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The dynamics of housing affordability: movements in and out of housing affordability stress 2001–2006

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ACRONYMS

AHURI	Australian Housing and Urban Research Institute Ltd.
CRA	Commonwealth Rent Assistance
DSP	Disability Support Pension
FaCHSIA	Department of Families, Community Services, Housing and Indigenous Affairs
HAR	Housing affordability ratio
HILDA	Household, Income and Labour Dynamics in Australia
LVR	Loan to Value Ratio
MIAESR	Melbourne Institute of Applied Economic and Social Research
NRAS	National Rental Affordability Scheme
NRV3	AHURI national research venture
SIHC	Survey of Income and Housing Costs
SLID	Survey of Labour and Income Dynamics

EXECUTIVE SUMMARY

This project investigates the dynamics of housing affordability in Australia over the period 2001–06 by tracking the housing affordability trajectories of a nationally representative sample of Australians across a period of six years, using the Household, Income and Labour Dynamics in Australia (HILDA) Survey. This project provides important information for the formulation and design of policies that aim to improve housing affordability in Australia. The key research questions of this project are:

- Has housing affordability stress increased over the period 2001–06? Are there differences by socio-demographic characteristics, such as tenure, geography, household type and age etc.?
- What is the number of households moving in and out of housing affordability stress over time in different housing tenures?
- Is housing affordability stress transient or persistent, that is, do those who escape housing affordability stress successfully stay out of housing affordability stress, and do those who drop into housing affordability stress remain in or shed this affordability status in subsequent years? Are there differences by socio-demographic characteristics such as tenure, geography, household type and age etc.?
- What are the key factors that cause those in housing affordability stress to escape it?
- What are the key factors that result in those in affordable housing falling into housing affordability stress?

The panel nature of the HILDA data is exploited in order to track each individual's housing affordability stress trajectory over a six-year period. The ability to observe each individual or socio-demographic group's housing affordability stress pattern over time allows analysis of whether housing affordability stress is persistent or transient. This is a key question for policy-makers because if housing affordability stress is typically a temporary state, there is less reason to regard housing affordability stress as a cause of policy concern.

Our panel analyses of housing consumers between 2001 and 2006 demonstrate that:

- Most Australians in housing affordability stress escape within a year. However, there is a 'hard core'– albeit small in number – for whom housing affordability stress is a more permanent feature. Among those exiting unaffordable housing circumstances there is a high chance of return.
- Most Australians already in affordable housing in 2001 tend to survive in affordable housing over a spell of five or so years. A minority do drop into housing affordability stress but manage to quickly climb back into affordable housing.

We find that employment, the presence of children, mortgage equity withdrawal and residential moves are particularly important factors shaping the dynamics of affordable housing:

- Those with no earnings are more prone to persistent housing affordability stress;
- Owner-purchasers are less likely to survive in affordable housing and large numbers were adding to mortgages over the period 2001–2006 in order to cash in some of their housing equity;

- Residential moves made during spells living in unaffordable housing tend to alleviate housing cost burdens because such households trade down in the housing market. Renters are much more likely to move and hence they have better chances of escaping housing affordability stress than home buyers, who tend to be less mobile;
- Residential moves made by households during a spell living in affordable housing are associated with the onset of housing affordability stress because these moves tend to involve trading up in the housing market;
- Precarious housing affordability circumstances are particularly evident among younger couples with dependent children, a stage in the life cycle that is associated with pressing spending needs.

Overall, it is fair to say that only a minority experiences housing affordability stress on what seems to be a long-term basis. These are typically the unemployed and non-participants in the labour force; their housing affordability problems appear chronic and warrant long-term support and assistance if their position is to be alleviated. However, among the group that quickly escapes housing affordability stress a surprisingly large number churn in and out of unaffordable housing.

There are several important future research directions that are flagged by the findings of this report:

- We need to gain a good understanding of why improvements in housing affordability tend to be temporary for a sizeable number of Australians who escape housing affordability stress;
- The significance of residential moves by stressed Australians needs to be further explored, such as whether they are accommodating housing cost burdens by trading down into housing of low standards and inferior location, given household type and size;
- New methods need to be developed that will allow longitudinal analysis to be conducted, using a housing affordability stress measure that incorporates the income constraint in the housing affordability stress definition;
- Further insight could be offered by a decomposition of the housing cost and income changes that accompany movements into and out of housing affordability.

There is a suggestion in our findings that young Australian couples are trading in house price gains and banking on future growth in earnings and house prices to ‘see them through’ in the medium to long term. It now looks as if home owners will face a prolonged period of house price slump, and a rapidly deteriorating labour market will leave some of these couples with reduced incomes, negative equity and large mortgages. Federal and State Governments should now be considering blueprints of policy interventions that could be introduced in the event that housing stress for large numbers of home buyers is transformed into an even more serious predicament that threatens their continued home ownership. These policy interventions can be grouped into two categories: first there are debt-based solutions that involve assistance with repayments, either through financial institutions granting deferral of mortgage repayments, or governments extending financial assistance in the form of direct subsidies. The second group of policy interventions are equity-based solutions, such as shared ownership, equity loans that would allow home buyers to trade in some share of future price appreciation for lower current repayments, or home equity insurance programs that offer some protection of housing equity based on regional or neighbourhood house price indices.

1 INTRODUCTION

1.1 Background

This project investigates the dynamics of housing affordability in Australia over the period 2001–06 by tracking the housing affordability trajectories of a nationally representative sample of Australians across a period of six years. Long-run trends in housing affordability from the Australian Bureau of Statistics' Survey of Income and Housing Costs (SIHC) indicate that housing affordability in Australia has been deteriorating over the 20-year period 1982–2002. Table 1 reports the long-run median net housing affordability ratios (HARs), defined as median net household housing costs as a proportion of median gross household income, for owner-purchasers and private renters. The table shows that for owner-purchasers, net HARs have increased by approximately one-third, from 11.5 per cent to 15 per cent, over the 20-year period. Private renters also experienced a rise in net HARs, though this increase is more moderate. Their housing cost burden nevertheless remains higher (at 19.7% in 2002) than that of owner-purchasers (15.0% in 2002).

Not only has the housing affordability position of the typical owner-purchaser and private renter in Australia worsened in the long-run, the proportion of the population in housing affordability stress (henceforth 'housing stress') – those whose net housing costs exceed 30 per cent of gross household income – has also increased markedly. Table 2 indicates that the number of stressed owner-purchasers has more than doubled over the period from 168000 to 368000 households. This represents an increase in the incidence of housing stress from 10 per cent to 15 per cent of all households. Similarly, the number of private renters in housing stress has almost doubled over the period, though the incidence of housing stress has remained relatively constant in the case of private renters.

Table 1: Median net housing affordability ratio (HAR)[a] of households, by housing tenure, 1982-2002, per cent

Net HAR	*1982*	*1990*	*1996*	*2000*	*2002*
Owner-purchasers	11.5	16.7	16.9	15.1	15.0
Private renters	16.6	n.a.[b]	19.2	19.5	19.7

Source: 1982 SIHC, 1990 SIHC, 1996 SIHC, 2000 SIHC, 2002 SIHC

Notes:

a. Owner-purchasers' and private renters' net housing costs are mortgage repayments and rent net of Commonwealth Rent Assistance (CRA) entitlements respectively.

b. CRA entitlements are computed using the AHURI-3M tax-benefit simulator, which is operationalised using the SIHC. The tax-benefit simulator has not been coded for the year 1990. Hence, 1990 net housing costs for private renters are not available.

Table 2: Number and per cent of households[a] with net housing costs[b] exceeding 30% of gross household income, by housing tenure, 1982–2002

	1982	*1990*	*1996*	*2000*	*2002*
Owner-purchasers					
Number ('000s)	168	325	319	359	368
Per cent	9.6	18.1	16.6	15.2	14.6
Private renters					
Number ('000s)	212	n.a.[c]	287	329	362
Per cent	19.9	n.a.[a]	19.0	20.1	20.3

Source: 1982 SIHC, 1990 SIHC, 1996 SIHC, 2000 SIHC, 2002 SIHC

Notes:

a. Population estimates are generated using population weights in the SIHC.

b. Owner-purchasers' and private renters' net housing costs are mortgage repayments and rent net of Commonwealth Rent Assistance (CRA) entitlements respectively.

c. CRA entitlements are computed using the AHURI-3M tax-benefit simulator which is operationalised using the SIHC. The tax-benefit simulator has not been coded up for the year 1990. Hence, 1990 net housing costs for private renters are not available.

Given the decline in housing affordability in Australia over the last 20 years and the recent sharp increases in house prices and rents, housing affordability has become a key policy concern that is receiving overdue attention. The National Affordable Housing Agreement provides the framework for the Federal and State governments to work together to improve housing affordable outcomes in Australia. The overall objective of the Agreement is to enable all Australians to have access to affordable, safe and sustainable housing that would improve social and economic participation. Key outcomes as laid out in the Agreement include enabling Australians to rent housing that is suitable for their needs, assisting people into affordable home ownership, improving access to housing, improving the housing circumstances of Indigenous Australians and helping the homeless to achieve sustainable housing (Council of Australian Governments, 2009). In an effort to ease the housing cost burdens of low to moderate income private renters, the Federal Government has recently introduced the National Rental Affordability Scheme (NRAS) to stimulate the supply of private rental housing stock by providing tax credits to owners of new dwellings who are willing to lease these dwellings at rents that are 20 per cent below the market rate for ten years. Against this policy background our research project explores a dimension of housing affordability that has received little attention – the dynamics of housing affordability.

