Report

Redesigning AHURI's Australian Housing Market Microsimulation Model

authored by

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ACRONYMS

ABS	Australian Bureau of Statistics
AHURI-3M	AHURI Housing Market Microsimulation Model
CPI	Consumer Price Index
CRA	Commonwealth Rent Assistance
CURV	Confidential Unit Record File
DSP	Disability Support Pension
DVA	Department of Veteran Affairs
FHOG	First Home Owner Grant
FHSA	First Home Saver Account
FTB	Family Tax Benefit
HILDA	Household, Income and Labour Dynamics in Australia
LVR	Loan-to-value ratio
MITR	Marginal income tax rate
NRAS	National Rental Affordability Scheme
NRV1	National Research Venture 1
PP	Parenting Payment
SHA	State Housing Authority
SIHC	Survey of Income and Housing Costs

1 INTRODUCTION

1.1 Aims of the Study

The chief aim of this project is to redesign a comprehensive housing market microsimulation model that will provide policy analysts with a capacity to anticipate the quantitative impacts of economic and policy changes on the drivers of housing supply and demand and housing tenure outcomes; and provide reliable estimates of government budgetary cost or savings from proposed reforms. A microsimulation model uses data records containing the socio-economic and demographic characteristics of decision makers (persons, households, income units) to analyse choices in different settings or scenarios with respect to important parameters (interest rates, capital appreciation rates, tax rates and inflation, for example). In 2003 we designed such a model – AHURI-3M (AHURI Housing Market Microsimulation Model) – using the confidentialised unit records of the Australian Bureau of Statistics (ABS) 1997 Rental InvestorsSurvey and 1996-97 Survey of Income and Housing Costs. In this project we redesign AHURI-3M to incorporate several new features.

First, the AHURI-3M model was originally operationalised through the use of these two separate surveys. The 1997 ABS Rental Investors Survey was used for supply-side analyses of the private rental market, while the 1996-97 Survey of Income and Housing Costs (SIHC) was used for demand-side analyses. The Rental Investors Survey has not been repeated and needs to be replaced by an alternative data source. The redesigned model has been constructed using wave 2 of the Household, Income and Labour Dynamics Australia (HILDA) Survey, which contains comprehensive data on both housing investors and consumers that will for the first time enable us to draw together both the supply and demand components of the housing system using one data set. Secondly, wave 2 of the HILDA Survey was conducted in 2002. By using a more recent data set, we will be able to 'update' the model based on more recent demographic and socioeconomic information regarding Australian households[1]. Thirdly, the AHURI-3M model made use of 2000-01 tax-benefit parameters (deflated to 1997 prices). The redesigned model is built using 2006-07 parameters (deflated to 2002 prices) that incorporate changes to Disability Support Pension (DSP) and Parenting Payment (PP) arrangements introduced in 2006.

The redesigned AHURI-3M model also incorporates an important structural innovation. It now links housing and labour market decisions. Housing assistance programs can impact on labour supply decisions through their effects on work incentives. The 2008 version of AHURI-3M computes measures of work incentives that include housing assistance programs, as well as all the other features of the Australian tax-benefit system. These work incentives are a key variable in an econometric model that is able to make quantitative estimates of the impact that work incentives have on employment participation outcomes (Dockery et al, 2008)[2]. This innovation opens up new opportunities for policy analysis as it allows possible trade-offs between housing policy and employment policy goals to be explored.

[1] Data on investors was collected as part of a wealth module that had been added to the wave 2 survey instrument. After the project was commissioned a second wealth module was incorporated into the wave 6 survey instrument, and the confidentialised unit record file (CURF) was released in March 2008. It is straightforward to update the model using the wave 6 CURF and this is being completed as part of project 30521, commissioned in March 2008. We expect this update to be complete in September 2008.

[2] The new feature of AHURI-3M is a product of the research conducted by Mike Dockery, Rachel Ong and Gavin Wood for NRV1 (National Research Venture 1) "Housing Assistance and Economic Participation".

1.2 AHURI-3M: FUNCTION AND CONCEPTUAL FOUNDATIONS[3]

The institutional basis and key economic variables comprising the AHURI-3M model are described in Figure 1. The objective of the model is to analyse the housing affordability, housing tenure and employment outcomes of housing consumers under existing government policy parameters, and to predict those outcomes under alternative policy parameters that emerge as a result of reform measures. We begin with the upper right-hand side of Figure 1 and housing affordability. AHURI-3M contains a tax-benefit simulator that imputes income unit tax liabilities, eligibility for and entitlements to the income support programs of 6585 income units (housing consumers)[4]. All the major taxation provisions and income support programs are modelled by the AHURI-3M simulator. Most importantly, in the current context, this component of AHURI-3M models the rents that public housing tenants pay, the gross and net housing costs of private renters and the housing costs of home owners. The detailed rules that state housing authorities employ in defining assessable income are used to impute the rents and thus housing costs of public housing tenants. The relevant income support program provisions are used to determine private renters' Commonwealth Rent Assistance eligibility, and CRA rent thresholds are used to impute entitlements, so that housing costs after adjustment for CRA can be calculated. Finally, data on outstanding mortgage debt is employed to impute the recurrent housing cost outlays of home purchasers. HILDA contains detailed records of private income by source (e.g. earnings, interest, dividends and so on), and these are used to impute tax liabilities and income support program eligibility and entitlements.

Detailed modelling of the Australian tax-transfer system and its emphasis on housing assistance programs is an important attribute of AHURI-3M. It allows the user to analyse how changes to housing assistance programs will impact on the housing affordability position of different groups in the Australian population, and to estimate the budget cost of program reforms. Furthermore, interactions between different programs can be taken into account. An example serves to illustrate the point. The National Rental Affordability Scheme (NRAS) provides tenants with a discount on market rents (20 per cent). But if they are private rental tenants eligible for CRA, there could be offsetting reductions in CRA entitlements (see chapter 3 for analysis). Using AHURI-3M we also have the capacity to analyse the housing affordability implications of reforms to Australian tax, pension and allowance programs.

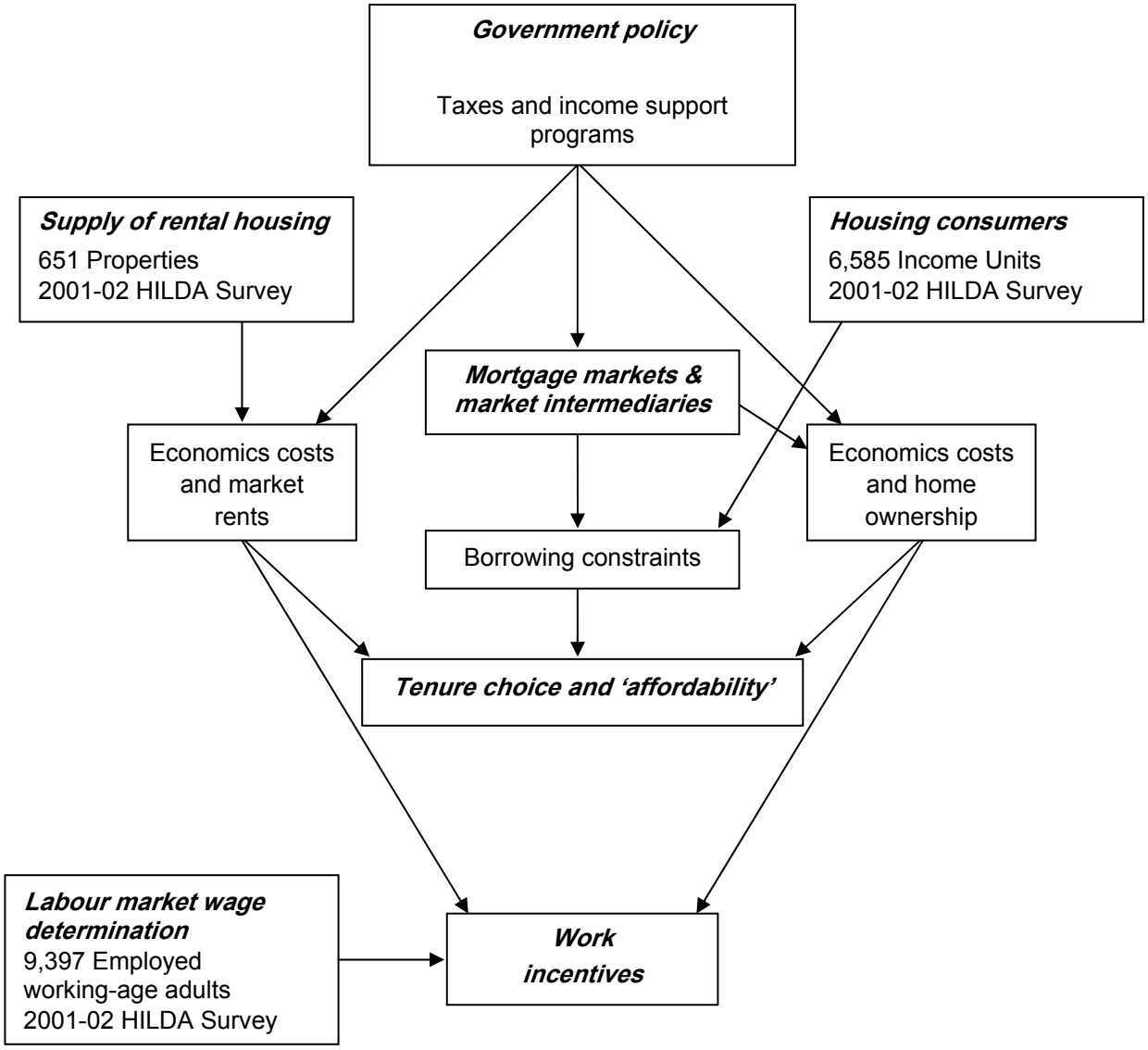
The upper left-hand side of Figure 1 depicts the supply side of the Australian housing market. The HILDA data base includes rental investors that own 651 properties and we measure the economic costs that investors incur when offering rental housing services from these properties. The measure includes operating costs such as maintenance and local government rates, but also encompasses the costs of holding an asset such as housing, and these are the cost of capital net of capital gains. The economic costs of investors are strongly influenced by state and federal government taxation arrangements. AHURI-3M measures these economic costs taking stamp duties and land taxes into account, as well as the more important capital gains and negative gearing taxation provisions that are Federal Government responsibilities.

[3] A literature review that surveys the key studies shaping the design and specification of AHURI-3M can be found in Wood, Watson and Flatau (2003, pp.6–10).

[4] An income unit 'is one person or a group of related persons within a household, whose command over income is assumed to be shared. Income sharing is assumed to take place within married (registered or de facto) couples and between parents and dependent children' (ABS, 1999). The household is defined as 'a group of people who usually reside and eat together' (ABS, 1999). The household can then contain more than one income unit, but in 2002 most households (89%) contained one income unit.

Care is taken to measure the economic costs of investors because economic theory predicts that rents will converge on economic costs. Economic theory also indicates that ceteris paribus a household will be better off owning rather than renting if their economic costs as home owners are less than the rent that they would be charged by landlords. This is the relative price rule AHURI-3M applies in predicting the preferred tenure choice of the 6,585 housing consumers in the sample. The economic costs of each housing consumer are then calculated using the same principles that are applied to rental investors – thus operating costs and capital costs are carefully defined, taking into account the tax treatment of owner-occupiers by both state and federal governments.

Figure 1: The redesigned AHURI-3M



The operation of mortgage markets has an important role to play, as in the first version of AHURI-3M. The relative price rule is used to indicate the preferred choice of housing consumers, but that preferred choice can be prevented by credit/borrowing constraints. These constraints are binding if prospective homeowners have insufficient savings to meet a required deposit (*downpayment constraint*), or insufficient income to meet the lending criteria of lending institutions (*repayment constraint*). Since the first-version AHURI-3M the first of these situations may have become less relevant as a result of

mortgage market innovation. The advent of low-doc (sub-prime) loans that enable borrowers to gear house purchases 100 per cent could relax downpayment constraints, though the Productivity Commission (2004) points out that low or zero deposit loans account for only 2 per cent of mortgages. We have decided to retain the downpayment constraint for three reasons. First, the 2007 sub-prime crisis in the USA and its knock-on effects could persuade lenders to return to a more conservative approach on lending criteria. Second, transaction costs on purchase are a substantial addition to the capital requirements of purchasers, who must meet these from savings, even if a 100 per cent loan is available. Finally, a 100 per cent loan might be available but the repayment constraint is binding unless the prospective home buyer has accumulated savings sufficient to reduce the loan's size to a level at which the repayment constraint is relaxed.

The specification of downpayment and repayment constraints is much more sophisticated than in previous versions of AHURI-3M. We use reported measures of wealth (savings) rather than imputed measures in order to operationalise the downpayment constraint. The repayment constraint is now based on the lending criteria that a major 'high street' bank (Westpac Banking Corporation) reveals on its website. The website's lending calculator is used to compute the maximum loan that applicants can borrow, given their household type and size, income, other loan repayments and credit card limits. Since our data source includes reported measures of all these variables we are able to offer a much more precise analysis of how borrowing constraints might impede transitions into home ownership, and the type of households most likely to be affected.

