	0.004	-0.237	0.081	0.003
	Rest of Western Australia	-0.187	0.095	0.048	-0.428	0.146	0.003
	Tasmania	-0.547	0.107	0.000	-0.297	0.107	0.006
	Northern Territory	-0.072	0.159	0.651	0.329	0.206	0.111
	Australian Capital Territory	0.039	0.097	0.690	-0.008	0.127	0.949
Number of children	Aged 0-2	-0.021	0.036	0.571	-0.426	0.091	0.000
	Aged 3-4	-0.040	0.051	0.431	-0.392	0.103	0.000
	Aged 5-9	-0.048	0.028	0.087	-0.208	0.051	0.000
	Aged 10-12	-0.023	0.035	0.508	-0.156	0.043	0.000
	Aged 13-14	-0.010	0.048	0.839	-0.138	0.056	0.014
Disabled		-0.717	0.137	0.000	-0.317	0.137	0.021
Lambda		1.502	0.404	0.000	0.403	0.404	0.318
Observations		3373			3226		
Adjusted R-square		0.304			0.203		
F		44.395		0.000	25.168		0.000

Table A4: Wage regression, wave 4

Explanatory variables		Males			Females		
		Coef.	Std. error	Sig.	Coef.	Std. error	Sig.
Constant		9.562	0.163	0.000	8.944	0.306	0.000
Marital status (never married omitted)	Married	0.292	0.055	0.000	0.059	0.084	0.477
	Divorced/Separated/ Widowed	0.066	0.065	0.308	0.020	0.119	0.869
	Year 12	0.143	0.059	0.015	0.377	0.125	0.002
	Certificate not defined	-0.137	0.338	0.686	-0.002	0.230	0.994
	Certificate I or II	-0.385	0.156	0.014	-0.297	0.182	0.102
	Certificate III or IV	0.146	0.044	0.001	0.397	0.116	0.001
	Diploma/Advanced diploma	0.225	0.069	0.001	0.516	0.111	0.000
	Bachelor degree	0.394	0.078	0.000	0.772	0.159	0.000
	Graduate diploma	0.540	0.089	0.000	0.876	0.175	0.000
	Postgraduate degree	0.514	0.108	0.000	0.940	0.188	0.000
Work experience	Years in paid work	0.082	0.007	0.000	0.094	0.015	0.000
	Years in paid work squared	-0.002	0.000	0.000	-0.002	0.000	0.000
	Years unemployed	-0.146	0.017	0.000	-0.075	0.017	0.000
English proficiency (Australian-born omitted)	Good	-0.151	0.079	0.056	0.016	0.089	0.862
	Poor	-0.722	0.303	0.017	-0.890	0.429	0.038
State/Capital city (Sydney omitted)	Rest of New South Wales	-0.214	0.069	0.002	-0.180	0.075	0.016
	Melbourne	-0.008	0.047	0.867	-0.189	0.060	0.002
	Rest of Victoria	-0.244	0.072	0.001	-0.279	0.095	0.003
	Brisbane	-0.094	0.059	0.108	-0.178	0.070	0.011
	Rest of Queensland	-0.183	0.056	0.001	-0.226	0.066	0.001
	Adelaide	-0.169	0.064	0.008	-0.251	0.079	0.001
	Rest of South Australia	-0.430	0.115	0.000	-0.441	0.121	0.000
	Perth	-0.042	0.069	0.540	-0.290	0.086	0.001
	Rest of Western Australia	-0.153	0.092	0.095	-0.317	0.121	0.009
	Tasmania	-0.356	0.132	0.007	-0.149	0.105	0.157
	Northern Territory	-0.058	0.154	0.706	0.114	0.188	0.542
	Australian Capital Territory	0.023	0.099	0.818	-0.128	0.130	0.325
Number of children	Aged 0-2	-0.009	0.042	0.840	-0.463	0.078	0.000
	Aged 3-4	0.081	0.051	0.114	-0.332	0.101	0.001
	Aged 5-9	-0.009	0.032	0.786	-0.200	0.053	0.000
	Aged 10-12	-0.062	0.041	0.132	-0.173	0.047	0.000
	Aged 13-14	-0.057	0.049	0.250	-0.100	0.056	0.074
Disabled		-0.339	0.135	0.012	-0.254	0.146	0.081
Lambda		0.254	0.394	0.519	0.148	0.425	0.727
Observations		3291			3193		
Adjusted R-square		0.293			0.242		
F		41.042		0.000	30.996		0.000