1.2 Aims, key research questions and methods

1.2.1 Aims and key research questions

This project provides important information for the formulation and design of policies that aim to improve housing affordability in Australia. We will survey patterns of housing stress across the Australian population over the period 2001–06 and uncover factors associated with movements in and out of housing stress using a nationally representative panel data set that contains a myriad of socio-demographic, housing, income and labour market variables, the Household, Income and Labour Dynamics in Australia (HILDA) Survey. In particular, we will address the following research questions:

- Has housing stress increased over the period 2001–06? Are there differences by socio-demographic characteristics, such as tenure, geography, household type and age etc.?
- What is the number of households moving in and out of housing stress over time in different housing tenures?
- Is housing stress transient or persistent, that is, do those who escape housing stress successfully stay out of housing stress, and do those who drop into housing stress remain in or shed this affordability status in subsequent years? Are there differences by socio-demographic characteristics, such as tenure, geography household type and age etc.?
- What are the key factors that cause those in housing stress to escape from housing stress?
- What are the key factors that result in those in affordable housing falling into housing stress?

This project builds on AHURI's national research venture (NRV3), which examined the persistence of housing affordability problems over a three-year period using data from the first three waves of the longitudinal Household, Income and Labour Dynamics Australia (HILDA) Survey. NRV3 findings indicate that 1.2 million households (or 15.8% of all households) in Australia paid 30 per cent or more of gross income in meeting housing costs over the period analysed. NRV3 also found housing affordability problems are protracted rather than transient problems. This project will analyse movements in and out of housing stress over six, rather than three years, using all six available waves of the HILDA Survey. The research findings of this study will inform policy development in several critical areas. First, the findings will provide policy-makers with information on the extent, persistence and recurrence of housing stress. Furthermore, the findings will enable policy-makers to distinguish between temporary and permanent spells of housing stress and determine how policy measures might be tailored to address temporary and permanent spells. The dynamic nature of the analysis will inform policy-makers about the events causing housing consumers to escape from housing stress or fall into housing stress by placing events in a temporal order, such that movements of the same person into or out of housing stress can be observed and correlated with circumstances in preceding periods.

1.2.2 Methods

The two key methods employed in this project are microsimulation and panel modelling. The AHURI-3M tax-benefit simulator which is operationalised using the HILDA Survey is a model containing detailed tax, benefit and housing assistance parameters for each of the years from 2001–06. The simulator has a critical function in the context of housing affordability studies - it facilitates the computation of CRA entitlements for each private renter household using a detailed set of socio-demographic characteristics including household type, number of dependents, rent paid, private income and government benefit type. This allows the computation of housing stress measures taking CRA into account.

The panel nature of the data will be exploited in order to track each individual's housing stress trajectory over a six-year period. For an individual observed to be in housing stress in 2001, we will be able to examine the shape of the individual's housing stress trajectory. For example, we will observe whether owner-purchasers in housing stress in 2001 are likely to remain in housing stress over the entire study period, or whether they are likely to escape housing stress quickly within the period. Conversely, we will look at whether owner-purchasers in affordable housing in 2001 are likely to stay in affordable housing. The ability to observe each individual or socio-

demographic group's housing stress pattern over time allows analysis of whether housing stress is persistent or transient. This is key question for policy-makers because if housing stress is typically a temporary state there is less reason to regard housing stress as a cause of policy concern. Panel modelling will be used to estimate the probability of movements in and out of housing stress as a function of housing consumers' socio-economic, demographic and geographical characteristics in order to measure the impacts of housing consumers' characteristics on housing affordability positions.

1.3 Literature Review

This section presents an overview of the existing Australian and overseas literature on the dynamics of housing affordability. It will examine the methods that have been employed by other studies to investigate housing affordability issues and their key findings. Additionally, the literature review will identify key research and policy questions that have not been adequately addressed in previous studies.

For some time now there has existed a plethora of studies that have investigated the incidence of housing affordability and its trends through time using repeated cross-sectional data. Overseas examples include Green (1996), a study that measured housing affordability in the United States using the 1980 and 1990 Census and Quigley and Raphael (2004), that employed the data from the American Community Survey to investigate trends in housing affordability over the period 1960–2000. In Australia, Yates and Gabriel (2006) use the Survey of Income and Housing Costs (SIHC) to examine housing affordability over the period 1995-2003, while studies such as those by Wood, Watson and Flatau (2006) and Dalton and Ong (2007) have used the SIHC to examine the impacts of alternative policy reforms on housing affordability outcomes.

However, there have been few studies that examine whether individuals' housing affordability problems are transient or persistent. In Australia this has been primarily due to the lack of longitudinal data that would allow researchers to track a panel of individuals through time so that they could measure whether the duration of spells of housing stress experienced by these individuals were persistent or transient. Overseas longitudinal data are more widely available; longitudinal research by housing researchers has typically focused on residential mobility and housing careers, and how tenure transitions are intertwined with phases in the life course, instead of the dynamics of housing affordability. Examples from the United States include Pickles and Davies (1985; 1986) and Clark, Deurloo and Dieleman (2003), which used the Panel Study of Income Dynamics. Studies from the United Kingdom include Andrew and Meen (2003) and Andrew (2004), using the British Household Panel Survey.

The release of the longitudinal HILDA Survey allows researchers to explore the issue of persistence in Australia. Recently, two studies have investigated issues relating to both the incidence and persistence of housing stress using the HILDA Survey. Marks and Sedgwick (2008) conducted an Australian study that examined the incidence and persistence of housing stress over the period 2001-06 using the HILDA Survey Waves 1 to 6. To calculate the incidence of housing stress, the study presented estimates of such stress (housing costs in excess of 30 per cent of gross household income) in each of the years after the first experience. The study found that the incidence of housing stress increased marginally in the total sample over the period of analysis, but more so for owners, with a discernible jump in stress between 2005 and 2006. The study reported the surprising finding that housing stress has actually fallen among households in the lowest income decile (defined using equivalised disposable

income), and increased among the higher income quartiles. It was suggested that mortgage borrowing might be partly responsible for this situation among higher income owners. The study assessed the persistence of housing stress by estimating the percentage of individuals in housing stress in a particular year who are also in housing stress one or several years later. The study found that the persistence of housing stress was lower than expected; among those in housing stress in 2001, less than half were in housing stress in 2002, approximately 40 per cent in 2003 and 35 per cent in 2006. Persistence in housing stress was found to be higher among renters than owners, although the same pattern of declining persistence was evidenced as time passed.

While Marks and Sedgwick's (2008) focus on persistence is a novel and important one from an academic and policy perspective, the rigour of its findings is affected by several drawbacks. The study did not make clear how housing costs and income were calculated when providing estimates on an 'individual' basis, and whether the housing costs of renters were net of rent assistance. Nor did the study indicate whether it was using a balanced panel. A balanced panel tracks individuals who responded in all waves of the study period; it excludes those who did not respond during one or more waves, and is not replenished by the addition of new entrants into the survey or persons who achieved independence during the period studied. If the study did use a balanced panel, then its persistence measures would confound life cycle effects with the role of interest rate, house price, rent and income variables in shaping housing stress. Furthermore, the persistence measure may not have accounted for churning in and out of housing stress.

Using data from the 2002–03 SIHC, Yates and Gabriel's (2006) NRV3 study showed that, of the 7.6 million households in Australia, 1.2 million or 15.8 per cent were in housing stress (paid 30% or more of gross household income in meeting their housing costs) in 2002–03. Analysis of the persistence of housing stress was carried out using a balanced panel of the HILDA Survey Waves 1–3, that is, a panel consisting of individuals who responded in all three waves. The study tracked individuals over time but computed housing cost and income estimates using a household measure.[1] The study found that one-half of Australians in housing stress in a particular year would still be in housing stress in the following year; one-third would still be in housing stress in the two following years. The study concluded that housing stress was a protracted rather than transient problem.

Because individuals move between households over time, the study selected only one person in each Wave 1 household and measured housing affordability outcomes for the household in which s/he resided in each wave. This might have resulted in sample bias as not all households will have been tracked through time; shrinking households due to departures (because of events such as divorce or separation) will be under-represented. Yates and Gabriel (2006) also compute CRA entitlements by assuming that when eligible a household receives the maximum rate of CRA available for its particular household type, regardless of how much rent it paid. This approach is likely to under-estimate net housing costs because not all private renter households receive the maximum rate of CRA.

Engeland, Figueroa, Rea and Yuen (2008) used a balanced panel from the Survey of Labour and Income Dynamics (SLID) to investigate housing affordability dynamics in Canada over the period 2002–04. Like Yates and Gabriel, the researchers tracked

[1] A household is in housing stress if paying at least 30% of gross household income in housing costs.

individuals while measuring housing stress on a household basis.[2] It was reported that 28 per cent of Canadians were in housing stress at some point during 2002–04. Among these, almost one third were in housing stress in all three years, an estimate that is similar to the Australian findings of Yates and Gabriel (2006).