The AHURI-3M model predicts that a renter will make the transition into home ownership if the renter satisfies the relative price rule, and credit constraints are not binding. The model is able to analyse the role of mortgage markets in shaping access to home ownership, and forecast the short-run impact of key variables (e.g. interest rates) on tenure choice. It also has an important policy evaluation role in this respect. Australian governments have traditionally encouraged homeownership aspirations and introduced various programs to help renters realise those aspirations. The First Home Owner Grant (FHOG) and the First Home Saver Account (FHSA)[5] are examples of such programs at the Federal Government level. Various stamp duty concessions are examples of state government initiatives. These programs ease credit constraints and, as Wood, Watson and Flatau (2006) show, their impacts can be analysed in terms of the types of households predicted to take them up, the type of rental housing vacated and the budget cost, given possible interactions with other transfer programs.

A major innovation in AHURI-3M is the modelling of housing assistance, work incentives and economic participation (see lower half of Figure 1). AHURI's NRV1 "Housing Assistance and Economic Participation" offered evidence indicating that housing assistance programs can blunt work incentives and result in lower rates of employment among recipients[6]. We draw on that research by augmenting AHURI-3M using econometric estimates from a model of employment participation that includes a measure of work incentives. It means that AHURI-3M is capable of tracing through the implications of reforms for both housing policy goals and employment outcomes. Any trade-offs between housing affordability and employment outcomes are capable of being

[5] Savings in the Rudd Labor government's FHSA will receive preferential tax treatment. The first $5,000 of income deposited by savers will be subject to a low tax rate of 15%, and the interest earned on the savings will be taxed at 15% or less (Australian Labor Party, 2007). This harmonises the tax treatment of FHSA deposits with salary sacrificed contributions to superannuation.

[6] There are of course other factors shaping the employment outcomes of housing assistance recipients (see Hulse and Saugeres, 2007)

quantified, a feature that is potentially important as a source of guidance to policy makers.

1.3 SCOPE OF THIS FINAL REPORT

We begin in chapter 2 with an explanation of the methods used to redesign AHURI-3M. The data sources are described and the approach taken to measurement of key parameters is set out. Technical details are relegated to an appendix. The emphasis is on giving the reader a good understanding of the assumptions underpinning the model, the methods used to measure parameters and a sense of how important various parameters are in determining variables such the relative price of owner-occupied housing. The reader will also find a considerable amount of descriptive statistics in this chapter. Chapter 3 focuses on the outputs from AHURI-3M; we examine the position of renters with respect to homeownership aspirations. A particular interest is in estimates of the number of Australian renters that would be economically better off as home owners than renters, but whose transition into home ownership is impeded because they do not have the savings that would enable them to meet deposit requirements, or the maximum loan that they qualify for is insufficient to purchase housing in their location. These renters are subject to binding borrowing constraints that could be relaxed by programs of assistance such as the FHOG. This chapter provides estimates of how many renters will be assisted into homeownership at current levels of FHOG. We also illustrate the policy evaluation capabilities of the model by taking the National Rental Affordability Scheme (NRAS) and analysing its impact on housing affordability. An important feature here is the interaction between policy programs and the impact this can have on the net budget costs of such programs. A final chapter describes future directions for research and, in particular, explains how AHURI-3M will be adapted for use with panel data.

2 METHOD AND MEASUREMENT[7]

2.1 Introduction: Data sources and sample

A major issue that had to be confronted in the redesign of AHURI-3M was the choice of a suitable data set. The original design utilised the ABS Rental Investors' Survey to model the supply side of the market and the ABS Survey of Income and Housing Costs to model the demand side of the market. The former was carried out in 1997 and has not been repeated since then. We chose to replace both data sets with the HILDA Survey, which allows identification of rental investors, the value of their rental property holdings and rental income, all of which are critical to the supply-side modelling. The HILDA Survey is a nationally representative panel survey of Australian households and individuals. The panel nature of the data set also has advantages as in the longer run we envisage the specification of AHURI-3M in such a way that it will allow the panel nature of the data to be exploited (see chapter 4 for further discussion). In this project we have used wave 2 of the data set because it contains a wealth module that elicits the critical supply-side variables from respondents and allows a much more sophisticated specification of borrowing constraints than previously. Since this project began wave 6 has been released and it contains a repeat of the wealth module. The updating of AHURI-3M so that it is compatible with wave 6 is being completed as part of AHURI project 30521, due to report in September 2009[8].

*As its name implies, the HILDA Survey has detailed data on income, labour and household dynamics. Among other things, the survey contains a myriad of variables describing labour market histories, housing circumstances and socio-demographic characteristics. Table 1 presents sample numbers and population estimates on an income unit basis[9]. All sampled income units (a total of 6,585) are used for the analyses of housing affordability and tenure choices. The majority are home owners (57 per cent), with private rental housing the second most common tenure. It should be kept in mind that home ownership rates are typically measured with reference to households rather than income units, and when measured on a household basis there is a much higher rate of home ownership (of around 70 per cent). There are 651 income units that hold rental properties (9.9 per cent of the sample), which is equivalent to a population estimate of 715,658 income units.

Table 1: Sample and population estimates by tenure of housing consumers

Housing tenure	***Sample***		***Population***	
	N	***%***	***N***	***%***
Outright owner	1,820	27.6	2,044,550	26.5
Owner purchaser	1,919	29.1	2,106,584	27.3
Private renter	1,869	28.4	2,251,054	29.2
Public renter	359	5.5	453,556	5.9
Rent free	618	9.4	849,956	11.0
Total	6,585	100.0	7,705,700	100.0

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

[7] The equations and regression models used in the redesigned AHURI-3M model are not discussed in this chapter but are described in appendix 1 and 2 respectively.

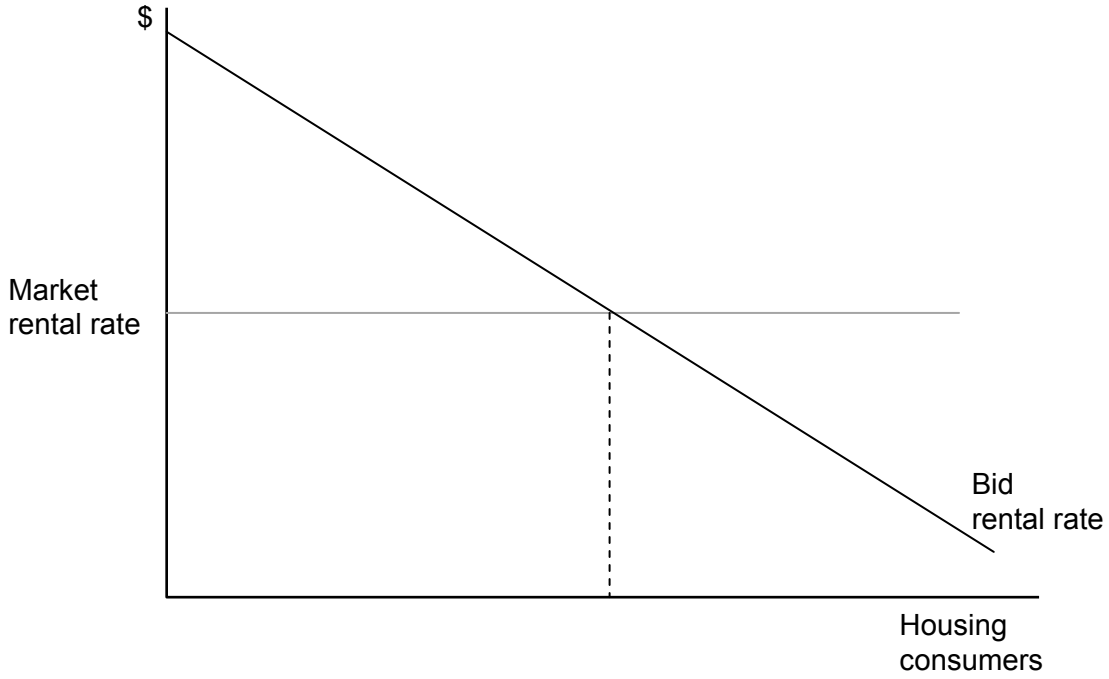
[8] However, as pointed out in footnote 1, the updated and redesigned AHURI-3M will be available for use in September 2008.

[9] We have chosen the income unit as the measurement unit because the Australian tax-benefit system applies rules defining liabilities and eligibility using the income unit's resources and outlays as the reference point.

2.2 The supply and demand modules of AHURI-3M

Figure 2 describes the analytical framework that is the basis for measurement of the relative costs that housing consumers face as home owners[10]. The schedule labelled bid rental rate describes the maximum rent a housing consumer is prepared to pay as a tenant before it becomes cheaper to purchase the desired amount of housing as an owner-occupier. The bid rent will then equal the annual economic cost of supplying oneself with the desired amount of housing as a home owner. These annual economic costs will vary across households, with the home owner's marginal tax rate being a particularly influential parameter. If we rank housing consumers according to their bid rental rates we generate a downward sloping schedule like that depicted in figure 2.

Figure 2: The supply and demand sides of AHURI-3M



Whether a housing consumer is economically better off owning rather than renting depends upon the market rent that residential investors (landlords) charge in rental markets. Critical to the analysis of market rents is an assumption that earning an economic return is necessary for at least a sizeable minority of investors, and that positive economic returns will then attract new investment. It follows that market rents will reflect the economic costs of the most 'efficient' investors. To illustrate, consider the introduction of a new tax incentive granted conditionally on investment in rental housing. Some if not most investors will be unaware of the new incentive, and their decision-making will be unaffected at this stage. However, we can still anticipate a fall in market rents. Some investors, perhaps better informed because they employ tax accountants or financial advisers, become aware of the incentive that, if sufficiently attractive, will encourage new investment. The supply of rental housing expands; when rental units fall vacant ill-informed investors will find that it takes longer to find a new tenant willing to pay the previous rent. Some investors will have debt repayments to meet and will not be able to afford to wait until a willing tenant is found; a lower rent might be offered by those who can earn an economic return from a lower rental income while others, particularly

[10] This is a brief presentation. For detailed explanations of the model's analytical properties see Wood, Watson and Flatau (2003, chapter 2).

those with higher costs and lower returns, will be forced out of their property investments. Market rents are then driven down to levels that just cover the economic costs of those investors with the lowest economic costs.

This analytical perspective is illustrated in figure 2, where the horizontal line describes how the supply of private rental housing adjusts to meet the demand of housing consumers at the prevailing economic cost of those investors with the lowest economic costs[11]. If these economic costs fall, the horizontal line will shift down in a parallel fashion, and the market rental rate will fall. The point of intersection between the bid rental and market rental rates is significant because it identifies those housing consumers to the left, who are better off renting than owning (because they can rent more cheaply); and those housing consumers to the right, who are better off owning than renting (because their economic costs as owners are lower).

2.3 Rental investors' economic costs; measurement and descriptive statistics

2.3.1 Landlords' User Cost of Capital

The economic costs of investors (including residential investors) are commonly referred to as their user cost of capital[12]. Conventional investment appraisal techniques can be used to evaluate user costs. We calculate the net present value of the 'project's' cash flows over the years that investors expect to hold their residential investment (the holding period)[13]. This can be defined as:

> Net Present Value = realised capital gains-equity contribution + after-tax net rents - capital gains tax liabilities

The financial sums on the right-hand side are discounted at the after-tax interest rate, on the grounds that an investor who realises their rental property will be able to deposit the proceeds in an interest-bearing account. Wood (2003) shows that this statement of present value can be solved to find the gross rental yield that will just cover all after-tax economic costs; this gross rental yield is equal to the sum of the following cost components defined on a per dollar of capital value basis;

> Annual financing costs + annual operating costs - annual capital gains + amortised[14] value (of capital gains tax liability + transaction costs)

These are the components of the user cost of holding a rental property investment. They include the financing costs net of after-tax capital gains and transaction costs. The financing costs include after-tax interest on debt and the after-tax return sacrificed on the investor's equity stake in the rental property investment. The operating costs of providing accommodation include meeting rates and utility charges, repairs, property management fees and land taxes.

The critical determinant of investor economic costs is the marginal income tax rate (MITR). This is because investors can negatively gear a property, sheltering other

[11] When we operationalise the model this restriction is relaxed.

[12] It can also be termed the rental investor's reservation rental rate, since user cost is the minimum acceptable rental rate before an investor makes economic losses.

[13] This is probably an unrealistic description of how most investors behave. But it will be a good approximation of how a minority of sophisticated investors (with financial advisers) behave. As argued above, we only need a minority of investors to act in this fashion.

[14] Capital gains tax and transaction costs are lump sum cash amounts rather than recurrent cash flows like operating costs. To find an annual equivalent figure they are amortised or spread over the investor's holding period.

sources of income from tax, while earning part of their return in the form of lightly taxed capital gains[15]. As a result, low tax-bracket investors are 'inefficient' suppliers of rental housing because they require higher rents to meet their higher economic costs.