Table A5: Market rent regression, wave 1

Explanatory variable		Coef.	Std. error	Sig.
Constant		6.165	0.058	0.000
Number of persons	Aged 0-4 years	0.043	0.016	0.009
	Aged 5-9 years	0.052	0.018	0.004
	Aged 10-14 years	0.036	0.020	0.073
	Aged 15+ years	0.094	0.013	0.000
State/Capital city	Rest of New South Wales	-0.267	0.041	0.000
(Sydney omitted)	Melbourne	-0.274	0.030	0.000
	Rest of Victoria	-0.432	0.050	0.000
	Brisbane	-0.334	0.036	0.000
	Rest of Queensland	-0.227	0.041	0.000
	Adelaide	-0.391	0.048	0.000
	Rest of South Australia	-0.371	0.074	0.000
	Perth	-0.422	0.037	0.000
	Rest of Western Australia	-0.330	0.073	0.000
	Tasmania	-0.350	0.064	0.000
	Northern Territory	0.204	0.138	0.139
	Australian Capital Territory	-0.041	0.078	0.601
Region	Inner region	-0.131	0.032	0.000
(major cities omitted)	Outer region	-0.268	0.041	0.000
	Remote	-0.254	0.102	0.012
Number of bedrooms	Zero	0.081	0.088	0.356
(One omitted)	Two	0.213	0.035	0.000
	Three	0.296	0.039	0.000
	Four	0.257	0.046	0.000
	Five or more	0.354	0.084	0.000
Dwelling type	Semi-detached/row or terrace house/town house – one storey	0.076	0.030	0.011
(Separate house omitted)	Semi-detached/row or terrace house/town house – 2+ storeys	0.089	0.043	0.037
	Flat/unit/apartment – 1 storey block	0.045	0.038	0.234
	Flat/unit/apartment – 2 storey block	0.073	0.036	0.040
	Flat/unit/apartment – 3 storey block	0.187	0.040	0.000
	Flat/unit/apartment – 4-9 storey block	0.178	0.072	0.013
	Flat/unit/apartment – 10 storey block	0.524	0.153	0.001
	Flat/unit/apartment – attached to a house	0.043	0.163	0.793
	Caravan/tent/cabin/houseboat	0.109	0.359	0.761
	House/flat attached to shop, office, etc	-0.272	0.148	0.067
	Other	-0.077	0.187	0.681
Dwelling condition	Good	-0.062	0.026	0.017
(Very good omitted)	Average	-0.111	0.026	0.000
	Poor	-0.213	0.037	0.000
	Very poor/almost derelict	-0.663	0.117	0.000
Presence of security features		0.046	0.018	0.012
Household financial year income/$1000		0.002	0.000	0.000
SEIFA 96 Decile of Index of education and occupation	0.024	0.004	0.000	
Observations	1687			
Adjusted R-square	0.449			
F	33.750			0.000