The Canadian study goes beyond the descriptive analyses of the two Australian studies by estimating two regression models to uncover the causal impacts of varying socio-economic characteristics on the probability of being observed to be suffering housing stress. Their first regression model estimated the probability of a Canadian suffering housing stress in at least one year of the study period; the second model targeted the issue of persistence by estimating the probability of a Canadian suffering housing stress in all three years of the study period. Individuals living alone, female sole parents, renters, immigrants and residents of Vancouver or Toronto were estimated to have a higher probability of being in housing stress at some point, or persistently, during the three-year period. Additionally, individuals who had experienced a change in household structure, moved into another place of residence, or another tenure also had a higher probability of being in housing stress at one time or another during 2002–04. Unlike Yates and Gabriel (2006), Engeland et al (2008) track all individuals in a household. However, Engeland et al (2008) exclude individuals belonging to group households from their analysis.

To our knowledge, there has been no previous Australian study that has undertaken regression modelling to identify causal factors associated with movements in and out of housing stress. This project attempts to extend the study of housing affordability dynamics in Australia by modelling the key factors that cause movements into and out of housing stress. This project also attempts, through its sampling and modelling approaches, to address certain methodological weaknesses in previous studies e.g. the exclusion of certain individuals from analysis and the use of maximum rates of rent assistance in the calculation of housing affordability measures. Details of the methods we have employed are explained in Chapter 2.

1.4 Scope of report

We begin in Chapter 2 with a detailed explanation of the methods used to frame the sample for analysis. A difficult issue associated with the use of panel data sets is attrition, that is, some individuals are not interviewed in all waves because they refuse to be interviewed, had died or could not be tracked by the interviewers because they had changed address or moved overseas. We conduct an examination of the extent of attrition in our sample and the potential impacts of attrition on the accuracy of our findings. We also address the issue of missing values, that is, cases where an individual is interviewed but refuses to provide an answer to certain questions posed by the interviewers. Various methods are used to impute a variable's value when missing, in order to minimise loss of sample numbers. In this chapter we also describe the measurement of housing costs (net of housing assistance entitlements, income and housing affordability estimates such as HARs), the percentage of persons in housing stress, and the probability of escaping from or falling into housing stress, using what is commonly known as a hazard rate approach.

Chapter 3 presents descriptive statistics designed to address the first three key research questions in section 1.2 above.

[2] Like Yates and Gabriel (2006), Engeland et al. (2008) also define a household as being in housing stress if paying at least 30% of gross household income in housing costs.

Chapter 4 presents results from panel models that uncover key factors that cause individuals in housing stress to escape from housing stress, and those that result in individuals in affordable housing falling into housing stress.

Chapter 5 concludes by summarising the key findings, potential policy implications and directions for future research.

2 METHOD

2.1 A sample design – the attribution approach

Longitudinal studies are typically more complicated than their cross-section counterparts. The latter offer a snapshot of a sample of individuals (or firms etc.) at a point in time. With longitudinal studies we track a sample of individuals over time; such an approach raises difficult issues of method that we address in this chapter.

Sample design defines:

- The units of measurement and analysis, and
- Rules for the inclusion or exclusion of units

We have used the *attribution approach* to sample design for panel data sets – in the present context this means that we track the housing affordability position of adult persons, but measure their housing affordability position on an income unit basis.[3] At the start of the data collection period – Wave 1(2001) – there are 12612 responding independent adults in HILDA that could be tracked through to Wave 6 (2006). To illustrate the measurement approach, consider an income unit made up of the couple John and Kate, who have a six-year-old daughter Carol, and are home purchasers in Wave 1. The daughter is not an adult and is therefore not included in the sample frame, though both John and Kate are included. Their housing affordability position is calculated by measuring their combined income, and calculating mortgage repayments as a percentage of their combined income (the Housing Affordability Ratio). Both John and Kate enter the sample and each has the same Housing Affordability Ratio (HAR). The sample for analysis is persons, and the rate of housing stress, for example, is the percentage of all persons with HARs in excess of 30 per cent. The attribution approach uses persons as the unit of analysis, but the income unit (that the person belongs to) as the unit of measurement. In cross tabulations by tenure, for example, both John and Kate would enter the sample as home purchasers, and if cross tabulation were by household type, they would each be classified as 'couple with children'. Note that in the latter case the total sample number is not households or income units, but persons – so if there are three couples like John and Kate and four singles living alone in the sample, the sample size is 10 (3x2 + 4) persons, not seven income units.

The sample design is complicated by the break-up of couples, the formation of new married or de facto couples, new persons joining income units and Wave 1 dependents that subsequently become independents during the data collection period. If, for example, John and Kate were to divorce in Wave 4 they would both be retained in the sample. With the attribution approach the sample size remains unchanged, but because John and Kate now form separate income units they will no longer share the same housing affordability measure. If John or Kate form an income unit with another adult (not present in the Wave 1 sample), that adult is not added to the sample, but their income is included for the purposes of calculating housing affordability.

[3] Yates and Gabriel's (2006) housing affordability analysis is conducted on a household basis. The income unit is chosen as the unit of housing affordability measurement here because important variables that affect housing affordability, such as Commonwealth Rent Assistance and Family Tax Benefit, are measured on an income unit basis. Most households in 2006 (87%) contain only one income unit and so the choice of income unit versus household does not affect the measurement of variables in the vast majority of cases.

The formation of new couple relationships typically involves a single adult (say Sally), who subsequent to Wave 1 marries (say Ben) or forms a de facto relationship. Typically Ben was not a member of the Wave 1 responding sample. Our approach was to omit Ben from the sample design, though his income was taken into account in calculating Sally's housing affordability status from the wave in which they married or formed a de facto relationship onwards.

There are 1136 persons who were dependents in Wave 1, but subsequently became independent. The 719 independents who stayed in the household they had previously occupied as a dependent were added to the sample frame from the wave/year in which they became an independent income unit. Because they are a separate income unit their housing affordability position is calculated separately from that of the other income unit(s) that occupy the same household.[4] There are 417 independents that move out and form a separate household on achieving independence. Once again, these independents are added to the sample from the wave/year that independence is attained. Housing affordability measures are calculated on an income unit basis; if on forming a new household the person also becomes partnered, their partner's income is taken into account in calculating housing affordability.[5] Finally, there is a small number (106) who achieve independence but then return to their dependent status before the end of the study period. This churning complicates sample design and increases data processing requirements. In view of the small number of such persons, and the resource cost associated with inclusion, they have been omitted from the sample design.

A number of groups included in the sample design warrant discussion because similar studies have omitted them (see, in particular, CMHC, January 2008):

- Persons with zero housing costs are included; this could be because the person lives in employer-provided housing. A wage discount may eventuate and this could be interpreted as an effective housing cost for those living in employer-provided housing. Wage equations have been estimated and if the hypothesis has been confirmed, Wage equations have been estimated and if the hypothesis has been confirmed, the estimates have been used to impute an effective housing cost.[6]
- Persons residing in group households – that is dwellings occupied by two or more unrelated income units – are included. Their exclusion might be justified on the grounds that rent must be apportioned using arbitrary criteria. On the other hand, group sharing is a potentially important way for singles to economise on housing costs. By sharing, singles can gain some of the economies of scale in housing consumption and specialization that couples are able to exploit (Lehrer, 2003; Lupton and Smith, 2003; Zagorsky, 2005).

Three groups have been omitted:

- Those persons belonging to income units with zero or negative gross or disposable incomes. Typically, these outcomes are the result of tax minimisation strategies or temporary losses from self-employment that disguise underlying financial positions. We follow Buddelmeyer and Verick (2008) who omit these

[4] In practice these independent income units are adult sons and daughters living 'rent free' with their parents. Treatment of income units living 'rent free' is discussed in more detail below.

[5] But their partner is not added to the sample unless they happened to be members of the wave 1 sample frame.

[6] The approach involves adding a rent-free dummy that equals 1, if housing is part of job compensation, zero otherwise, to the right-hand side of wage equations. The estimated coefficient is used to compute person-specific effective housing costs. The wage equation has a log linear specification.

persons from their study of poverty dynamics because their underlying financial position is not transparent.

- → Those living in nursing homes (and other institutions) are excluded. It is not possible to observe the housing costs of residents of non-private dwellings who report that they are home owners. For residents of non-private dwellings who report that they are renters, reported housing costs may include board as well as accommodation.
- → Of more concern is the enforced omission of boarders, whose housing costs cannot be identified in HILDA, and the primary homeless – the latter a common exclusion because sampling frames are typically address-based. These groups may well be more vulnerable to housing affordability problems when housed, and these problems may contribute to transitions into and out of homelessness and boarding accommodation (Jope, 2000). Our measures and analyses are then subject to a caveat; certain groups prone to housing stress are not adequately represented in our sample.

Table 3 describes the sample design. There are 13748 responding adults in Wave 1; with the exclusion of boarders and others where tenure cannot be identified; 'churning' dependents; and income units with zero or negative incomes, the final Wave 1 sample is 11334.