If a landlord's user cost rises above a landlord's gross rental yield, there will be economic losses. Some landlords will respond to such circumstances by cashing in their property investment in favour of alternative investments. As supply shrinks, gross rental yields will increase and converge on user cost. The reverse process can be anticipated when user cost is less than gross rental yields.

The implication of this supply-side adjustment process is that in the long run, only those investors in the highest tax bracket will remain in the market as they typically have the lowest user costs. However, at any moment the market will be placed at some point on a path of adjustment to this long-run outcome. We therefore use the weighted[16] average of rental investors' user costs of capital to measure the market rental rate.

Our computations reveal a market rental rate in Australia of 9.29 per cent, which is substantially higher than the 6.44 per cent rate used in the first version of AHURI-3M and reflects higher interest rates in 2006-07[17].

2.3.2 Measurement

Landlord status is identified in the data on an individual basis but our unit of measurement is the income unit. Residential investor (landlord) income units are one or more adults who:

- Report that they own properties other than their principle place of residence ('other properties'), and
- Receive rental income.

There are 692 landlords in the data set according to these criteria, which is equivalent to a population estimate of 759,829 landlords. There may be some income units that have holiday homes that are rented out for part of the year. They will be outlier observations as rental incomes will be low relative to capital values. Landlords with extremely low or extremely high rent relative to property value are treated as outliers and excluded. Outliers are identified using the following method. Firstly, extreme cases are graphically identified in a scatterplot of rent versus property value. Secondly, because the minimum annual rent paid by private renters is $402 in the data, $402 is used as the benchmark to represent the minimum financial year rental income that landlords can receive. Landlords who report rents below $402 are excluded. Finally, landlords with rent-to-property value ratios of less than 0.1 per cent or greater than 100 per cent are excluded. After deleting investors where it is impossible to calculate marginal tax rates, we are left with a sample of 651 landlords.

Landlords report the total value of 'other' properties. We cannot distinguish between single-property and multiple-property investors. Where landlords in an income unit share residential investments with other members within the *same household* the rental property value of the household is divided by the number of household members who are landlords, then multiplied by the number of landlords in the income unit to get an

[15] Capital gains are lightly taxed by comparison with increments in ordinary sources of income such as rents, because capital gains are taxed when they are realised rather than when they accrue. Furthermore, only one-half of capital gains are taxed.

[16] The weights are the proportion of investors in each tax bracket.

[17] In the original AHURI-3M, the market rental rate was computed as the average reservation rental rate of investors in the highest MITR bracket. In the redesigned version, the market rental rate has been computed as the average reservation rental rate of all investors.

income unit estimate. Only 13 income units or 1.9 per cent share other properties with other members in the household.

User-cost parameters are sourced and measured in the same way as reported in Wood, Watson and Flatau (2003); however, they are now measured at their 2006-'07 values. See Table 7, where each parameter is defined and key assumptions are listed.

There are some interesting and important observations to be made in relation to the descriptive statistics presented in Table 2. Only a minority of investors (5.80 per cent) belong to the top tax rate band (40-45 per cent). This in part reflects negative gearing among higher income investors, and also that most investors (75 per cent) are couples and the marginal rates are the average of the partners' marginal rates. If rental losses were added back into taxable incomes, 14 per cent of investors would be in the highest MITR band. Operating costs make only a small contribution to the typical investor's user-cost of capital. In the now higher interest rate climate (7.95 per cent), and given a 1 per cent long-run rate of real capital gain, the user-cost of capital is nudging 10 per cent. As actual gross rental yields are typically around 6.87 per cent, residential investment is not particularly attractive at current interest rates[18]. The shortage of private rental housing in many areas of Australia is, then, unsurprising. Finally, note that at the 2006-07 parameter values, high tax-rate investors' user costs are only marginally lower than those of low-rate investors.

Table 2: Components of landlords' user costs; mean values by landlords' marginal income tax rate bracket, 2002-03

After-tax economic cost components	*MITR tax bracket*					*Population average*
	0%	*0-15%*	*15-30%*	*30-40%*	*40-45%*	
Population number	18,167	58,186	369,410	228,358	41,535	715,658
Population share (%)	2.54	8.13	51.62	31.91	5.80	100.00
Rental property value ($)	253,205	281,707	273,801	361,022	577,145	319,358
MITR (%)	0.00	14.68	28.66	36.58	43.43	30.18
LVR (0-1)	0.13	0.15	0.33	0.31	0.28	0.30
Gross rental yield (%)	4.56	5.56	7.34	6.66	6.65	6.87
Operating costs (% point contribution to after-tax economic cost)	1.84	1.83	1.84	1.76	1.79	1.81
Pre-tax equivalent of the capital gain component of a landlord's return (% point contribution to after-tax economic cost)	2.36	2.77	3.31	3.73	4.17	3.43
Amortisation coefficient	0.15	0.16	0.19	0.20	0.22	0.19
Present value of landlord's capital gains tax liability (% of property value)	0.00	1.26	2.73	3.68	4.56	2.95
Present value of transaction costs (% of property value)	5.19	5.45	5.88	6.31	6.82	6.02
Reservation rental rate (%)	9.41	9.33	9.30	9.23	9.32	9.29

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

[18] The real capital gain assumption is typical in the literature, but perhaps overly pessimistic. If long-run real rates of capital gain were 2% per annum the mean user cost would be 7.87%.

2.4 Housing consumers' economic costs; measurement and descriptive statistics

2.4.1 Housing consumers' bid rental rate

Given market rents are determined by the process described in section 2.3, the next 'building block' in this theory of tenure choice is a process describing the formation of bid rents – the maximum rent a housing consumer is prepared to pay as a tenant before it becomes cheaper to purchase the desired amount of housing as an owner-occupier. The bid rent will then equal the annual after-tax economic cost of supplying oneself with the desired amount of housing as a home owner. We derive this bid rent using the same present-value appraisal approach as was employed for residential investors. In fact, the definition of the net present value of cash flows similar to that for investors; though home-owner capital gains are tax exempt and financing costs are more complicated, as we will see below. The definition is:

> Net Present Value = equity contribution + imputed value of housing services - operating costs - realised net capital gains

Wood (2003) shows that on solving such a present value appraisal for the imputed value of housing services we obtain the maximum amount (the bid rent) that a housing consumer is prepared to pay as a home owner for the services yielded by owner-occupied housing:

> Bid Rent = annual financing costs + annual operating costs - annual capital gains + amortised value of transaction costs

On the right-hand side of the equals sign are the after-tax economic costs of a homeowner. These include financing costs net of capital gains and transaction costs. The financing costs include repayments on debt and the after-tax return sacrificed on the home owner's equity stake in the housing asset. The operating costs of providing accommodation include meeting rates and utility charges and repairs. If a housing consumer is offered the desired amount of housing at a market rent less than the bid rent, s/he is financially better off renting.

There are a number of important differences between the economic costs of home owners and those of investors. The first arises because the home owner supplies her/himself with accommodation, and there are therefore none of the agency problems that potentially confound the investor who owns a property that is occupied by someone else. There are then agency costs (such as property management fees) that are unique to rental housing. Second, the tax treatment of financing costs differs. Unlike investors, home owners are not able to deduct interest payments from taxable income, though the imputed value of housing services is tax-exempt. Thus debt finance is more expensive than equity finance, since the return a home owner sacrifices on the next best alternative investment will invariably be taxed[19]. Finally, the capital gains realised by homeowners are tax-exempt; landlords must include one-half of realised capital gains in taxable income.

The mean bid rental rate of housing consumers is 6.73 per cent and this is much lower than the market rental rate of 9.29 per cent. With higher real rates of interest (as compared with the first version of AHURI-3M), and modest capital gains assumptions,

[19] Note that for an investor a dollar increase in financing costs increases the reservation rent by a dollar, regardless of whether the increase is due to debt or equity finance. This is because an investor's rental income is taxable and his/her financing costs are deductible. But for home owners there is not this symmetry in tax treatment. Bid rents (imputed rents) are tax-exempt. When equity financing costs rise by a dollar the after-tax return sacrificed by the home owner is (1-MITR), and since bid rents are tax exempt the latter need increase by only (1-MITR), where MITR is the marginal

the exemption of home owner-imputed rents pushes typical bid rents well below the market cost of rental housing. We would therefore expect most housing consumers to prefer home ownership on financial grounds, a finding that confirms a conclusion reported in Wood, Watson and Flatau (2003).

2.4.2 Measurement

Home owner financing costs, an important component of their after-tax economic costs, are dependent upon loan-to-value ratios (LVRs). For owners, information on the property purchase price and amount of loan taken out at the time of purchase is readily available from the data. Hence, for owners we can calculate their LVR at the time of purchase. For renters, however, their expected LVR as home buyers have to be imputed.

Hence, the sample of wave 2 first home owners (for whom LVR at the time of purchase is known) is used to estimate a regression with LVR at the time of purchase as the dependent variable, and socio-demographic, education, labour market and financial measures as right hand side variables[20]. The estimated regression is then used to predict renters' LVRs at purchase[21].

A second important component of home owners' after-tax economic costs is the amortised value of transaction costs, the most important being stamp duty. It is levied on the purchase price and this must be imputed for renters in the sample of housing consumers. As most renters (see below) would be first home buyers if they purchased, a sample of first home owners is used to estimate a regression, where 2002 house values are expressed as a function of socio-demographic, education, labour market and financial variables. The estimated regression is used to impute predicted house values for renters if they were to purchase a property in 2002[22].

The LVR and house value regression estimates are reported in the appendix. However, the tables below give some indication of the predictions generated by the models. The mean LVR reported by first home owners is 0.643. The predicted mean LVR for renters is extremely close, at 0.674 per cent. Both the reported and predicted measures range from close to zero to slightly over 1. The mean predicted house value is over $160,000, somewhat lower than the mean house values of around $240,000 reported by first home owners.

Table 3: LVR Regression Estimates, 2002-03

Measure	***Sample***	***Mean***	***Minimum***	***Maximum***	***N***
Reported	First home owners (owners)	0.643	0.000	1.778	1,380
Predicted	First home buyers (renters)	0.674	0.022	1.094	3,686

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

[20] There are two innovations here as compared with the original AHURI-3M design. We are now able to identify gearing at purchase and to separately identify first homeowners, measurements and sample selections that were not previously possible.

[21] The LVR regression is a tobit model, that is, a model where the dependent variable is a continuous variable for which there are a sizeable number of zero observations.

[22] The model has a linear specification, and is estimated by ordinary least squares. The house value is expressed in logarithmic form, and the continuous explanatory variables are also expressed in logarithmic form.

Table 4: House value regression estimates, 2002-03

Measure	*Sample*	*Mean*	*Minimum*	*Maximum*	*N*
Reported	First home owners (owners)	241,691	3,000	2,519,730	1,400
Predicted	First home buyers (renters)	162,116	55,212	611,997	3,487

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Rental tenants are not asked whether they have ever owned a home before. This is problematic as it precludes identification of renters eligible for FHOGs and other concessions targeted on first home buyers. To address this issue we compute first home owners as a proportion of all home owners in each of the age bands listed in Table 5.

We use these proportions as estimates of the probability of first home buyer status among renters, and randomly assign our sample of renters using these probability estimates. So, for example, 6 in every 10 renters in the age band 25-34 years are randomly assigned as first home buyers. The probability of first home ownership declines markedly from age 45 onwards. Since the age distribution of renters is skewed toward younger age bands, we estimate that 59 per cent of renters would be first home buyers if they purchased.

Table 5: Probability of first home ownership by age band, homeowners, 2002-03

Age band years	*Probability of first home ownership %*
Under 25	92
25-34	66
35-44	40
45-54	28
55-64	27
65-74	29
75 or older	32
All	36

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

The key cost parameters are sourced and measured in the same way as reported in Wood, Watson and Flatau (2003); however, they are now measured at their 2006-07 values. See Table 7, where each parameter is defined and key assumptions are listed.

Table 6: Housing consumers' bid rental rates and components of after-tax economic cost, Mean values by housing consumers' MITR bracket, 2002-03

	MITR bracket1					*Population average*
	0%	*0-15%*	*15-30%*	*30-40%*	*40-45%*	
Population number	711,998	2,338,112	3,598,561	952,669	104,360	7,705,700
Property value ($)	183,155	189,631	243,105	347,101	571,910	238,651
MITR (%)	0.00	14.93	28.91	36.40	43.54	23.12
LVR	0.67	0.48	0.66	0.64	0.60	0.60
Cost of equity capital (% point contribution to after-tax economic cost)	7.95	6.76	5.65	5.06	4.49	6.11
Tax penalty[2] (% point contribution to after-tax economic cost)	0.00	0.28	0.57	0.55	0.46	0.43
Operating costs (% of property value)	1.55	1.49	1.40	1.36	1.35	1.44
Depreciation rate net of house price appreciation (%)	-2.10	-2.10	-2.10	-2.10	-2.10	-2.10
Amortisation coefficient	0.13	0.15	0.17	0.18	0.20	0.16
Transaction costs (Present value equivalent as % of property value)	4.48	4.77	5.46	6.22	7.11	5.27
Bid Rental Rate (%)	7.99	7.13	6.44	6.00	5.62	6.73

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. For couples, the marginal tax rate is the average of the partners' marginal rates. 2 See equation 2 appendix 1, where this is defined.