Table A6: Market rent regression, wave 2

Explanatory variable		Coef.	Std. error	Sig.
Constant		5.920	0.063	0.000
Number of persons	Aged 0-4 years	0.089	0.021	0.000
	Aged 5-9 years	0.084	0.021	0.000
	Aged 10-14 years	0.069	0.022	0.002
	Aged 15+ years	0.133	0.015	0.000
State/Capital city	Rest of New South Wales	-0.159	0.048	0.001
(Sydney omitted)	Melbourne	-0.193	0.035	0.000
	Rest of Victoria	-0.430	0.059	0.000
	Brisbane	-0.171	0.040	0.000
	Rest of Queensland	-0.198	0.047	0.000
	Adelaide	-0.300	0.051	0.000
	Rest of South Australia	-0.260	0.082	0.002
	Perth	-0.332	0.047	0.000
	Rest of Western Australia	-0.209	0.085	0.014
	Tasmania	-0.334	0.071	0.000
	Northern Territory	-0.131	0.204	0.520
	Australian Capital Territory	-0.135	0.092	0.144
Region	Inner region	-0.085	0.040	0.033
(major cities omitted)	Outer region	-0.187	0.049	0.000
	Remote	-0.082	0.115	0.475
Number of bedrooms	Zero	-0.102	0.131	0.437
(One omitted)	Two	0.261	0.039	0.000
	Three	0.301	0.043	0.000
	Four	0.260	0.052	0.000
	Five or more	0.179	0.081	0.027
Dwelling type	Semi-detached/row or terrace house/town house – one storey	0.059	0.040	0.142
(Separate house omitted)	Semi-detached/row or terrace house/town house – 2+ storeys	0.082	0.049	0.097
	Flat/unit/apartment – 1 storey block	0.060	0.044	0.171
	Flat/unit/apartment – 2 storey block	0.077	0.043	0.073
	Flat/unit/apartment – 3 storey block	0.198	0.048	0.000
	Flat/unit/apartment – 4-9 storey block	0.196	0.067	0.004
	Flat/unit/apartment – 10 storey block	0.420	0.143	0.003
	Flat/unit/apartment – attached to a house	-0.116	0.090	0.198
	Caravan/tent/cabin/houseboat	-0.435	0.201	0.031
	House/flat attached to shop, office, etc	-0.177	0.108	0.099
Dwelling condition	Good	-0.081	0.029	0.005
(Very good omitted)	Average	-0.159	0.029	0.000
	Poor	-0.225	0.043	0.000
	Very poor/almost derelict	-0.278	0.134	0.038
Household financial year income/$1000		0.002	0.000	0.000
SEIFA 96 Decile of Index of education and occupation		0.044	0.004	0.000
Observations	1492			
Adjusted R-square	0.440			
F	30.346			0.000

Table A7: Market rent regression, wave 3

Explanatory variable		Coef.	Std. error	Sig.
Constant		6.053	0.059	0.000
Number of persons	Aged 0-4 years	0.065	0.020	0.001
	Aged 5-9 years	0.034	0.021	0.105
	Aged 10-14 years	0.074	0.021	0.000
	Aged 15+ years	0.107	0.014	0.000
State/Capital city	Rest of New South Wales	-0.199	0.044	0.000
(Sydney omitted)	Melbourne	-0.171	0.033	0.000
	Rest of Victoria	-0.371	0.057	0.000
	Brisbane	-0.210	0.037	0.000
	Rest of Queensland	-0.191	0.044	0.000
	Adelaide	-0.292	0.046	0.000
	Rest of South Australia	-0.324	0.075	0.000
	Perth	-0.365	0.041	0.000
	Rest of Western Australia	-0.274	0.081	0.001
	Tasmania	-0.402	0.066	0.000
	Northern Territory	-0.088	0.144	0.541
	Australian Capital Territory	-0.097	0.078	0.212
Region	Inner region	-0.062	0.038	0.100
(major cities omitted)	Outer region	-0.191	0.046	0.000
	Remote	-0.220	0.085	0.010
Number of bedrooms	Zero	-0.787	0.109	0.000
(One omitted)	Two	0.294	0.034	0.000
	Three	0.368	0.038	0.000
	Four	0.427	0.047	0.000
	Five or more	0.386	0.085	0.000
Dwelling type	Semi-detached/row or terrace house/town house – one storey	0.024	0.041	0.550
(Separate house omitted)	Semi-detached/row or terrace house/town house – 2+ storeys	0.096	0.040	0.018
	Flat/unit/apartment – 1 storey block	0.002	0.038	0.948
	Flat/unit/apartment – 2 storey block	0.037	0.039	0.344
	Flat/unit/apartment – 3 storey block	0.189	0.044	0.000
	Flat/unit/apartment – 4-9 storey block	0.230	0.068	0.001
	Flat/unit/apartment – 10 storey block	0.338	0.130	0.009
	Flat/unit/apartment – attached to a house	-0.172	0.079	0.030
	Caravan/tent/cabin/houseboat	-0.289	0.254	0.255
	House/flat attached to shop, office, etc	0.084	0.094	0.374
Dwelling condition	Good	-0.103	0.027	0.000
(Very good omitted)	Average	-0.135	0.028	0.000
	Poor	-0.204	0.040	0.000
	Very poor/almost derelict	-0.384	0.111	0.001
Household financial year income/$1000		0.002	0.000	0.000
SEIFA 96 Decile of Index of education and occupation		0.035	0.004	0.000
Observations	1452			
Adjusted R-square	0.472			
F	33.416			0.000