Table 3: Composition of the sample (persons in responding income units only)[a]

	Number of persons
Independents in Wave 1:	
In private non-group households in all waves	10705
In private group households in all waves	1822
In non-group households in non-private dwellings in at least one wave	65
In group households in non-private dwellings in at least one wave	20
Dependents in Wave 1 who become independents	1136
Sub-total	13748
Excluding:[b]	
Boarders, residents of non-private dwellings and persons in unidentified tenures in at least one wave	1169
Independents in Wave j who become dependents in Wave j+i	272
Persons with zero or negative gross or disposable income unit incomes in at least one wave	1520
Total sample	***11334***

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Notes:

a. For couples, responding income units are income units in which both the reference person and partner have agreed to be interviewed.

b. Groups are not mutually exclusive e.g. a person in an unidentified tenure could also have zero or negative incomes.

2.2 Attrition

A robust panel design is a balanced one in which each person is successfully re-interviewed in each subsequent wave of the data collection period. This is rarely achieved in social science panel studies. It is typical to encounter difficulties in

tracking persons, particularly those who move; and there will be others who subsequently refuse interview in one or more waves.

This problem is referred to as attrition. Of the 11334 persons who agreed to be interviewed in Wave 1 or agreed to be interviewed on achieving independence in a subsequent wave, there are 7217 (64%) who continue in the panel through Waves 1 to 6; on the other hand there is attrition of 4117 (36%) persons who either refused interview in one or more waves, or could not be contacted in one or more waves. Nearly 50 per cent of the attrition sample failed to be interviewed in only one or two waves
(see Table 4).

Table 4: Number of occasions when persons were unsuccessfully interviewed

	Unsuccessfully interviewed in					
	One Wave	***Two Waves***	***Three Waves***	***Four Waves***	***Five Waves***	***Total***
Number of persons	1155	725	680	621	936	4117
% of attrition sample	28.1	17.6	16.5	15.1	22.7	100.0

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

If the attrition sample of 4117 constitutes a 'random draw' from the Wave 1 sample frame tit does not pose a serious concern for the empirical analysis, as the sample will remain as representative of the population as the Wave 1 sample. In these circumstances attrition only poses problems when sample numbers are whittled down to levels that cannot support robust statistical hypothesis testing. In comparing the attrition and non-attrition sample on a number of key Wave 1 individual and household[7] characteristics, which measure stage in the life cycle, gender, location, household type, marital status and labour market history, we find that persons particularly prone to attrition were marginally younger, lived in cities, were single, Indigenous and not working when the data collection began. Those less prone to attrition are female, Australian-born and were employed and living with a partner at the beginning of the panel study. Persons who had spent a longer proportion of time in paid work were also less prone to attrition. These differences are generally small, but nevertheless statistically significant at the 1 or 5 per cent level.[8] Details are available in appendix A1. These findings are cause for concern, but these this is mitigated if the chances of attrition are unrelated to housing affordability status. Table 5 examines whether attrition rates are significantly different when calculated for housing consumers in housing stress as compared to housing consumers not in housing stress in the first wave they are observed to be independent (a person is in housing stress when net housing costs exceed 30% of income). The difference in attrition rates is not statistically significant (sig. level = 0.141), which is reassuring.

[7] It should be recalled that our attribution approach uses the household (income unit) as the unit of measurement and the person as the unit of analysis. For household characteristics each adult member is included in the sample of persons, and each one is assigned the same household characteristic.

[8] The most notable difference is singles – they make up 22.1% of the sample interviewed in all six waves but 27.2% of the sample that refused to be interviewed or could not be traced in one or more waves.

Table 5: Attrition rate, by housing stress status in Wave 1, per cent

	Not in housing stress in Wave 1	*In housing stress in Wave 1*
Attrition rate (%)	36.1	38.7
N	10261	754

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Note: The sample used for analysis here is 11015 instead of the 11334 persons referred to previously, because this sample of 11015 persons excludes persons who were dependents in Wave 1.

We further examine attrition from a somewhat different vantage point; we tabulate the number of Wave 1 responding persons who are continuously present in the panel to Wave 1+j (where j = 1,2,…4). If we drop Waves 5 and 6 and analyse housing dynamics using the first four waves only, the balanced panel number increases from 7028 to 7795. One way of examining the sensitivity of our measurements to attrition involves repeating our research exercises using this shorter panel.

Appendix A1 presents descriptive analyses using two samples drawn from the first four waves of data – a sample that includes those persons that subsequently refuse interview, or could not be tracked down – and a second sample that excludes these persons. If our findings are unaffected when alternatively including and omitting the Wave 5 and 6 persons in the attrition sample, it lends some credence to our view that attrition does not matter. The descriptive analyses presented in Appendix A1 indicate that the difference in median HAR computed from the two samples is merely 0.1 percentage points. Furthermore, the difference in proportion of individuals in housing stress is also only 0.1 percentage points. Housing affordability estimates remain largely similar, even when they are computed for smaller subgroups, e.g. by gender.

Overall our investigations indicate that the attrition sample is correlated with certain socio-demographic characteristics. For example, persons particularly prone to attrition were marginally younger than the average, single, Indigenous, not working and were living in cities when the data collection began. However, an important and reassuring finding is that attrition rates are not significantly different for housing consumers in housing stress and those who occupied affordable housing. Furthermore, if we compare key estimates when alternatively including and omitting the Wave 5 and 6 attrition sample, our housing affordability estimates remain largely similar. Overall, our findings indicate that attrition is not a serious problem within the context of our analysis.

2.3 Missing values

Missing values can be a more serious problem in panel data than cross-section data. Designing a balanced panel – that is, one where all persons have a complete set of records in Waves 1–6 for the variables used in statistical analyses – requires the omission of any person and all his/her records if there is a missing value for a variable in one or more waves. This can result in a considerable drop in sample size. Table 6 illustrates using a hypothetical six-person sample where only two individuals (person D and F) in the sample have provided complete answers to interview questions in all six waves.

This is clearly unsatisfactory. An alternative method is to construct an unbalanced panel, where a person's records for a wave are included when there are no missing values, but omitted when there is a missing value. The sample size does not fall as precipitously as happens with a balanced panel design. However, unbalanced panels are prone to spurious composition effects due to the churning of persons in and out of the panel. With a balanced panel the same units are compared from wave to wave.

Changes in the mean value of a variable from wave to wave will be representative of all persons in the sample, but with an unbalanced panel changes in the mean value can be driven by differences in the composition of the panel from wave to wave. Another approach uses information in the data base to impute a value for a variable in the wave(s) when it is missing. The simplest approach is to assume that variable values are unchanged from wave to wave so that when a variable is recorded in , for example, Wave 1, but not in Wave 2, the former value is used as the estimate for Wave 2. However, there are other options and these are listed below:

Table 6: Hypothetical sample illustrating occurrences of missing values

<table>
<tr><th></th><th>Wave 1</th><th>Wave 2</th><th>Wave 3</th><th>Wave 4</th><th>Wave 5</th><th>Wave 6</th></tr>
<tr><td>Person A</td><td>Complete record</td><td>Missing data</td><td colspan="4">Complete records for the remainder of the data collection period</td></tr>
<tr><td>Person B</td><td>Complete record</td><td colspan="3">Missing data for three consecutive waves</td><td>Complete record</td><td>Complete record</td></tr>
<tr><td>Person C</td><td>Complete record</td><td>Missing data</td><td>Complete record</td><td>Missing data</td><td>Complete record</td><td>Missing data</td></tr>
<tr><td>Person D</td><td colspan="6">Complete records for all waves</td></tr>
<tr><td>Person E</td><td>Missing data</td><td colspan="5">Complete records for remaining waves</td></tr>
<tr><td>Person F</td><td colspan="6">Complete records for all waves</td></tr>
</table>

Option 1: As mentioned above, we could use the value in the immediately preceding or subsequent wave for the variable that is missing. In the case of person E in Table 6 we would use the Wave 2 value as the imputed Wave 1 value. There are time invariant variables where this procedure is clearly valid; it is less appropriate for variables whose values are volatile – house prices, for example.

Option 2: For certain key variables (e.g. market rent, earnings) that vary from year to year we have well-developed regression models that can be used to impute values. In the case of earnings, model specifications have been designed that include the human capital and other socio-economic variables typical of earnings functions. The models 'fit' the data quite well; the predicted values from such regression models are then a reasonably reliable imputed value.

Option 3: There are some variables that are time indexed, e.g. age and labour market history, where we can compute their missing values from values in earlier (or later) waves. In the case of age this is straightforward.

But variables like labour market history require extraneous information. Where a respondent is not interviewed in every wave, the HILDA data personnel have where possible, used the reported calendar of labour market activities to impute missing values. When the time in each labour market state is not covered by the reported calendar of labour market activities, it is filled in as:

- employed, if the respondent's tenure in his/her current job overlaps the entire missing period, or if they are working for the same employer as in the last interview;
- unemployed, if the respondent's current spell of unemployment overlaps the entire missing period;
- not in the labour force, if the respondent retired before the start of the missing period (MIAESR, 2008).

Only in cases where the three HILDA imputation methods mentioned above have not resolved a missing value problem, have we relied on a cruder time-indexed approach. Consider years employed since leaving full-time education. We might know that 'Mike' was employed in Wave 1 and had been employed fifteen years since leaving full time education. If the variable 'years employed since leaving full-time education' is missing in Wave 2, we can infer the correct value if the current employment status variable has been recorded in that wave.

Option 4: There are variables like 'disposable income' that we construct ourselves using AHURI-3M's tax-benefit simulator. The method involves use of reported private sources of income and application of Australian Taxation Office tax provisions and Centre Link eligibility and entitlement criteria to compute tax liabilities and Income Support Payments. But if private sources of income are missing, these methods cannot be applied. However, there are HILDA-generated variables, such as imputed disposable income, that can be used as alternative measures.