There are some interesting patterns evident from the descriptive statistics presented in Table 6. With marginal tax rates calculated as an income unit average (for couples) we find that the majority of housing consumers are in the 15-30 per cent tax-rate band. Property values are strongly and positively related to marginal tax rates, but LVRs seem unrelated to these tax rates. There is a relatively steep decline in after-tax economic costs and hence bid rental rates as marginal tax rates climb. This is because the tax benefits from exemption of capital gains and net imputed rents are more valuable the higher the marginal tax rate, while constancy of LVRs across tax brackets ensures that the tax penalty on debt finance does not increase as steeply as do the tax benefits.*

Table 7: AHURI-3M housing supply and demand module key parameters

Parameter	*Details*	*Source*	*Updated from original AHURI-3M?*
Financing costs			
Interest on mortgage debt	Interest on debt is set at 7.95 per cent, the average of the banks' monthly interest rate on housing loans over the period 2006-07*	RBA (2008)	Yes
Operating costs			
Agency costs	Searches through property-management company websites indicate that management fees are typically 8-9 per cent of annual rent and letting fees are approximately 1-2 weeks of rent (which equates to about 2 per cent of annual rent). Hence, agent's fees are set at 11 per cent of gross annual rent.	Sites include: http://www.portfolioms.com.au http://www.abelrealty.com.au/pmfees.htm	Yes
Maintenance cost	Maintenance expenditures for owner-occupiers and investors are based on the mean expenditure by property value/State segment, obtained from the 1999 Australian Housing Survey and the 1997 Rental Investors Survey.	Wood et al (2003)	No
Property taxes	Means of property taxes as a percent of property value by location from the 2002-03 SIHC	ABS 2003-04 SIHC	Yes
Land taxes	The Victorian Valuer-General's statewide valuations database is used to derive an estimated land component of property value. The data set is from 2004. Values for Victoria are calculated, then applied to other states to derive the following averages: Metro areas: Land value is typically 57 per cent of property value Non-metro areas: Land value is typically 39 per cent of property value The 2006-07 land tax schedules are applied to imputed land values that are set equal to 57 per cent of the owner's self-assessed property value if located in a metro area. The 57 per cent figure is replaced by 39 per cent in non-metro areas.	Victorian Valuer-General's statewide valuations database; NSW Treasury (2007)	Yes
Building insurance premium	Online insurance premium estimators indicate that annual building insurance premiums are typically around 0.2 per cent of building value (property value-land value).	http://www.rac.com.au	Yes (not in original AHURI-3M)

Parameter	*Details*	*Source*	*Updated from original AHURI-3M?*
Transaction costs			
Stamp duties	2006-07 rates and thresholds	NSW Treasury (2007)	Yes
Mortgage duties	2006-07 rates and thresholds (Some states and territories, that is, Victoria, Northern Territory and Australian Capital Territory, had abolished mortgage duties by 2006-07. Other states will abolish mortgage duties progressively in coming years) NSW	Treasury (2007)	Yes
Lenders mortgage insurance premium	Payable where LVR is greater than 80 per cent. June 2008 estimates derived from the lenders' mortgage insurance estimator from Yourmortgage.com.au, a website that offers updated information to Australians to assist them in finding loans that suit their needs. The mortgage insurance premium ranges from 0.43 per cent to 2.12 per cent depending on the LVR and loan amount.	http://www.yourmortgage.com.au/calculators/mortgage_insurance/	
Brokerage fees	Guides for buyers and sellers of properties indicate that brokerage fees are typically wide-ranging, from 1-8 per cent. Brokerage fees in the model have been set at 3.5 per cent of property value at the time of sale.	Sites include: http://www.portfolioms.com.au; http://www.echoice.com.au/mortgage/home_loans?pn=/homebuyercentre/preparehomesearch/howmuchbuyinghomereallycost.html http://www.lowfeerealty.com.au/Commission%20Rate%20Calculator.xls-web.xls	Yes
Other			
Nominal capital gains rate	3.5 per cent (Real capital appreciation rate of 1 per cent + Mid-point of RBA target cash rate of 2.5 per cent)	Wood, Watson and Flatau (2003); RBA (2007)	Yes
Economic depreciation rate	1.4 per cent	Wood et al (2003)	No
Holding period	This is the number of years a property is held before sale (10 years)	Wood et al (2003)	No

2.5 The tax benefit simulator

The tax-benefit simulator uses the reported private incomes (from earnings, interest, dividends and so on) of survey respondents to calculate eligibility and entitlements to income support programs and tax liabilities under personal income tax arrangements. It also computes MITRs, taxable and disposable incomes, work incentive measures (for working-age persons), Commonwealth Rent Assistance (CRA) entitlements and rebated rents in public housing. These are very important functions in AHURI-3M. They enable researchers to estimate the consequences for housing affordability (and tenure outcomes) of changes to the tax-benefit system, as well as to

- compute the impact of housing assistance programs on work incentives
- estimate the budget cost of policy reforms
- allow for complex interactions – for example, a supply-side subsidy lowers rents, but there are offsetting impacts via CRA.

The 2006-07 tax-benefit parameters are used. As the data set is from a pre welfare-to-work reform year (2002), certain assumptions are employed to determine which individuals would be affected by the welfare-to-work reforms, if the reforms had been introduced in 2002. We are conducting a hypothetical here – we take the 2006-07 tax benefit system and suppose that it is in place at 2002 prices. The 2006-07 tax-benefit parameters are deflated to 2002 price levels using a Consumer Price Index (CPI) deflator calculated as the ratio of the CPI in 2006 to the CPI in 2002, that is 154.3/137.6 or 1.12.

2.5.1 Taxation

The 2006-07 tax programs can be broadly divided into three key categories. The first is personal income tax arrangements, which include a tax-free threshold of $6,000 and MITRs that increase in successively higher income tax brackets. The tax rates are applied to taxable income.

A second key category is the Medicare levy, an additional levy on taxable income used to fund the public health system. The levy is not payable below a lower income threshold. Between the lower income threshold and an upper income threshold, the levy is calculated as 10 per cent of the difference between a taxpayer's taxable income and the lower income threshold. Beyond the upper income limit the levy is calculated at 1.5 per cent of taxable income[23].

The third key tax category comprises tax offsets – rebates given to eligible taxpayers that reduce their income tax liabilities. The 2006-07 tax offsets include Dependent Spouse tax offset, Senior Australian Tax Offset, Pensioner Tax Offset, Low Income Tax Offset and the newly introduced Mature-Age Worker's Tax Offset.

2.5.2 Income support programs

2006-07 income support programs can be broadly divided into five key program types. First, means-tested pensions and allowances are income-support programs that are subject to income and asset eligibility criteria. Each income support recipient can only receive one means-tested pension or allowance at any one time. This category includes Age Pension, Disability Support Pension, Carer Payment, Department of Veterans'

[23] Concessions are available for low-income earners, such as Senior Australian Tax Offset and Pensioner Tax Offset recipients, and family concessions are also available and increase with the number of dependent children.

Affairs (DVA) Service Pension, Newstart Allowance, Sickness Allowance and Youth Allowance.

Second, there are non-means-tested pensions and allowances. Each recipient of a non-means-tested payment can receive other income support payments as well. Non-means-tested pensions and allowances include the DVA War Widow's Pension, DVA Disability Pension and Carer Allowance.

Third, family payments are paid to eligible families with dependent children. The key family payments in 2006-07 were Family Tax Benefit (FTB) parts A and B, which are income-tested. In 2006-07, only the income of the secondary earner in the family was subject to means-testing for FTB(B). Family payments can be paid in addition to other income support payments.

Fourth, supplementary payments are paid to recipients of one or more of the three above-mentioned income support payment categories. An important example is the Pharmaceutical Allowance. Pharmaceutical Allowance is subject to a 'sudden death' means test, and as such it is removed completely when the income support payment to which it is attached cuts out.

Finally, housing assistance is available to eligible renters to help meet their housing costs. There are two key housing assistance measures. CRA is a Federal payment which is paid as a supplement to pension or allowance recipients who do not have dependent children, and families with dependent children who are receiving more than the base rate of FTB(A)[24]. CRA is means-tested only after the income support payment to which it is attached cuts out (the 'passport' income support payment). Public housing assistance is the difference between market rent and the rebated rent. State Housing Authorities (SHAs) typically set rebated rents at 25 per cent of assessable income, though rules defining assessable income differ across SHAs. These differences have been modelled.

This is an important innovation in the redesigned model. Market rents are the predicted values from a hedonic rent regression estimated using the property and area characteristics of the private rental housing units sampled by HILDA, and these regression results are reported in the appendix[25]. The regression estimates are used to impute market rents to the properties that public rental tenants reside in. The regression is estimated on a household basis. Public housing assistance is then calculated on a household basis but apportioned among the income unit members according to their share of assessable income. Details of the rules used by SHAs in defining assessable income can be found in Wood, Ong and Dockery (2007).

[24] All income support payment recipients receive the maximum rate of FTB(A).

[25] In this regression, the dependent variable is household monthly rent expressed in logarithmic form.

Table 8: AHURI-3M tax benefit module key parameters

Tax	*Benefit*
Personal income tax	Means-tested pensions
Tax-free threshold $6,000	Age Pension
	Disability Support Pension
Medicare levy	DVA Service Pension
Beyond the upper income limit, the levy is calculated at 1.5 per cent of taxable income. Family concessions apply	Wife Pension
	Carer Payment
	Parenting Payment Single
Non-refundable tax offsets	
Dependent spouse tax offset	Means-tested allowances
Senior Australians tax offset	Newstart Allowance
Pensioner tax offset	Youth Allowance
Beneficiary tax offset	Mature Age Allowance
Low income tax offset	Sickness Allowance
Superannuation pension or annuity tax offset	Parenting Payment Partnered
	Special Benefit
Refundable tax offsets	Widow Allowance
Franking tax offset	Partner Allowance
	Carer Allowance
Superannuation surcharge	Austudy
Employer superannuation contribution rate based on 2002–03 average rate by industry	
	Non-means-tested pensions or allowances
	DVA War Widow's Pension
	DVA Disability Pension
	Family payments
	Family Tax Benefit Part A
	Family Tax Benefit Part B
	Supplementary payments
	Pharmaceutical Allowance
	Large Family Supplement
	DVA War Widow's Income Support Supplement
	Housing assistance
	CRA
	Public housing subsidy

2.5.3 The July 2006 reforms

In July 2006, the Federal government implemented major changes to the eligibility criteria for DSP and PP. The 2006 DSP reform affects post-10 May 2005 applicants who are able to work for at least 15 hours per week. Those for whom the criteria are binding will have to apply for Newstart/Youth Allowance (Andrews, 2006). DSP applicants

exempt from the changes are the permanently blind, all applicants who are unable to work for at least 15 hours per week and all individuals who applied for DSP before 10 May 2005.

We are conducting a hypothetical by assuming that the 2006 reforms are applicable to individuals in our 2002 data. To identify those affected by the changes we use answers to questions on previous financial year (2001–02) income, weekly income at the time of interview (time of interview was the latter half of 2002) and how much their long-term health condition limits the amount of work they can do. The affected individuals are those who did not receive DSP in the previous financial year but were receiving DSP at the time of interview in 2002, and who state that a long-term health condition limits the amount of work s/he can do at a level of '5' or less on a scale of 0 to 10 (where 0 means 'not at all' and 10 means 'you can do nothing').

Parenting Payment (PP) applicants unaffected by the 2006 PP reforms comprise pre-July 2006 applicants who did not leave PP for more than 12 consecutive weeks. Post-2006 applicants will not receive PP once their youngest child turns 8 (6) for single (partnered) parents. Those no longer eligible for PP will go onto Newstart/Youth Allowance (Andrews, 2006). To translate these reforms into a 2002 hypothetical, we assume that individuals not receiving PP in the previous financial year are subject to the changes.

2.6 Borrowing constraints

2.6.1 Downpayment and repayment constraints; definitions

Borrowing constraints are an important component of AHURI-3M because they help explain why we observe some income units renting, even though they would be economically better off as homeowners. These housing consumers are constrained because they do not have the wealth levels to meet deposit requirements, or they have insufficient income to meet the repayment criterion. Ignoring borrowing constraints on tenure choice would lead to incorrect estimates of the impact, and budgetary costs, of policies which lower the cost of owner-occupied housing. Hence, a potential first home buyer who finds home ownership cheaper than renting is required to meet both deposit and repayment constraints before we predict their transition into homeownership.

We specify a deposit requirement that is 10 per cent of the purchase price, inclusive of transaction costs. Potential home owners must therefore have accumulated sufficient savings to meet this requirement. The repayment criterion is based on rules that financial institutions apply in evaluating the maximum loan they are prepared to advance, given a borrower's income. These rules are typically defined in terms of a maximum loan-to-income multiple that is a function of household size, composition and income. An explicit statement of these borrowing constraints can be found in appendix 1. Details concerning measurement follow below.

2.6.2 Measurement

Modelling borrowing constraints requires measurement of certain key variables that affect potential home buyers' ability to meet deposit and repayment requirements. These include wealth, loan-to-income multiples, house value and stamp duties.