Table A8: Market rent regression, wave 4

Explanatory variable		Coef.	Std. error	Sig.
Constant		6.065	0.060	0.000
Number of persons	Aged 0-4 years	0.061	0.020	0.002
	Aged 5-9 years	0.052	0.020	0.011
	Aged 10-14 years	0.060	0.022	0.006
	Aged 15+ years	0.085	0.015	0.000
State/Capital city	Rest of New South Wales	-0.130	0.047	0.005
(Sydney omitted)	Melbourne	-0.227	0.033	0.000
	Rest of Victoria	-0.218	0.059	0.000
	Brisbane	-0.222	0.039	0.000
	Rest of Queensland	-0.102	0.046	0.026
	Adelaide	-0.259	0.046	0.000
	Rest of South Australia	-0.249	0.080	0.002
	Perth	-0.403	0.044	0.000
	Rest of Western Australia	-0.339	0.087	0.000
	Tasmania	-0.203	0.067	0.002
	Northern Territory	-0.029	0.140	0.836
	Australian Capital Territory	-0.062	0.093	0.508
Region	Inner region	-0.112	0.039	0.004
(major cities omitted)	Outer region	-0.215	0.048	0.000
	Remote	-0.304	0.090	0.001
Number of bedrooms	Zero	-0.192	0.134	0.152
(One omitted)	Two	0.260	0.036	0.000
	Three	0.334	0.039	0.000
	Four	0.285	0.047	0.000
	Five or more	0.507	0.087	0.000
Dwelling type	Semi-detached/row or terrace house/town house – one storey	0.027	0.043	0.527
(Separate house omitted)	Semi-detached/row or terrace house/town house – 2+ storeys	0.023	0.043	0.596
	Flat/unit/apartment – 1 storey block	-0.029	0.039	0.462
	Flat/unit/apartment – 2 storey block	-0.095	0.040	0.017
	Flat/unit/apartment – 3 storey block	0.146	0.048	0.002
	Flat/unit/apartment – 4-9 storey block	0.204	0.063	0.001
	Flat/unit/apartment – 10 storey block	0.336	0.151	0.026
	Flat/unit/apartment – attached to a house	0.000	0.083	0.996
	House/flat attached to shop, office, etc	0.090	0.100	0.370
Dwelling condition	Good	-0.038	0.027	0.159
(Very good omitted)	Average	-0.111	0.027	0.000
	Poor	-0.150	0.042	0.000
	Very poor/almost derelict	-0.362	0.133	0.007
Household financial year income/$1000		0.004	0.000	0.000
SEIFA 96 Decile of Index of education and occupation		0.029	0.004	0.000
Observations	1455			
Adjusted R-square	0.461			
F	32.831			