Option 5: Some variables are related to other variables in unambiguous ways. Consider 'death of a parent by age 14', a variable that we have used in other research to measure inter-generational transmission of disadvantage. There are refusals to reveal this information. But elsewhere in the survey, respondents are asked if their parents were employed when they themselves were youngsters (age 14 years). Parent employment status can then be used to rule out death of parents by this stage in their offspring's life course.

Appendix A2 gives details on how each of these options has been used to impute variable values where needed, due to missing values. In cases where none of the options resolve the missing values problem for variable x, these cases are omitted from the sample in the descriptive and modelling sections, wherever the variable x is required for analysis. For example, if none of the options resolve the missing values problem for a labour market history variable for eight persons, these persons are omitted from the sample in the descriptive and modelling sections where the labour market history variable is required for analysis. Where the labour market history variable is not required, these eight persons are retained in the sample for analysis.

2.4 Measurement of housing costs and housing affordability

Housing costs are measured on a tenure-specific basis. Owner-purchasers' housing costs are mortgage repayments. Outright owners are assumed to have zero housing costs. Though home owners incur other housing-related costs, such as water rates, property taxes and maintenance expenditure, they cannot be included in our housing cost calculations because they are not elicited in all six waves of HILDA. Private renters' housing costs are measured as rent net of Commonwealth Rent Assistance (CRA). Public renters' housing costs are estimated rebated rents. The rent-free have zero housing costs, except for rent-free persons who live in employer-provided housing as part of their job compensation. Engeland, Figueroa, Rea and Yuen (2008) make the valid point that those receiving rent-free accommodation from employers may receive lower wages than would otherwise be the case. If valid, the person 'pays' a rent in foregone earnings. We estimate wage equations for males and females in each wave using model specifications that include a rent-free dummy that equals one if housing is part of job compensation, zero otherwise. The estimated coefficient is used to compute person-specific effective housing costs. The wage equation has a log linear specification. The estimated rent-free dummy coefficient and the number and percentage of the employed who are living in rent-free employer provided housing are reported below. During the earlier waves, males pay a rent in foregone earnings, but during the later waves it seems that females are more likely to sacrifice earnings.

The rent 'paid' in foregone earnings is large, ranging from 19 per cent to 39 per cent of earnings.

Table 7: Propensity to reside in rent-free employer provided housing and impact on wage, 2001–06

	Male		***Female***	
	N (% of employed)	Impact on wage (rent free coef.)	N (% of employed)	Impact on wage (rent free coef.)
Wave 1	26 (0.7%)	-0.279**	19 (0.5%)	-0.094
Wave 2	22 (0.6%)	-0.388***	14 (0.4%)	-0.051
Wave 3	30 (0.8%)	-0.189*	23 (0.7%)	-0.249*
Wave 4	24 (0.7%)	-0.041	16 (0.5%)	-0.387**
Wave 5	38 (1.1%)	-0.001	23 (0.7%)	0.117
Wave 6	36 (1.0%)	0.042	23 (0.7%)	-0.260**

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1-6
*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

The income measure employed is equivalised disposable income. Income is equivalised using the OECD equivalence scale (1982), where a weight of 1 is assigned to the first adult member of the income unit, 0.7 to the second adult member, and 0.5 to each additional dependent child. A couple with two children is assumed to be the standard income unit, that is, for couples with two children, their equivalised income is simply equal to their reported unequivalised income. The income of all other income unit types is adjusted with reference to couples with two children as the standard income unit. To illustrate, consider the example of a sole parent with one child, whose reported unequivalised disposable income is $20,000. The sole parent has a weight of 1.5, while a couple with two children has a weight of 2.7. Hence, the sole parent's equivalised disposable income is $20,000 x 2.7/1.5 = $36,000.

The HAR is the ratio of net housing costs to equivalised disposable income. Calculations of housing costs and HARs are based on a measure of housing costs net of recurrent housing assistance (CRA) – so net HARs subtract housing assistance from gross housing costs rather than being added to income. We invoke this approach because CRA is a price subsidy – the entitlement is a function of the rent paid. It cannot be treated as an Income Support Payment as they are received regardless of how households spend their income and the prices they are charged for the goods they choose to purchase.

Cross-sectional housing affordability studies typically define a household as being in housing stress when housing costs exceed 30 per cent of income and the household is in the bottom 40 per cent of the income distribution. Examples include Landt and Bray (1997) and the cross-sectional analysis in Yates and Gabriel (2006). However, in longitudinal analysis, households are usually defined as being in housing stress when housing costs exceed 30 per cent of income, regardless of where the household lies in the income distribution the household. This is the composition of households in the bottom 40 per cent of the income distribution changes over time due to mobility across the income distribution. In their longitudinal analysis, Yates and Gabriel (2006) note that the data 'has not been constrained to households in the lowest two quintiles of an equivalised income distribution because of the complexities of defining this over time,' (p.47). Other longitudinal studies such as Marks and Sedgwick (2008) and Engeland et al (2008) also did not restrict their definition of housing stress to those in the bottom 40 per cent of the income distribution. Income mobility figures in appendix A3 confirm that there has been considerable mobility across the income distribution over the

period 2001–06. Of those in the bottom 40 per cent in 2001, around 20–25 per cent were in higher income quintiles in subsequent waves. Similarly, of those who were in the top three quintiles in 2001, 13 to 19 per cent had moved into the bottom two quintiles by subsequent waves. Clearly, such income mobility indicates that difficulties would arise in trying to restrict the definition of stressed status to low-income persons only. However, the use of all persons, regardless of income levels, has its own limitations, in that we are capturing some high-income persons who are paying high housing costs relative to their income levels because they can afford to do so.

2.4.1 Computation of income using AHURI-3M

Our disposable income measure is computed by taking reported private income and using AHURI-3M to impute income support payments and tax liabilities. Missing values in private income can result from respondents refusing to report their private income. AHURI-3M computes benefit entitlements and tax liabilities based on reported private income. Hence, AHURI-3M will not compute benefit and tax values where there are missing values in private income and/or other socio-demographic variables required for the computation of benefits and taxes. Missing values on disposable income are replaced by HILDA imputed disposable income estimates.

2.4.2 Computation of housing assistance using AHURI-3M

The two main forms of housing assistance in Australia are CRA for private renters and public housing rental rebates. Both forms of housing assistance are computed using AHURI-3M. The computation of housing assistance is a critical and novel function of AHURI-3M for two reasons. First, CRA entitlements are not reported separately in HILDA. AHURI-3M computes CRA entitlements using a detailed set of socio-demographic characteristics including private income, type of government benefit received, income unit type, number of dependent children and rent paid. Second, while public housing tenants do report their rents in the HILDA data, their reported rents do not always reflect their rebate entitlements, due to lags in the reporting of income changes to state housing authorities. Our approach addresses the problem of lags in income reporting by using a detailed set of assessable income rules from each state/territory housing authority to compute the amount of rent each public housing tenant should be paying at the time of interview. This approach also has merit because it facilitates analyses of reforms to rent-setting methods.

AHURI-3M computes CRA entitlements by using reported benefit type and private income in HILDA. Where a person reports receipt of a benefit that is a passport to CRA eligibility, for instance, Disability Support Pension (DSP), the person's DSP entitlement is computed using his/her reported private income. If the person's DSP entitlement is greater than zero, then AHURI-3M treats the person as eligible for CRA and calculates the person's CRA entitlements using the CRA rent thresholds and rates for the relevant tax-benefit year. When the standard AHURI-3M procedure is derailed by missing private income, a modified AHURI-3M procedure is employed, which bypasses the use of reported private income. Under the modified approach, where a person reports receipt of a benefit that is a passport to CRA eligibility, DSP for example, AHURI-3M immediately treats the person as eligible for CRA, then calculates the person's CRA entitlements using the CRA rent thresholds and rates for the relevant tax-benefit year.

Appendix A2 reports the percentage of private renters who are eligible for CRA using the standard and modified AHURI-3M approaches. The percentages are calculated only for private renters for whom it is possible to determine CRA eligibility using both methods, that is, private renters with no missing private income values. Under each approach, a private renter is assigned a value of one if CRA eligible, and zero

otherwise. The correlation coefficient reports the extent to which CRA eligibility under the two approaches are correlated. The coefficients are very high, ranging from 0.807 upwards, and are all statistically significant at the 1 per cent level, indicating a high correlation between CRA eligibility computed under the standard and modified AHURI-3M approaches.

For public housing tenants, AHURI-3M is employed to compute the public housing rent each public housing tenant should pay using a set of detailed assessable income rules that each state/territory housing authority employs (see Wood, Ong and Dockery 2007). Where missing income values prevent the application of state/territory housing authority income rules, a modified approach is again employed where public housing rent is computed as a proportion of reported gross or disposable income using the broader state/territory housing rules derived from the Housing Assistance Act annual reports, and state/territory public housing policy documents (see appendix A2).

Other housing cost variables have missing values. The extent and treatment of missing housing cost and income values are further detailed in Appendix A2.