The amount of gross liquid wealth a housing consumer has determines the maximum amount of downpayment the home buyer can afford. The HILDA data contain detailed information on households' wealth holdings in 2002 that include savings assets held in bank accounts, businesses, investments, trust funds, life insurance, superannuation, investment properties, vehicles and collectables.

It is assumed that renters are able to convert all forms of wealth into cash to meet deposit requirements, with the exception of life insurance, superannuation, and trust funds (in the case of renters aged under 21). It is also assumed that renters are unwilling to cash in wealth held in business assets or vehicles to meet deposit requirements.

Wealth is reported on a household basis only. The majority (89 per cent) of households in the data are single income unit households. In the minority of cases, where a household contains multiple income units, household gross liquid wealth is equally divided among household non-dependents. The liquid wealth of income units is then simply the product of average liquid wealth holdings and the number of non-dependent individuals in the income unit.

Table 9 shows that renters hold an average $40,600 in liquid assets, but this figure reflects the presence of a small number of income units that have substantial rental property investments and share holdings. For example, only 9.8 per cent of renters have gross liquid wealth greater than $100,000. It is likely that these are professionals and business executives who have moved interstate and are leasing their former principal residence. The median figure is $2,300 and is a better measure of the amounts that a typical renter could muster to meet deposit requirements; indeed 3.4 per cent of renter income units have no liquid wealth. Furthermore, the median amount of all wealth components other than bank accounts is zero.

Table 9: Gross liquid wealth components, renters, '000 dollars, 2002-03

	Mean	***Median***	***% of gross liquid wealth*** **(on basis of medians)**
Shares	9.5	0.0	0.0
Cash investments	0.4	0.0	0.0
Trust funds	2.0	0.0	0.0
Bank accounts	8.6	1.0	44.4
Investment properties	18.5	0.0	0.0
Collectables	1.6	0.0	0.0
Gross liquid wealth	40.6	2.3	100.0

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

The product of the loan-to-income multiple and a home buyer's income level determines the maximum loan that a home buyer can borrow. The typical loan-to-income multiple at which first home buyers can borrow has been sourced from the Westpac home loan calculator. The maximum loan-to-income multiple is primarily dependent on income unit type, income unit monthly after-tax income, number of dependent children, amount of monthly repayments on non-housing-related loans (excluding credit card repayments) and amount of credit card limit. Descriptive statistics indicate that first home owners' mean monthly after-tax income unit incomes typically range from approximately $4,000 to $7,000 for couples and $2,000 to $4,000 for singles, as shown in Table 10 below.

Table 10: Mean monthly after-tax income unit income of first home owners, dollars, 2002–03

Income unit type	***Number of dependent children***						
	0	***1***	***2***	***3***	***4***	***5***	***6***
Couple	3,934	5,075	5,458	5,637	6,892	4,377	4,315
Single	1,875	2,800	2,417	3,582	3,123		

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

The Westpac home loan calculator is used to calculate the maximum loan-to-income multiple for couples and singles, with the number of children ranging from zero to two[26], and after-tax monthly income levels ranging from $4,000 to $7,000 for couples and $2,000 to $4,000 for singles. Table 11 lists the maximum loan amounts assuming zero debt repayments and zero credit card limits. As expected, the table shows that the loan-to-income multiple increases as the number of dependent children fall and income rises. These maximum loan-income multiples are considerably higher than those used in the original AHURI-3M design (2.5 for couples, and 3.5 for singles)[27]. They reflect the more liberal lending criteria that financial institutions have introduced in recent times. HILDA survey respondents are asked to report (in 2002) their repayments on non-housing related debt and credit card limits[28]. Both are variables used by financial institutions when computing maximum loan-income multiples. Simulations using the Westpac calculator indicate that maximum loans fall by $102 for every additional dollar of monthly repayments on non-housing related debt. The maximum home loan is reduced by $3 for every dollar increase in the credit card limit. So, for example, consider a couple with $4,000 monthly income and two children. According to the table below, the maximum loan amount is $181,865, assuming zero debt repayments and zero credit card limits. If the couple has $100 of monthly debt repayments and a $1,000 credit card limit, the maximum loan falls by $13,200. The maximum loan falls to $168,665 and the loan-to-income multiple falls from 3.8 to 3.5. The innovative use of Westpac's home loan calculator has resulted in a much more sophisticated and improved specification of the repayment constraint.

Other major banks' calculators also rely on similar criteria. For example, using the Australia and New Zealand (ANZ) Bank home loan calculator, a couple with no children with after-tax monthly income of $4,000 can borrow up to $264,556, resulting in a loan-to-annual income multiple of 5.5. Using the Westpac calculator, the multiple is 5.4 (see Table 11). Using the ANZ calculator, a couple with two children can borrow up to $195,866, resulting in a loan-to-annual income multiple of 4.1. Using the Westpac calculator, their multiple would be 3.8 (see Table 11). Using the ANZ home loan calculator, the maximum home loan is also reduced by $3 for every dollar increase in the credit card limit.

[26] Less than 10% of income units have more than two children.

[27] These were based on typical values reported by first home buyer couples and singles in the 1999 Australian Housing Survey.

[28] In the HILDA data each member of a couple is asked what his/her monthly loan repayment is. If both members report the same loan repayment amount, it is assumed that both partners are in fact reporting the income unit monthly repayment. For example, if each member reports $500 of monthly repayment, the income unit repayment is assumed to be $500, not $1,000. Where an income unit does not know the amount of loan repayments, it is assigned the mean repayment of income units in its disposable income quintile. Where an income unit specifies that it has a credit card that has no specified limit or does not know the limit, it is assigned the mean credit card limit held by income units in its disposable income quintile.

Table 11: Maximum loan and loan-to-income multiple, Westpac June 2008 home loan calculator

Income unit type	*After-tax monthly income*	*Maximum loan amount ($)*			*Maximum loan-to-annual income multiple*		
		No children	*1 child*	*2 children*	*No children*	*1 child*	*2 children*
Couple	4,000	257,720	219,793	181,865	5.4	4.6	3.8
	5,000	361,347	323,420	285,492	6.0	5.4	4.8
	6,000	464,974	427,047	389,119	6.5	5.9	5.4
	7,000	568,601	530,674	492,746	6.8	6.3	5.9
Single	2,000	99,171	59,067	21,140	4.1	2.5	0.9
	3,000	202,798	162,694	124,767	5.6	4.5	3.5
	4,000	306,425	266,321	228,394	6.4	5.5	4.8

Source: Westpac home loan calculator as at June 2008

Note:

- Couples with income <=$4,000 are assigned the multiple of couples with $4,000.
- Couples with income $4,001-$5,000 are assigned the multiple of couples with $5,000.
- Couples with income $5,001-$6,000 are assigned the multiple of couples with $6,000.
- Couples with income >$6,000 are assigned the multiple of couples with $7,000.
- Singles with income <=$2,000 are assigned the multiple of couples with $2,000.
- Singles with income $2,001-$3,000 are assigned the multiple of couples with $3,000.
- Singles with income >$3,000 are assigned the multiple of couples with $4,000.

The borrowing constraints renters face can only be calculated when their predicted house purchase price (house value) is known. The predicted values are imputed using the house value regression described above (see page 16). Stamp duties are then calculated using the imputed house values and 2006-07 stamp duty thresholds. These include stamp duty on conveyances, and mortgage duties (if relevant) and first home buyer concessions. Deposit requirements are set equal to 10 per cent of the predicted house value.

2.7 Tenure choice: Assignment rules

The assignment rules are applied sequentially, with a relative price rule applied in the first stage of the sequence. The relative price rule compares the after-tax economic costs of income units in each tenure, and assigns them to the tenure that minimizes these costs. This is the preferred or equilibrium tenure choice. Tenants must also meet lending criteria, as specified in borrowing constraints. Those who at current parameter values prefer home ownership on relative price grounds could be the subject of binding borrowing constraints. A major strength of the model is its capacity to diagnose the type of binding constraint, and to predict the relaxation or otherwise of constraints under alternative policy scenarios.

2.7.1 Home owners

A home owner's bid rental rate is compared with the market rental rate. If the bid rental rate is higher (lower) than the market rental rate, the income unit is assigned to the private rental (owner occupation) tenure.

The market rental rate is adjusted to take into account CRA. The rent that a home owner income unit would have paid had the income unit been privately renting is derived by multiplying the market rental rate by the actual value of the house it occupies. If eligible its CRA entitlement is computed and deducted from rent to get a net annual rent. The net annual rent is divided by house value and this market rental rate is compared with the bid rental rate. The model should correctly assign most home owners. If it does there is reason to believe that relative prices are a factor shaping tenure decisions.

2.7.2 Private renters

If the private renter's bid rent is higher (lower) than the market rent, the income unit is assigned to the private rental (owner occupation) tenure. The benchmark for this comparison is the predicted house value – that purchase price that we expect tenants to pay if they make a transition into home ownership. We impute a market rent by multiplying the market rental rate by predicted house value. If tenants are eligible their CRA entitlement is calculated and subtracted to obtain a suitably adjusted net market rent. The bid rent is also measured with respect to the predicted house value. Note that we assume that public housing is rationed and that private renters cannot therefore immediately apply for and enter public housing. In the short-term the choice is therefore between private rental and home ownership.

2.7.3 Public renters

Public housing tenants' rebated rents are set at 25 per cent of assessable income and measured according to state housing authority rules. These rents are compared to their bid rents and net market rents that are estimated using predicted house values as the benchmark. Tenants are assigned to the tenure that offers the lowest housing costs.

2.7.4 Rent-free

The rent-free do not pay for housing. If they were to choose home ownership or private renting, they would have to pay for housing. Hence, the rent-free are assigned as rent-free regardless of the relationship between bid and market rental rates.

2.7.5 Application of borrowing constraints

Lending rules are applied to each tenant in the sample in a straightforward manner. A 10 per cent deposit requirement is computed at predicted property values and if liquid wealth (savings) is insufficient to meet the requirement, the deposit constraint is binding. Appropriate loan-to-income multiples are applied to calculate maximum loans, and if less than the purchase price, the repayment constraint is binding[29].

2.8 Housing assistance, the labour market and work incentives

A significant addition to the redesigned AHURI-3M model is a labour market module that estimates the impact of reforms on work incentives, and models the consequences for labour supply. We have chosen the replacement rate as our measure of work incentives as it is most relevant to transitions into employment (see Dockery et al 2008).

2.8.1 Measurement of replacement rates

The replacement rate is the proportion of income when working that is replaced by income when not working. The higher the replacement rate, the lower the incentive to work. In the model, the replacement rate of an individual is specifically computed as the

[29] At this stage the model does not assume that home owners would use all their savings in the event that the repayment constraint is binding. When adapting the model for the purposes of project 30521 we will alter the application of the repayment constraint by assuming that potential home owners will plough all their savings into home purchase in the event that the repayment constraint is binding. Since median savings are only $2,300 we do not expect this change to have much impact.

ratio of the individual's disposable income when unemployed or not in the labour force (unwaged) to disposable income when working. Both income when unwaged and income when in paid work are calculated on an income unit basis, so that the replacement rate estimates account for the full income unit ramifications of a transition from one labour force status position to another. This approach is appropriate because the level of income support payments and tax liabilities of each individual is not simply dependent on personal income, but on the income of the income unit to which s/he belongs.

The method of computing income when unwaged and when employed depends on initial labour force status. For unwaged persons, income when unwaged is known. For example, actual retirement annuities are included in the 'known' incomes of currently unwaged persons. However, income when in paid work is unknown and is imputed by estimating separate wage equations for males and females, using Heckman (1979) models to address sample selection bias issues. For waged persons, income while unwaged is unknown. A waged person may become eligible for income support payments upon quitting paid employment. It is assumed that non-disabled persons apply for Newstart Allowance, whereas disabled persons apply for Disability Support Pension. Disabled persons are those who report a disability or long-term health condition. Females in the sample who would be eligible for Age Pension, should they quit employment, receive Age Pension regardless of their disability status. Retirement annuities are imputed for persons aged 55 or over. When imputing income, the wage and salary of one's partner is assumed to remain constant.

Replacement rate estimates are computed using the tax-benefit simulator. Importantly, the simulator allows tax and income support programs to be taken into account in both income while unwaged and income while working[30]. The replacement rate will reflect public housing subsidy because the difference between market rent and rent paid is added to income.

Table 12 shows the mean and median replacement rates of working-age Australians. Those employed full-time have the lowest replacement rates. 'Part-timers' have higher replacement rates than the full-time, reflecting their typically lower earnings. Unwaged persons have the highest replacement rates. Public rental tenants have particularly high replacement rates and this reflects the loss of housing subsidy as earnings increase. Sole parents and the disabled have blunt work incentives and are over-represented in public housing. The estimates in the table below are in line with 2002-03 estimates produced from the 2002–03 SIHC, as reported in Wood et al (2007).

Table 12: Mean and median replacement rates by characteristics of working-age persons, 2002–03

	Mean replacement rate %	***Median replacement rate %***
All	32.4	22.4
Employment status		
Employed full time	18.3	6.1
Employed part time	37.8	32.2
Unemployed	53.5	66.4
Not in the labour force	56.3	60.8
Housing tenure		
Outright owner	40.1	36.9
Owner purchaser	26.9	17.5

[30] Even when an unwaged person gains employment, s/he is still eligible to receive income support payments at a reduced rate if earnings are low.

	Mean replacement rate %	*Median replacement rate %*
Private renter	33.6	21.8
Public renter	62.4	69.9
Rent-free	23.8	2.9
Income unit type		
Couple with children	36.2	29.2
Couple without children	27.5	8.0
Sole parent	63.1	71.5
Single	26.7	2.9
Disability status		
Not disabled	28.3	16.5
Disabled	50.1	55.6

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

2.8.2 Work incentives and employment

A labour market regression model is estimated, which incorporates a replacement rate variable. The employment outcomes of housing policy reforms that affect the replacement rate of working-age persons are predicted using the estimated regression model. The sample is non-dependent persons aged 15-64, the population subgroup where work incentives matter[31]. The dependent variable is a binary variable, which is equal to one if an individual is employed at the time of interview and zero otherwise. We estimate a probit regression model where the explanatory variables measure key socio-economic and demographic characteristics such as human capital, marital status, ethnicity, disability status, education levels, labour market history, incentives and location. The key right-hand side variable is the replacement rate variable. Replacement rates are typically endogenous. The model addresses this issue by computing the replacement rate using previous financial year (2001-02) income and tax-benefit parameters. Detailed estimates are presented in appendix 2. There is a statistically significant negative relationship between work incentives and employment outcomes. For the typical male, a 10 percentage point increase in the replacement rate decreases employment probability by 5 percentage points. A 10 percentage point increase in the typical female's replacement rate decreases employment probability by 3 percentage points. The table below shows that the predictive accuracy of the model is very high at 81.6 per cent.

Table 13: Employment participation regression model predictive accuracy

Observed	*Predicted*		*Percentage correct*
	Employed	*Not employed*	
Employed	3,275	237	93.3
Not employed	607	466	43.4
Total			81.6

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

[31] Business owners are excluded as large profits or losses tend to distort replacement rates, and their labour supply decisions are qualitatively different from those of employees.

3 THE MODEL IN ACTION

This chapter demonstrates how the model can be applied to conduct policy simulations. Section 3.1 compares actual tenure outcomes and predicted tenure outcomes using AHURI-3M's relative price and borrowing constraint assignment rules, and investigates the sensitivity of tenure outcomes to changes in interest rates. The estimates employ HILDA population weights to derive Australian population estimates. Section 3.2 conducts policy simulations with respect to a grant for first home owners (FHOG), and a scheme designed to reduce the housing stress of private rental tenants (NRAS).

3.1 Analysis of tenure choice

Table 14 compares the actual tenure outcome with preferred tenure outcomes as generated by our relative price assignment rules. A key finding is that most private renters would be economically better off as home owners. Their preferred tenure choice is then thwarted by borrowing constraints. A second notable result is that under current housing assistance arrangements in public housing, all tenants have lower housing costs if they remain in public housing.

The majority of owner-occupiers (3,826,000 or 92.2 per cent of all owner-occupiers) are also assigned to owner occupation under relative price assignment rules. This finding suggests that the relative price of home ownership has an important role to play in explanations of tenure choice, and is consistent with findings from econometric modelling (Bourassa, 1995, 1996; Bourassa and Yin, 2006). The minority of owner-occupiers who would be able to rent the equivalent amount of housing at a lower after-tax economic cost (325,000 or 7.8 per cent of all owner occupiers) have non-price-related reasons for continuing to reside in their current homes as owner occupiers. These reasons may include the ontological security provided by home ownership and the desire to pass on the family home as a bequest[32].

Table 14: Preferred tenure outcomes[1]

Preferred tenure		*Actual tenure*				
		Owner-occupier	***Private rental tenant***	***Public rental tenant***	***Rent-free arrangement***	***Total***
Owner-occupier	N '000s	3,826	1,986	0	0	5,812
	Col. %	92.2	88.2	0.0	0.0	75.4
Private rental tenant	N '000s	325	265	0	0	590
	Col. %	7.8	11.8	0.0	0.0	7.7
public rental tenant	N '000s	0	0	454	0	454
	Col. %	0.0	0.0	100.0	0.0	5.9
Rent-free arrangement	N '000s	0	0	0	850	850
	Col. %	0.0	0.0	0.0	100.0	11.0
Total	N '000s	4,151	2,251	454	850	7,706
	Row %	53.9	29.2	5.9	11.0	100.0

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. The number of income units in each cell is a population estimate arrived at by applying population weights from the data.

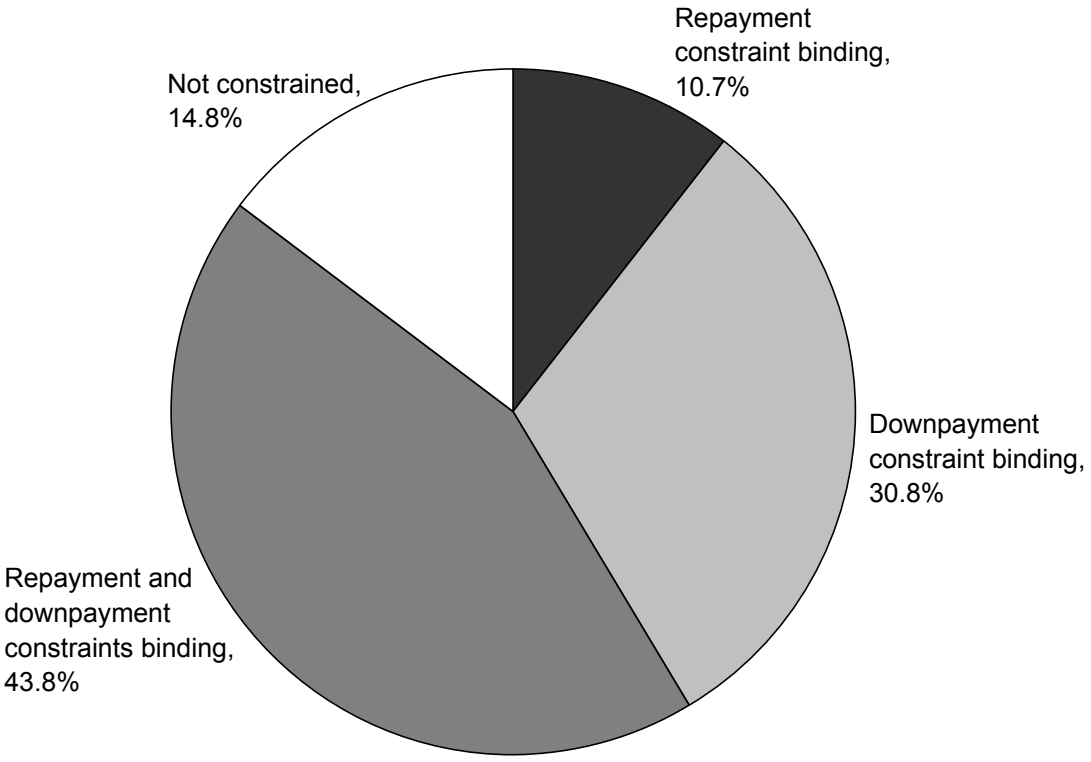
Of the nearly two million private renters who prefer home ownership, only 293,000 or 13 per cent are able to meet deposit and repayment requirements. They are likely to make

[32] The oldest person in 37.5% of these income units is 65 years or over, retired and eligible for CRA if they choose to rent. Over one-half (57%) are retired.

an imminent transition into home ownership[33]. Figure 3 identifies binding constraints for all rental tenants who prefer home ownership on relative price grounds. Both deposit and repayment constraints are binding for 43.8 per cent, deposit constraints alone are binding for 30.8 per cent and repayment constraints alone are binding for another 10.7 per cent.

The most important barrier to home ownership seems to be insufficient savings to meet the 10 per cent deposit requirement, a finding that confirms Wood, Watson and Flatau (2003). Despite more liberal loan-income multiples, just over 1 in 2 private renters (who prefer home ownership on price grounds) are unable to borrow amounts that would finance home purchase. So repayment constraints are important.

Figure 3: Borrowing constraints, rental tenants who prefer home ownership on relative price grounds



Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Table 16 cross-tabulates the socio-economic and demographic characteristics of credit-constrained tenants by type of binding borrowing constraint. The repayment-constrained tend to be older, more likely to be sole persons, with comparatively high levels of investment income, but dependent more on government benefit payments than the downpayment-constrained. However, they have significantly higher wealth levels than the downpayment-constrained. This is not surprising, as over one-third of rental tenants who are repayment constrained only, already own properties. It is likely that these are professionals and business executives who have moved interstate and are leasing their former principal residence. Approximately one-half of the repayment-constrained also own financial investments. However, the combination of lower wages and higher credit card limits result in lower maximum loan amounts, and this contributes to their repayment-constrained status.

[33] Though some are landlords, perhaps because they have temporarily moved (say) interstate and are leasing their primary residence prior to moving back.

The deposit-constrained have markedly different characteristics from the repayment-constrained. They have higher wages and labour force participation rates and, as such, have access to higher maximum loans from financial institutions. However, their median liquid wealth levels are extremely low compared with those of the repayment-constrained.

Income units who are both repayment and downpayment constrained are far more likely to experience unemployment, and they lack education; 69.5 per cent of all income units are sole-person income units, and they have lower wage and investment income than both the repayment and downpayment constrained. Their maximum loans are also noticeably lower than those of the other two constrained groups, and they also face higher deposit gaps than the deposit constrained, given their lower savings.

Table 15: The socio-economic and demographic characteristics of rental tenants by binding borrowing constraint

	All renters	***Repayment constrained***	***Downpayment constrained***	***Repayment & downpayment constrained***
Demographic characteristics				
Median age of reference person (years)	34	39	31	34
Proportion of income units with at least 1 person aged over 65 (%)	8.2	18.4	0.6	11.4
Couple (%)	29.7	21.8	45.9	17.6
Two earners in income unit (%)	12.4	1.0	26.7	2.0
Sole parent (%)	11.3	10.0	12.1	12.9
Sole person (%)	59.0	68.3	42.0	69.5
Housing				
Median current weekly rent ($)	110.3	125.3	135.5	90.2
Private rental tenancy (%)	83.2	88.5	92.2	74.4
Receiving housing assistance (%)	46.1	44.1	30.7	60.6
Metropolitan residence (%)	72.7	77.4	63.7	77.8
Median deposit gap[1] ($)	10,698.9		11,859.8	13,153.3
Median maximum loan ($)	113,988.3	98,979.9	198,594.6	60,676.3
Income & employment[2]				
Median annual income from wages & salaries ($)	18,200.0	2,080.0	34,996.0	0.0
Median annual income from investments ($)	0.0	80.0	0.0	0.0
Median annual income from government cash transfers ($)	0.0	0.0	0.0	7,591.8
Not in labour force (%)	27.4	36.5	7.8	40.9
Unemployed (%)	7.2	3.6	2.5	11.7
Replacement rate (%, working-age only)	34.7	29.8	27.4	43.3
Income unit wealth and debt				

	All renters	*Repayment constrained*	*Downpayment constrained*	*Repayment & downpayment constrained*
Median savings[3] ($)	2,300.0	66,400.0	1,700.0	700.0
Median monthly debt repayments ($)	0.0	0.0	0.0	0.0
Median credit card limit ($)	500.0	2,000.0	1,500.0	0.0
Highest educational qualification[2]				
No qualifications (%)	52.7	49.2	50.8	60.9
Population estimates	2,704,610	269,186	729,036	1,397,927

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. The difference between deposit requirement and savings. 2. Statistics refer to the income unit reference person unless stated otherwise. 3. Savings are gross liquid wealth.

Those renters subject to a binding repayment constraint, particularly those who are subject to binding deposit constraint, are least likely to attain home ownership. They have inferior labour market participation rates, are typically single persons, older and more likely to be receiving housing assistance. The recent escalation in house prices has put home ownership out of reach because they cannot borrow the amounts required for home purchase in contemporary market conditions. The deposit constrained have more realistic chances of home ownership because they are typically couples, with two earners. They are younger and have yet to save enough to meet deposit requirements.

Table 17 presents the results of a sensitivity analysis of the impact of interest rate variations on tenure outcomes. It reports the rate of home ownership under the relative price assignment rules (preferred tenure), and when borrowing constraints are taken into account (predicted tenure). The base value of the interest rate is 7.95 per cent. This is increased or decreased by 1 and 2 percentage points on a nominal basis; this means that when interest rates increase by 1 percentage point, the inflation and house price appreciation rates also increase by 1 percentage point. This feature of the simulation acknowledges that interest rate changes are usually in response to changes in the expected inflation rate.

Changes in the interest rate will impact tenure outcomes through the following channels:

1. The market rental rate (through the influence of interest rates on the after-tax economic costs of landlords);
2. Housing consumers' bid rental rates; and
3. The repayment constraint because an increase (decrease) in the interest rate increases (decreases) other loan repayments, which in turn impacts on the maximum amount that can be borrowed.