3 THE MOVEMENT OF PERSONS IN AND OUT OF HOUSING AFFORDABILITY: DESCRIPTIVE STATISTICS

3.1 Introduction

An advantage of panel data is that we can analyse how housing consumers' affordability positions change over time. One dimension of time is a person's progress through the life cycle as he/she ages. Section 3.2 begins with a balanced panel of housing consumers and analyses how their housing affordability position changed over the period 2001–2006. As mortgages are repaid and incomes rise we might expect housing affordability to improve; but for much of this period interest rates were increasing, house prices were surging and these housing market factors might have been expected to outweigh the benefits that come from amortisation of loans and rising incomes.

We next ask whether the housing affordability position of adult Australians changed between 2001 and 2006. To address this question we add those dependent persons who formed new households in this timeframe, and compare the positions of individuals, holding age constant; this allows us to analyse whether persons belonging to different age groups and stages in the life cycle have experienced improvements or deterioration in housing affordability.

A key question for policy-makers is whether housing stress is transient or persistent. If housing affordability is typically a temporary state, there is little reason for housing stress to be a concern for policy-makers. For example, a finding that housing stress is commonly experienced by young persons who rent during periods when they have low incomes as they complete periods training, or who are meeting high mortgage repayments during the early years of a loan, signals transient rather than persistent housing stress. Moreover, this segment of the population that suffers housing affordability problems is not typically disadvantaged. In section 3.3 we take a hazard rate approach, common in medical research, to the persistence of housing stress. The approach forms a sample of those in housing stress in at least one year in the time frame 2001–2006, and measures the proportion who escape their first spell of housing stress in each subsequent year, if they were in housing stress in the previous year. This proportion is known as the hazard rate; the lower the hazard rate profile the more persistent is the housing stress. A steep fall in the hazard rate suggests that while many quickly 'escape' housing stress, those remaining in housing stress beyond the first year become less likely to escape as the duration of their first spells in housing stress lengthen. This is known as negative duration dependence – as a spell of housing stress lengthens it becomes more difficult to escape.

It is also of relevance for policy-makers to examine those 'at risk' of housing stress. This group of persons is formed by selecting those who experience at least one year residing in affordable housing over the period 2001–2006. We then compute the proportion of persons that 'survive' in affordable housing in each subsequent year, given that they were in affordable housing in the previous year. This proportion is known as the survival rate; the higher the survival rate profile the lower the risk of falling into housing stress. The shape of the survival rate profile conveys important information about how these risks change as the spell of residence in affordable housing lengthens. For example, a convex survival curve implies that the risk of entrapment in housing stress falls as spells lengthen; thus residence in affordable housing offers increasing protection against housing stress.

These research exercises use the initial experience of a housing affordability status and analyse the persistence of that status. They ignore subsequent transitions across housing affordability states. These subsequent transitions offer important insights into the permanence of escape from housing stress, or the transience of periods of housing stress. In section 3.4 churning in and out of housing stress is investigated; we ask whether those escaping problems of housing affordability are successful in staying out of housing stress, and whether those who drop into housing stress remain in this condition or or whether this affordability status changes in subsequent years.

3.2 The Dynamics of housing affordability 2001–2006

In this section we analyse how housing affordability changes over time. Since time has more than one dimension this issue can be approached in different ways – we can conduct comparisons within a cohort (perhaps an age group) at different points in time, or track persons as time unfolds. In Table 8 we analyse the second of these dimensions by asking whether housing affordability improves as Australians' housing 'careers' unfold (see also Marks & Sedgwick, 2008). Typically, we expect incomes to increase and, for purchasers, falling housing costs as mortgages are repaid. On the other hand, there are critically important variables such as interest rates, house prices and rents that can disrupt expectations of falling housing cost burdens. For much of the reference period 2001–2006, mortgage interest rates were increasing and a house price boom was underway. [9]

The net effect of these factors is revealed in Table 8, for a balanced panel of 7016 Australian adults.[10] A balanced panel ensures that there are no changes in the composition of the panel that could distort housing affordability measures. Our 2001 sample of 7016 Australians were seen to benefit from a 14 per cent decline (from 7.3% to 6.3%) in median housing affordability ratios. But there is some evidence of polarisation because the percentage of Australians paying more than 30 per cent of income in housing costs (housing stress) climbed from 6.4 per cent (2001) to 8 per cent (2006). While a growing number of outright owners helped to bring down median housing affordability ratios, those paying mortgages suffered increases in median housing affordability ratios and rising rates of housing stress, despite increasing incomes.[11]

Table 8: Housing affordability as housing careers unfold

	2001	***2002***	***2003***	***2004***	***2005***	***2006***
Median Housing Affordability Ratio (%)	7.3	6.7	7.1	6.5	6.6	6.3
Incidence of housing stress	6.4	6.6	7.0	6.9	7.8	8.0

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1-6.
Note: Estimates are based on a balanced sample of 7016 persons.

A second dimension of change is analysed when we compare the housing cost burden at some fixed stage of housing careers, but in two (or more) different years. Table 9 asks whether young (under 35s), middle-aged (35–54 years) and older (55

[9] In July 2001 the standard variable rate was 6.80% and by July 2006 it had reached 7.55% (RBA, 2008). The median house value reported by all home owners in the HILDA Survey increased from $20,0000 to $36,5000, an increase of 82.5%.

[10] The balanced panel is formed by excluding persons who have missing values for housing affordability ratios in one or more waves, and excluding dependents who form independent income units by 2006.

[11] The median equivalised incomes of home purchasers increased by 33%.

years and over) Australians had lower housing cost burdens back in 2001.[12] Housing cost burdens were found to have increased in each age group since 2001. The young and middle-aged have relatively high housing affordability ratios, which increased by 14 per cent between 2001 and 2006. There was also a steep increase in the incidence of housing stress, from 8.4 per cent to 11.4 per cent, among the young, and from 9.2 per cent to 12.1 per cent among the middle-aged. Older Australians typically have zero housing costs, and this is evident in both 2001 and 2006, but the incidence of housing stress has nonetheless increased from 1.3 per cent to 1.6 per cent. This second dimension of change with respect to time is an important one because it reveals whether housing became more or less affordable, and whether an affordability crisis was 'brewing' in the early years of the twenty-first century. The evidence is that housing was becoming less affordable. Whether the increasing cost of housing can be called an affordability crisis depends, in part, on the transience or persistence of unacceptably high housing cost burdens.

Table 9: Housing cost burden, by stage of housing career, 2001 & 2006

Age band in year	*2001*		*2006*	
	Per cent in housing stress	Median HAR (%)	Per cent in housing stress	Median HAR (%)
15-34	8.4	11.9	11.4	13.6
35-54	9.2	10.0	12.1	11.4
55+	1.3	0.0	1.6	0.0

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

3.3 The persistence of high housing cost burdens

To analyse the persistence of housing stress, we identify all persons in the sample who have experienced at least one episode of stress, where an episode is one year (wave). We take the first episode of stress and measure the length of spells of housing stress from that reference point. If that first spell is uninterrupted but ongoing at the end of the data collection period (2006) it is censored as we do not know when that first spell ended. At this stage we restrict analysis to escapes from first spells of housing stress. We use the unbalanced panel sample design described in Chapter 2, that is, dependents who achieve independence by 2006 are added to the sample in the year they achieve independence. Our unbalanced sample comprises 7218 persons who did not drop out between Waves 1 and 6. Among these, there were 12 owner-purchasers for whom it is not possible to impute a value for missing mortgage repayment information (for more details see appendix A2). This leaves a sample comprising 7206 persons. In total, these persons experience 1550 (first) spells of housing stress and 7166 (first) spells of affordable housing within the data collection period.

[12] Table 9 uses an unbalanced panel design. Those dependents who achieve independence by 2006 are added to the sample for that year. But all individuals in the sample have a continuous record of housing affordability ratio measures – that is, all individuals with one or more missing values for their housing affordability ratio have been omitted. For more details on sample design, see Chapter 2.

Table 10: Rates of 'escape' from a first spell of housing stress

Year[a] (t)	*Number*			*Hazard rate* $H_t = N_t / T_t$	*Survival rate* $S_t = S_{t-1}(1-H_t)$
	In housing stress at start of year (T)	Escaped housing stress during the year (N)	Censored[b] at end of year		
0	1550	0	172		1.000
1	1378	907	74	0.658	0.342
2	397	172	30	0.433	0.194
3	195	73	22	0.374	0.121
4	100	31	22	0.310	0.084
5	47	10	37	0.213	0.066

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Notes:

a. Housing costs and income are measured only once per year. The wave when a person is first recorded in housing stress is then labelled Year 0 because the person cannot leave housing stress until the following wave, which is then labelled Year 1.

b. Censored means that Year t+1 occurred after the end of the data collection period. For example, a first spell of housing stress that begins in Wave 6 will inevitably be censored at the end of Year 0 because Wave 6 is the last wave of data collection.

Table 10 is a 'life table' that tracks the event histories of the sample of 'stressed' individuals from the first year of their spell of housing stress, through to the end of the data collection period. We define the beginning of time as the first wave during which a person is recorded to be in housing stress; interest focuses on whether, and when the spell of housing stress ends. Time, measured in intervals of one year, is recorded in column 1. The following information is also then recorded:

- The number of persons in housing stress during the year (column 2)
- The number of persons that escaped housing stress during the year (column 3)
- The number of persons with spells that were censored because they were still in housing stress when the data collection period ended.