Table 16: Determinants of tenure outcomes-interest rates

Interest rate %	*Home ownership shares*[1]		*Market rental rate %*	*Mean bid rental rate %*	*Rental tenants subject to a binding repayment constraint %*
	Preferred tenure %	*Predicted tenure %*			
9.95	73.3	52.4	8.63	6.14	62.9
8.95	74.5	53.0	8.97	6.43	62.3
7.95	75.4	53.4	9.29	6.73	61.8
6.95	76.2	53.8	9.61	7.02	61.3
5.95	76.7	54,0	9.91	7.31	61.1

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

The model predicts (see Table 17) that home ownership rates will be resilient in the face of increases in nominal interest rates. The after-tax economic costs of (aspirant) home owners and landlords decline because of the accompanying higher rates of capital gain; there is then little change in preferred tenure choices. Furthermore, the numbers affected by repayment constraints increase only marginally; this is because the constraints are only indirectly affected through repayments on other loans.

3.2 Policy analysis

3.2.1 First Home Owner Grant (FHOG)

The FHOG was introduced by the Federal government on 1 July 2000 to offset the impact of the introduction of the goods and services tax. It was initially set at $7,000 but was increased to $14,000 on 9 March 2001 for first home buyers who build their home or purchase a newly constructed home. Since then the grant has been wound back to its initial value of $7,000.

The FHOG can affect transitions into home ownership through it impacts on both relative price and borrowing constraints. As an upfront grant, the amortised value of the FHOG reduces housing consumers' after-tax economic cost as home owners. Furthermore, FHOG can be used to meet deposit requirements, and by reducing borrowing requirements, it helps to relax repayment constraints. We use the redesigned AHURI-3M to simulate FHOGs impact on the number of first homebuyers predicted to become home owners with the assistance of FHOG.

When FHOG are $7000 the predicted rate of home ownership rises by 1.8 percentage points; at $14000 the increase is 2.4 percentage points, or 169,000 income units (see Table 18). It is of most help to the 17.7 per cent of first home buyers with binding deposit constraints; their mean deposit gap is $12,415 but that of income units with binding deposit and repayment constraints is $14,235, which is not even bridged with FHOG at $14,000. Among those with binding repayment constraints the maximum amount they can borrow is on average $70,000 short of what they need, and so FHOG of even $14000 is insufficient to bridge this shortfall.

Table 17: FHOG and forecast impacts on transitions into home ownership

Policy scenario	***Number of income units '000s***	***Increase in number of income units1***	***Share %***	***Percentage point increase in share %[1]***
Base Values	4,119	N/R	53.4	N/R
$7000	4,250	131	55.2	1.8
$14000	4,288	169	55.8	2.4

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. By comparison to base values, that is the forecast home ownership rates at current values of interest rates and other parameters. These are population estimates.

Table 19 lists the socio-economic and demographic characteristics of rental tenants by eligibility[34], and whether the FHOG of $14,000 facilitates transition into home ownership. First, we look at the characteristics of renters predicted to become home owners with the assistance of FHOG. They tend to be in their 30s, partnered, living in private rental

[34] Renters are ineligible if they have been home owners in their past housing career history.

housing and paying higher rents. They are also more qualified, enjoy higher wage and investment incomes, and much more likely to be employed. These rental tenants also have much higher savings than other groups; over one-third own properties they are not living in, two-thirds own financial investments and one-tenth have trust funds that they can access to meet deposit requirements.

Rental tenants ineligible for FHOG tend to be older and similar to eligible renters forecast to remain in rental tenancies. Both groups have inferior qualifications, wages and savings. They are also more likely to be public housing tenants. FHOGs are more likely to assist younger couples with stronger socio-economic and demographic characteristics, and they vacate rental housing that is relatively expensive and unlikely to improve low income households access to affordable rental housing[35].

Table 18: The socio-economic and demographic characteristics of tenant income units assigned to rental tenancies and home ownership when FHOG set at $14000

	All rental income units	***Renters ineligible for FHOG***	***Renters forecast to remain in rental tenancies***	***Renters predicted to make transition into home ownership due to FHOGs***
Demographic characteristics				
Median age of reference person (years)	33	43	27	33
Proportion of income units with at least 1 person aged over 65 (%)	8.8	14.7	4.8	2.2
Sole parent (%)	9.2	10.6	8.8	0.3
Sole person income units (%)	65.1	56.2	72.9	55.3
Housing				
Median current weekly rent ($)	85.2	96.8	70.2	140.4
Median optimal housing demand (%)	149,882.9	161,853.0	137,480.9	164,896.5
Private rental tenancy (%)	63.6	62.9	60.9	100.0
Metropolitan residence (%)	71.9	71.0	72.8	69.8
Median deposit gap ($)	9,531.4	10,603.3	9,657.9	0.0
Median maximum loan ($)	106,622.2	111,747.2	92,289.0	246,796.3
Income & employment[1]				
Median annual income from wages & salaries ($)	17,888.0	5,720.0	18,148.0	47,892.0
Median annual income from investments ($)	0.0	0.0	0.0	150.0
Median annual income from government cash transfers ($)	0.0	0.0	0.0	0.0
Not in labour force (%)	27.0	36.3	21.9	2.2
Unemployed (%)	6.7	5.4	8.3	0.0
Income unit wealth and debt				
Median savings ($)	3,500.0	3,854.0	2,701.0	63,250.0
Median monthly debt repayments ($)	0.0	0.0	0.0	0.0

[35] This is subject to the qualification that these vacancies can trigger a filtering process that can ultimately improve the supply of low income housing.

	All rental income units	*Renters ineligible for FHOG*	*Renters forecast to remain in rental tenancies*	*Renters predicted to make transition into home ownership due to FHOGs*
Median credit card limit ($)	0.0	500.0	0.0	5,500.0
Highest educational qualification[1]				
Post-graduate (%)	2.0	2.5	1.1	8.4
Under-graduate (%)	12.1	10.6	12.4	21.4
Diploma (%)	9.7	10.7	7.8	21.8
Vocational (%)	22.1	23.1	20.5	31.0
No qualifications (%)	54.2	53.1	58.2	17.5
Population estimates	3,538	1,478	1,875	185

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. Statistics refer to the income unit reference person.

3.2.2 National Rental Affordability Scheme (NRAS)

NRAS seeks to add 50,000 new rental dwellings over the next 4-5 years, with each addition and its occupants being supported for 10 years. Support will be provided to the investor in the form of a $6,000 tax credit (or grant if they are a non-income tax paying organisation), and an additional $2,000 cash or in-kind from State or Territory governments. The benefit for the tenant is that they rent a dwelling at 20 per cent below its market rent. Eligible tenants are those receiving CRA regardless of their housing stress levels.

We model the impact of NRAS on the target group of all CRA eligible renter income units that are sampled in the wave 2 data. The sample comprises 713 income units and this is equivalent to 793,458 CRA eligible income units in the population. The crucial assumption is that the program will randomly assign NRAS to 50,000 income units among the eligible pool of CRA recipients; each eligible unit has an equal chance of receiving NRAS. We have therefore randomly selected 1 in every 16 eligible income units.

Our definition of housing stress is based on the net housing affordability ratio (HAR) measure, where net HAR is housing costs minus CRA divided by income from all sources other than CRA. An income unit is deemed to be in housing stress if net HAR exceeds a 30 per cent benchmark. The simulation allows estimation of the following crucial policy questions:

- → The number and per cent of NRAS income units in housing stress.
- → The number and per cent of NRAS income units lifted out of housing stress.
- → The net annual budget cost of the program

Table 20 shows the impact of NRAS on housing stress across socio-economic and demographic groups. 11,328 or 22 per cent of those eligible to receive NRAS are in housing stress. Over 50 per cent are lifted out of housing stress by the scheme. Over half of both couples and singles are lifted out of housing stress by the scheme. The probability of being lifted out of housing stress is noticeably higher in regional or remote areas, where house and rent prices tend to be lower. Analysis of housing stress tends to be focused on income units in the bottom 40 per cent of the income distribution. The

simulation indicates that between one-third and one half of those in the lowest and second lowest quintiles will be lifted out of housing stress. This is nevertheless lower than typical impacts among all NRAS recipients because the net housing costs of the poorest 40 per cent of NRAS eligible tenants are disproportionately high relative to their incomes.

Table 19: NRAS and housing affordability stress, by socio-demographic characteristics of NRAS tenants, 2002-03, per cent[1]

	Number of NRAS income units	***Number of NRAS income units in housing stress before NRAS***	***Number lifted out of housing stress***	***Percentage lifted out of housing stress %***
All income units	50,000	11,328	5,832	51.5
Income unit type				
Couples	16,948	2,269	1,167	51.4
Singles (including sole parents)	33,052	9,059	4,665	51.5
Location2				
Major city	32,777	8,297	3,902	47.0
Regional or remote	17,223	3,031	1,930	63.7
Gross income quintile				
Lowest quintile <=$11,720.52	8,633	4,475	1,616	36.1
Second quintile $11,720.53-$16,107.45	11,345	3,549	1,712	48.2

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Note: 1. We have also run a simulation using the wave 6 sample and the 2006-07 tax-benefit parameters. The conclusions are similar.

2. The regional breakdowns are derived from the Accessibility / Remoteness Index of Australia scores from the 2001 Census.

The net budget cost of the scheme is $379m. There are annual CRA savings of $21m that reduce the gross budget cost by 5 per cent. CRA savings are somewhat smaller than might have been anticipated. This is because 55 per cent of CRA recipients are receiving the maximum rate; as a consequence nearly one third of CRA recipients find that their entitlements are unaffected by the rent discount.

Table 20: Annual budget costing, million dollars, 2002-03

Budget measure	***Million dollars***
Gross budget cost	400
CRA savings	21
Net budget cost	379

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

4 CONCLUDING COMMENTS AND FUTURE RESEARCH DIRECTIONS

The redesigned AHURI-3M housing market microsimulation model is a research tool that can be used by policy analysts and policy makers to evaluate the impact of policy programs on housing affordability, tenure outcomes and work incentives. It includes a tax-benefit simulator that allows the analyst to evaluate the housing market impacts of non-housing programs and to measure net budget costs that allow for complex interactions across programs. We have illustrated the use of AHURI-3M by conducting policy impact evaluation exercises on the First Home Owner Grant program and the National Rental Affordability Scheme.

The labour market module is a significant addition to this version of AHURI-3M. It expands the model's capability in two main ways. First, the model is now capable of measuring work incentives and how these are affected by housing assistance measures. Second, it now includes an econometric model that can estimate the impact that work incentives have on labour supply decisions. We are thus able to gauge potentially important trade-offs between housing assistance measures that aim to improve housing affordability and their impact on labour market participation. Equally important, we can trace through the consequences of welfare-to-work reforms on housing affordability stress.

There are at least two important future directions for research. The first and most immediate is an update of the model so that it is capable of being operationalised with wave 6 of the HILDA database. This is a routine exercise and is currently being completed as part of AHURI project 30521. We expect this update to be finalised in September 2008. The second development is more fundamental. The analysis in this and the previous version of AHURI-3M provides a snapshot analysis of the housing market at a moment in time. The redesigned AHURI-3M is estimated using HILDA, a panel data base that allows a cohort of Australian households to be tracked through time. An obvious extension of AHURI-3M is its specification as a dynamic model that is capable of longitudinal analysis. This program of research is also part of project 30521, and is currently underway. We expect a completion date of September 2009.

Finally, there is the supply side of AHURI-3M. The supply side of housing models is invariably difficult to analyse because of data deficiencies. One of the neglected areas of supply-side analysis is rental investor decision making. We know little about the role of economic variables in determining household decisions on whether to hold rental investments in their wealth portfolios, and if they do hold rental investments, what factors shape decisions to add to, hold or realise investments. A priority for future development of AHURI-3M is a richer analysis of the supply side. We envisage use of wave 2 and wave 6 of HILDA to analyse household decision making with respect to rental investments. Both waves included a wealth module that allows identification of new investments in rental housing, as well as realisations of existing rental investment properties. It therefore offers the opportunity to conduct a dynamic analysis of rental investment that can shed light on the factors shaping the supply side of the rental housing market.

APPENDICES

Appendix 1: AHURI-3M model equations

Landlord's after-tax economic cost

$$UC = \frac{i+v}{(1-\phi)} - CAP + AMORT \times (CAPTAX + TRANSCOST) \quad (1)$$

where

v = $m + t_p + t_L(1-\lambda_s) + b\lambda_s$

$$CAP = \frac{\pi_h - d}{(1-t_y)(1-\phi)}$$

$$AMORT = \frac{\delta}{(1-t_y)(e^{\delta T}-1)(1-\phi)}$$

$$CAPTAX = \tfrac{1}{2} t_y \left[(1-\beta)e^{\pi_h T} - (1+s)\right]e^{-kT}$$

i = interest rate

$\emptyset$ = agency costs as a proportion of gross rent

t_y = MITR (weighted average of partners of income unit in the case of couples)

m = maintenance costs as a fraction of asset price

t_p = property taxes as a fraction of asset price

t_l = land tax rate (applied to land value)

λ_s = the ratio of the building value to the asset price

$t_L(1-\lambda_s)$ = land tax as a fraction of asset attributable to land value

b = building insurance premium rate (applied to building value)

π_h = house price appreciation rate

d = rate of economic depreciation (excluding fittings)

T = holding period

β = brokerage fees as a fraction of asset price

s = stamp duties as a fraction of asset price

$k = (1-t_y)i$

Housing consumers' bid rental rate

$$UC_0 = (1 - t_y)i + t_y \alpha i - \frac{t_y \pi_h \alpha}{1 - t_y} + v_0 - \pi_h + d + AMORT_0 \times TRANSCOST \quad (2)$$

where

$v_0 = m + t_p + b\lambda_s$

$$AMORT_0 = \frac{\delta}{(1 - t_y)(e^{\delta T} - 1)}$$

$$TRANSCOST = s + \beta e^{\delta T}$$

t_y = MITR

i = interest rate

α = LVR at time of property purchase

π_h = house price appreciation rate

d = economic depreciation rate

m = maintenance costs as a fraction of asset price

t_p = property taxes as a fraction of asset price

λ_s = the ratio of the building value to the asset price

b = building insurance premium rate (applied to building value)

$\delta = \pi_h - (d + k)$

$k = (1 - t_y)i$

T = holding period

β = brokerage fees as a fraction of asset price

s = stamp duties as a fraction of asset price

Downpayment constraint

A home buyer's gross wealth level determines the maximum downpayment that the home buyer can pay, that is,

$$W = (1-\alpha^m)(V_w^m + s^m) \tag{3}$$

where

W = gross liquid wealth of home buyer (reported)

α^m = maximum LVR ratio =0.9

V_w^m = maximum house value a home buyer is able to purchase given wealth level

s_w^m = stamp duty in dollars that a home buyer has to pay on the maximum house value the home buyer is able to purchase given wealth level

Equation (3) can also be expressed as

$$(V_w^m + s_w^m) = \frac{W}{(1-\alpha^m)} \tag{4}$$

In equation (4), the left-hand side of the equation is unknown. The right-hand side contains known values.

The downpayment constraint is binding under the following conditions:

$$(V_w^m + s_w^m) < (\hat{V} + \hat{s}) \tag{5}$$

where $\hat{V}$ is the home buyer's imputed house value using the house value regression and is the amount of stamp duty in dollars that the home buyer would have to pay in order to purchase a property that is valued at $\hat{V}$.

Substituting (4) into (5), the downpayment constraint is binding when

$$\frac{W}{(1-\alpha^m)} < (\hat{V} + \hat{s}) \tag{6}$$

Repayment constraint

The product of the multiple and a home buyer's income level determines the maximum levels of repayment that the home buyer can afford, that is,

$$\sigma Y = \alpha^m \cdot V_y^m \tag{7}$$

where

Y = after-tax income of home buyer

σ = loan advance-to-income multiple (determined from major banks' mortgage repayment calculators)

α^m = maximum LVR = 0.9

V_y^m = maximum house value a home buyer is able to purchase given income level (unknown)

Equation (7) can also be expressed as

$$V_y^m = \frac{\sigma Y}{\alpha^m} \tag{8}$$

In equation (8), the left-hand side of the equation is unknown. The right-hand side contains known values.

The repayment constraint is binding under the following conditions:

$$V_y^m < (\hat{V} + \hat{s}) \tag{9}$$

where $\hat{V}$ is the home buyer's imputed house value using the house value regression and is the amount of stamp duty in dollars that the home buyer would have to pay in order to purchase a property that is valued at $\hat{V}$.

Substituting (8) into (9), the downpayment constraint is binding when

$$\frac{\sigma Y}{\alpha^m} < \hat{V} \tag{10}$$

Replacement rate

In the model, the replacement rate is specifically computed as the ratio of disposable income while unwaged to disposable income while in paid work. The higher the replacement rate is, the weaker the financial incentive to be in paid employment. The replacement rate formula is

$$RR_i = Y_i^u / Y_i^w \tag{11}$$

where

i indexes individuals

RR = replacement rate

Y_i^u = income unit disposable income of individual i while s/he is unwaged

Y_i^w = income unit disposable income of individual i while s/he is waged or in paid work

Appendix 2: Regression models

Table A1: LVR regression, 2002-03

Explanatory variable	*Coef.*	*Std. error*	*Sig.*
Age (oldest member of income unit)	-0.015	0.001	0.000
Sole parent	-0.081	0.049	0.103
Presence of children			
Number of children aged 0-4	-0.009	0.018	0.632
Number of children aged 5-9	-0.017	0.021	0.406
Number of children aged 10-14	0.032	0.020	0.114
Country of birth (oldest member of income unit) (Australia omitted)			
Main English-speaking countries	0.069	0.034	0.046
Other countries	-0.031	0.031	0.304
Marital status (Married omitted)			
Single	-0.095	0.038	0.013
De facto	-0.062	0.039	0.116
Separated	0.064	0.058	0.268
Divorced	0.128	0.052	0.015
Widowed	0.032	0.057	0.580
Labour market history since leaving full-time education (aggregate of partners in income unit)			
Years in paid work	0.004	0.001	0.000
Education (No post-school qualifications omitted)			
One bachelor degree or higher	0.059	0.027	0.033
Two bachelor degrees or higher	0.043	0.044	0.330
One other post-school qualification	0.022	0.023	0.325
Two other post-school qualifications	-0.008	0.043	0.852
Financial proxies/variables			
Number of siblings	-0.001	0.004	0.682
Whether parents ever divorced	0.026	0.024	0.282
Early death of a parent	0.011	0.036	0.764
Median house price of 3-bedroom properties by location (in millions)	0.496	0.119	0.000
Net non-housing liquid wealth (in ’00,000s)	-0.010	0.003	0.001
Gross income (in ’00,000s)	-0.032	0.028	0.249
Constant	1.118	0.064	0.000
Sigma	0.360	0.008	
Diagnostics			
Sample	1,380		
Left-censored observations	244		
Uncensored observations	1,136		
LR Chi2	406.87		0.000

Source: Authors’ own calculations from confidentialised unit record files of the HILDA Survey wave 2

Table A2: House value regression, 2002-03

Explanatory variable	*Coef.*	*Std. Error*	*Sig.*
Constant	6.804	0.338	0.000
Age (oldest member of income unit)			
Log of age	0.003	0.001	0.031
Gender (oldest member of income unit)			
Female	0.072	0.029	0.012
Country of birth (oldest member of income unit) (Australia omitted)			
Main English-speaking countries	-0.071	0.046	0.121
Other countries	-0.013	0.040	0.741
Presence of dependent children			
Log of number of dependent children	0.023	0.036	0.523
Marital status (Married omitted)			
Single	-0.122	0.048	0.011
De facto	-0.059	0.053	0.268
Separated	0.022	0.069	0.755
Divorced	-0.119	0.060	0.047
Widowed	-0.075	0.067	0.265
Labour market history since leaving full-time education (aggregate of partners in income unit)			
Log of years in paid work	0.061	0.028	0.031
Log of years unemployed	-0.040	0.017	0.019
Education			
One bachelor degree or higher	0.208	0.038	0.000
Two bachelor degrees or higher	0.286	0.059	0.000
One other post-school qualification	0.047	0.031	0.123
Two other post-school qualifications	0.041	0.056	0.472
Financial variables			
Log of user cost	-1.653	0.133	0.000
Log of median house price of 3-bedroom properties by location	2.917	0.171	0.000
Log of gross income unit income	-0.035	0.015	0.023
Diagnostics			
Sample	2,472		
F-stat	57.601		0.000
R2	0.435		

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Table A3: Employment participation regression, 2002-03

Explanatory variables		*Males*				*Females*			
		Coef.	Std. error	Sig.	Marginal effects	Coef.	Std. error	Sig.	Marginal effects
Marital status (married omitted)									
	Single	0.402	0.070	0.000	0.094	0.323	0.069	0.000	0.101
	De facto	0.252	0.079	0.001	0.059	0.136	0.074	0.067	0.044
	Separated	-0.227	0.124	0.066	-0.065	0.148	0.105	0.158	0.048
	Divorced	-0.029	0.101	0.770	-0.008	0.262	0.087	0.003	0.081
	Widow	-0.179	0.364	0.623	-0.050	0.147	0.130	0.260	0.047
Disabled		-0.483	0.056	0.000	-0.141	-0.459	0.058	0.000	-0.165
Aboriginal		0.181	0.193	0.349	0.043	0.262	0.156	0.092	0.081
Number of children									
	Aged 0-4	0.232	0.046	0.000	0.060	-0.243	0.039	0.000	-0.081
	Aged 5-9	0.135	0.047	0.004	0.035	0.096	0.040	0.015	0.032
	Aged 10-14	0.241	0.047	0.000	0.063	0.146	0.039	0.000	0.049
Highest qualification (Year 11 or below omitted)									
	Postgraduate	0.402	0.137	0.003	0.086	0.789	0.180	0.000	0.196
	Graduate diploma or graduate certificate	0.491	0.140	0.000	0.101	0.830	0.122	0.000	0.209
	Bachelor degree	0.460	0.090	0.000	0.100	0.511	0.074	0.000	0.150
	Advanced diploma or diploma	0.276	0.093	0.003	0.064	0.358	0.080	0.000	0.109
	Certificate III or IV	0.147	0.061	0.016	0.037	0.274	0.071	0.000	0.086
	Certificate I or II	0.456	0.224	0.042	0.094	0.113	0.158	0.475	0.036
	Certificate not defined	0.226	0.399	0.571	0.052	0.233	0.242	0.335	0.072
	Year 12	0.343	0.082	0.000	0.078	0.351	0.066	0.000	0.108
Labour market history									
	Time unemployed as a percentage of time since leaving full-time education	-0.003	0.002	0.083	-0.001	-0.014	0.002	0.000	-0.005
	Time not in the labour force as a percentage of time since leaving full-time education	-0.014	0.002	0.000	-0.004	-0.019	0.001	0.000	-0.006
English proficiency (speaks									

Explanatory variables		*Males*				*Females*			
only English at home omitted)									
	Good	-0.207	0.080	0.009	-0.058	-0.152	0.074	0.039	-0.053
	Poor	-0.484	0.178	0.007	-0.151	-1.060	0.176	0.000	-0.403
Location (Sydney omitted)									
	Rest of New South Wales	-0.050	0.089	0.576	-0.013	0.060	0.083	0.466	0.020
	Melbourne	0.077	0.086	0.368	0.020	0.128	0.078	0.101	0.042
	Rest of Victoria	-0.140	0.103	0.175	-0.038	0.016	0.096	0.863	0.005
	Brisbane	0.051	0.103	0.623	0.013	0.095	0.092	0.302	0.031
	Rest of Queensland	-0.008	0.095	0.929	-0.002	0.110	0.087	0.202	0.036
	Adelaide	0.107	0.113	0.343	0.027	-0.012	0.106	0.910	-0.004
	Rest of South Australia	-0.435	0.139	0.002	-0.133	-0.073	0.134	0.586	-0.025
	Perth	-0.015	0.108	0.888	-0.004	0.114	0.101	0.260	0.037
	Rest of Western Australia	-0.222	0.147	0.129	-0.063	-0.178	0.137	0.193	-0.062
	Tasmania	-0.104	0.141	0.460	-0.028	0.292	0.142	0.039	0.089
	Northern Territory	-0.004	0.307	0.990	-0.001	0.522	0.313	0.095	0.145
	Australian Capital Territory	0.185	0.221	0.402	0.044	0.309	0.197	0.117	0.094
2001-02 replacement rate		-0.018	0.001	0.000	-0.005	-0.010	0.001	0.000	-0.003
Constant		1.234	0.088	0.000		1.205	0.078	0.000	
Diagnostics									
	Sample	4,585				4,812			
	LR Chi2	1,353.33		0.000		1,845.74		0.000	
	Pseudo-R2	0.271				0.303			

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

Table A4: Household market rent regression, 2002-03

Explanatory variable		*Coef.*	*Std. error*	*Sig.*
Constant		5.920	0.063	0.000
Number of persons in household				
	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
Location (Sydney omitted)				
	Rest of New South Wales	-0.159	0.048	0.001
	Melbourne	-0.193	0.035	0.000
	Rest of Victoria	-0.430	0.059	0.000

Explanatory variable		*Coef.*	*Std. error*	*Sig.*
	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 (major cities omitted)				
	Inner region	-0.085	0.040	0.033
	Outer region	-0.187	0.049	0.000
	Remote	-0.082	0.115	0.475
Number of bedrooms (One omitted)				
	Zero	-0.102	0.131	0.437
	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 (Separate house omitted)				
	Semi-detached/row or terrace house/town house-one storey	0.059	0.040	0.142
	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 (Very good omitted)				
	Good	-0.081	0.029	0.005
	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 Quintile of Index of education and occupation		0.044	0.004	0.000
Diagnostics				
	Sample	1492		
	Adjusted R-square	0.440		
	F	30.346		0.000

Source: Authors' own calculations from confidentialised unit record files of the HILDA Survey wave 2

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