The time intervals are in years, with year 0 indicating the start of observation, year 1 indicating the first year after observation, and year t indicating the tth year after observation. In Year 0, all 1550 persons were in housing stress and 172 people's spells were censored in that year because their spell occurred in Wave 6. This leaves 1378 (1550–172) to enter the next time interval, Year 1. During Year 1, 907 people 'escaped' housing stress, but 74 people's spells are censored because their Year 0 occurred in Wave 5, the second last wave of the data collection period. This leaves 397 (1378 – 907 - 74) to enter the next time interval, the second year of housing stress. The number of individuals who enter each successive time period is typically referred to as the risk set – those who might escape during that time interval. By the start of Year 5 there are only 47 persons in the risk set, and censoring at 37 exacts a heavy toll, with only 10 escaping during that year.

The risk set declines in each year because of both event occurrence – transitions out of housing stress – and censoring. The risk set ignores repeat spells and so the

analysis is limited to the length of first spells (but see section 3.4 below).[13] The censored sample is of particular importance. We assume that the remaining risk set in a particular year is representative of all individuals who would have been at risk of event occurrence, had everyone been followed for as long as necessary to eliminate all censoring. This assumption is critical.

The hazard rate in column 5 is the key measure of the risk of event occurrence – the likelihood of escaping housing stress – in each time period. It is a conditional probability that a person will escape housing stress given that he or she did not escape in an earlier time period. It is the proportion of each time period's risk set that experiences the event during that interval. For example, in year 2172 people escape housing stress, which is 43 per cent of the 397 people who constituted the risk set at the beginning of Year 2.

Finally, the survival rate is listed in column 6 of their table. It is a measure of the probability that a randomly selected individual will remain in housing stress in year t, given that they have been trapped in housing stress in each year through to t. At the 'beginning of time' (Year 0) all persons are in housing stress and the survival rate is one. Over time, as people escape housing stress, the survival rate converges on zero.[14]

We learn from Table 10 that a majority of those in housing stress during Year 0are likely to evade housing stress during Year 1 – the hazard is 0.66 (obtained by dividing 907 into 1378). There is then a sharp decline in the hazard to 0.43 in Year two, which is followed by further modest declines to 0.21 in Year 5. In sum, those starting a spell of housing stress between 2001 and 2006 have a high chance of escaping housing stress by Year 1, but there is negative duration dependence. Those caught in housing stress a second, third, or even fifth year have a relatively low likelihood of breaking out. Nevertheless, as the survival rate profile indicates, the vast majority can expect to escape by Year 5.

There are important qualifications to these findings: one concerns recidivism. Dodging housing stress can be temporary; of those who escape a first spell of housing stress, 80 per cent are plunged back into housing stress at some point before the end of the data collection period (we return to this in section 3.4 below). A second qualification is that hazard profiles are not uniform across different types of persons and dwellings.

Figure 1 compares hazard rates by tenure; the hazards of owner-purchasers[15] and private renters are similar in Year 1. The majority of housing consumers can be expected to make an escape by Year 1, regardless of tenure. But after this first year, and in Years 3, four and 5 in particular, an owner-purchaser still in housing stress finds it more difficult to escape as compared to their private rental counterparts. Since moving costs are generally lower for renters they are better placed to make adjustments by moving into cheaper accommodation, reducing housing cost burdens and thereby avoiding housing stress; but such adjustments may involve compromising housing standards.

[13] Because time intervals of measurement are one year and the data collection period is six years, a minority of all spells of HAS are repeat spells. The 7206-person sample experienced 1922 spells of HAS; 37%, or 716, were repeat spells.

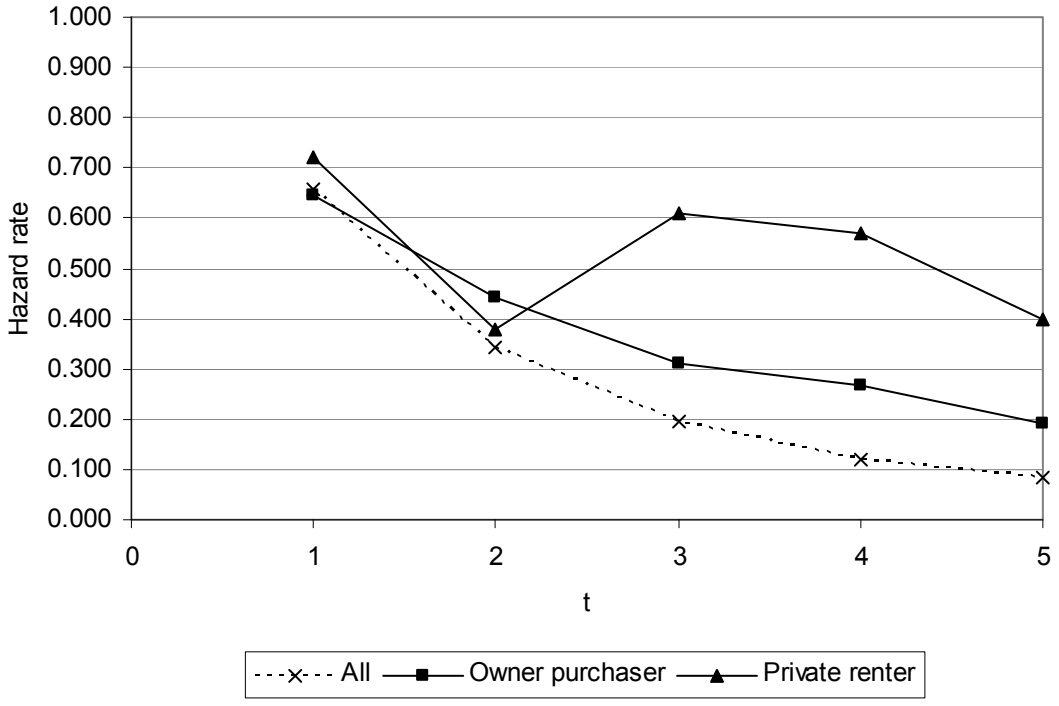
[14] Formally, the survival rate in t is measured by multiplying the survival rate in the previous year (t-1) by 1 minus the hazard rate in Year t. Use of the nomenclature survival rate is conventional but does not sit easily alongside the housing affordability status in which the person survives. The conventional nomenclature is retained despite the incongruity.

[15] Owner-purchasers are home owners with mortgages.

Evidence on moves confirms this hypothesis. In each year a much higher proportion of 'stressed' private renters move; for example, in 2001 38 per cent of stressed private renters as compared with only 4 per cent of stressed owner-purchasers moved to other housing of the same tenure type. In 2005 the proportions were 29 per cent and 6 per cent of stressed private renters and owner-purchasers respectively.[16] Between 2001 and 2006 nearly two-thirds (70%) of stressed private renters (owner-purchasers) who made intra-tenure changes in housing arrangements moved to cheaper rental (owner-occupied) housing during or at the end of their first spell of housing stress; these moves are clearly influential in terminating spells of housing stress. Among stressed private renters who have moved, mean net housing costs fall from $12,056 before the move to $5,868 after the move. For stressed owner-purchasers who have moved, their mean net housing costs fall from $18,252 to $13,621 after the move.

Most other sub-group hazard functions are poorly defined, given the small sample numbers. An exception is household type; Figure 2 indicates that the presence of children is associated with more protracted first spells in housing stress. Over 80 per cent of couples without dependent children have escaped housing stress by Year 1, and by Year 4 they have all escaped. But just under 60 per cent of couples with children escape housing stress by year 1, and the hazard rate declines to about 0.3 by Year 5. Further analysis of the factors determining hazard rates is reported in Chapter 4.

Figure 1: All individuals 'at risk' of escaping a first spell of housing stress, by housing tenure in first year of spell

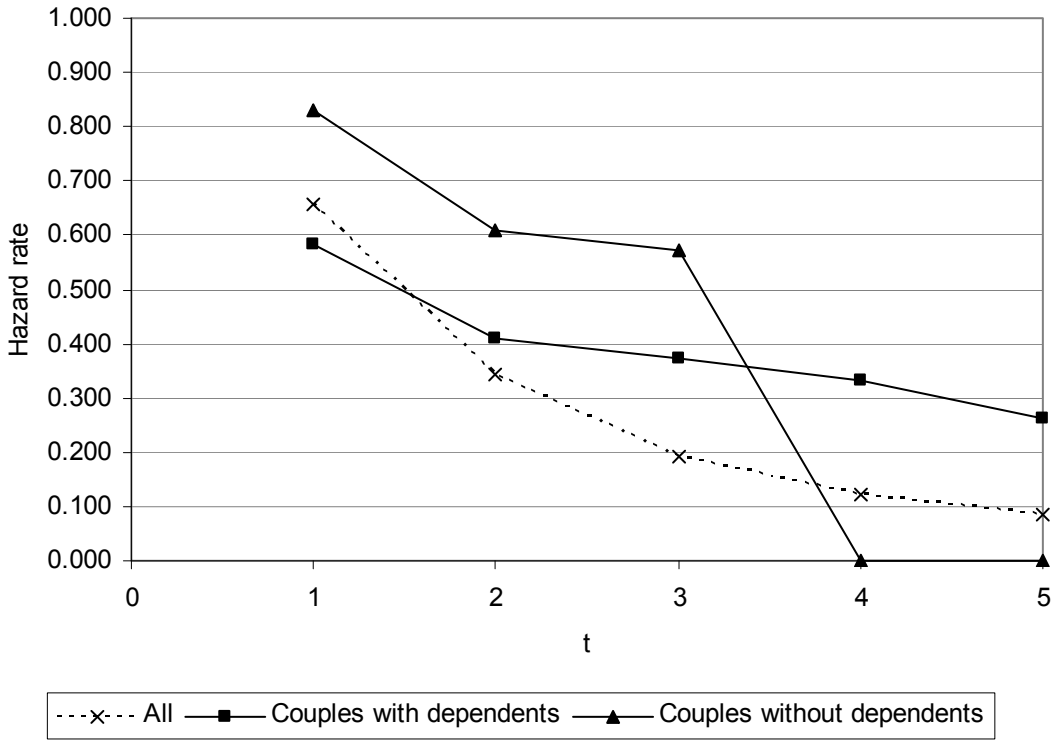


[16] The proportions of stressed owner-purchasers and private renters who moved into other housing within the same tenure in each year are:

Tenure	2001	2002	2003	2004	2005
Owner-purchaser	3.9%	3.7%	4.1%	3.4%	5.7%
Private renter	38.0%	27.4%	30.1%	23.3%	28.8%

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Figure 2: All individuals 'at risk' of escaping a first spell of housing stress, by income unit type in first year of spell



Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

3.4 Survival in affordable housing

We now turn our attention to spells in affordable housing and the risk of falling into housing stress because housing costs increase, and/or incomes decline. Table 11 analyses the first spell of 7166 Australians who 'survive' at least one year in affordable housing between 2001 and 2006; 6556 (92%) of these persons are first recorded to be living in affordable housing in Wave 1. In most of these cases this period is a continuation of a spell in affordable housing that began before Wave 1 (and are therefore left censored spells, that is we do not know when they began).

Only 4.7 per cent of the 'at risk' group plunges into housing stress in Year 1, and so the survival rate is very high, at 95.3 per cent. In fact the survival rate remains very high; by Year 5the probability that a randomly selected individual will survive in affordable housing is 82 per cent. Moreover, the hazard rate declines from 4.7 per cent of the 'at risk' group in Year 1, to only 2.9 per cent in Year 5. The length of a spell in affordable housing seems to offer a protective effect such that the chances of tumbling into unaffordable housing circumstances become progressively smaller as spells lengthen (but see section 3.4 below).

Table 11: The duration of first spells in affordable housing

Year[a] (t)	*Number*			*Hazard rate Ht = Nt / Tt*	*Survival rate St = St-1(1-Ht)*
	In affordable housing during year (T)	Fell into housing stress during the year (N)	Censored[b] at end of year		
0	7166	0	34		1.000
1	7132	333	48	0.047	0.953
2	6751	312	62	0.046	0.909
3	6377	234	71	0.037	0.876
4	6072	228	192	0.038	0.843
5	5652	166	5486	0.029	0.818

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Notes:

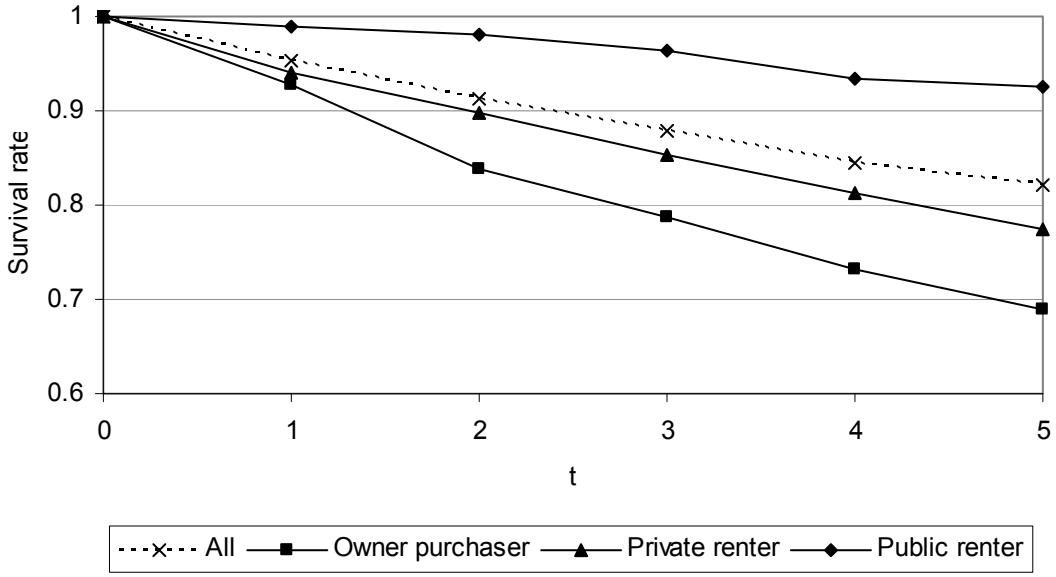
a. Housing costs and income are measured only once per year. The wave when a person is first recorded in affordable housing is then labelled Year 0because the person cannot fall out of affordable housing until the following wave, which is then labelled Year 1.

b. Censored means that year t+1 occurred after the end of the data collection period. For example, a first spell of residence in affordable housing that begins in Wave 6 will inevitably be censored at the end of Year 0 because Wave 6 is the last wave of data collection.

The spells in affordable housing represent a much larger sample of Australians, and so analysis of survivor functions by sub-groups is more convincing than that of spells in housing stress. Figures 3 and 4 confirm the importance of tenure[17] and children. Owner-purchasers and couples with children are considerably less likely to survive in affordable housing. These are Australians who are typically in the early stages of work and housing market careers, grappling with the pressing spending needs caused by children and the imperatives of finding suitable housing at a time when house prices were booming and interest rates climbing. Most of those dropping out of affordable housing are owner-purchasers – they account for 59.5 per cent of those who failed to survive in affordable housing; only 25.4 per cent are renters. The owner-purchasers that drop out of affordable housing have mean LVRs that were 54.6 per cent in the last year of their spell. This is much higher than a mean LVR of 32.8 per cent in the last year of the uncompleted spells of 'survivors'.

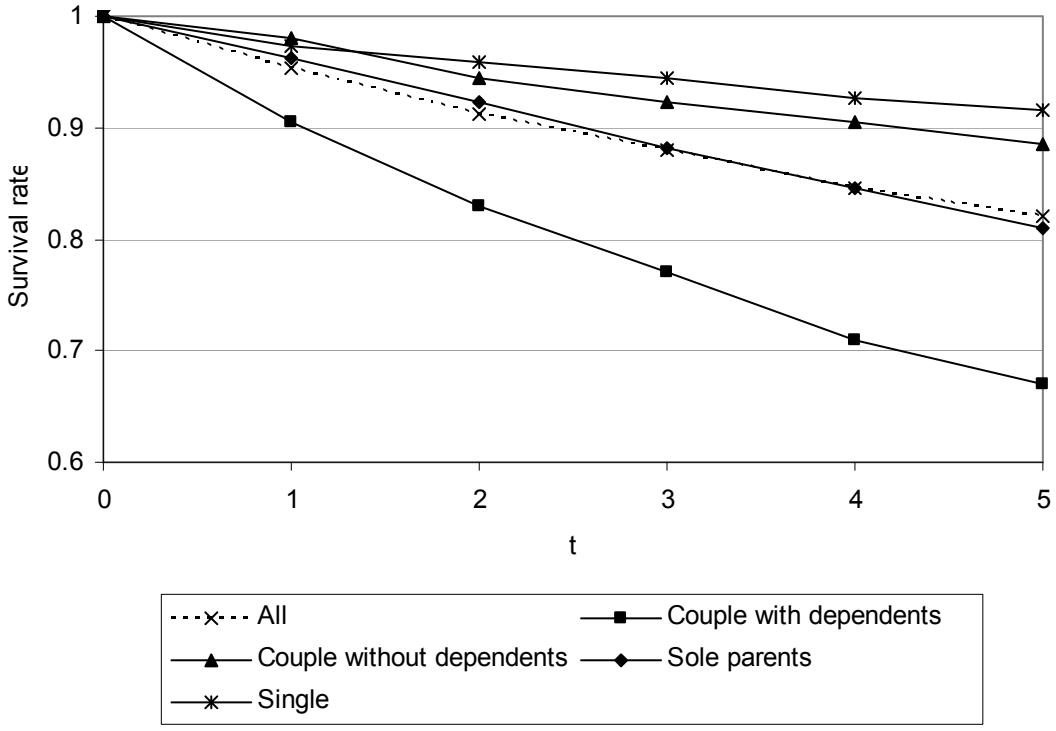
[17] Outright owners are not shown in Figure 3 because they almost all survive in affordable housing. Among 2525 outright owners with at least one spell of affordable housing, 2390 (95%) survived in affordable housing over the period 2001-06. 5% (135) fell out of affordable housing because they took on mortgages at some point during the period and as a result incurred housing costs in excess of 30% of income. Over two-thirds of these owners released housing equity by securing mortgages against the home they had previously owned outright.

Figure 3: The duration of first spells in affordable housing, by housing tenure in first year of spell



Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Figure 4: The duration of first spells in affordable housing, by income unit type in first year of spell

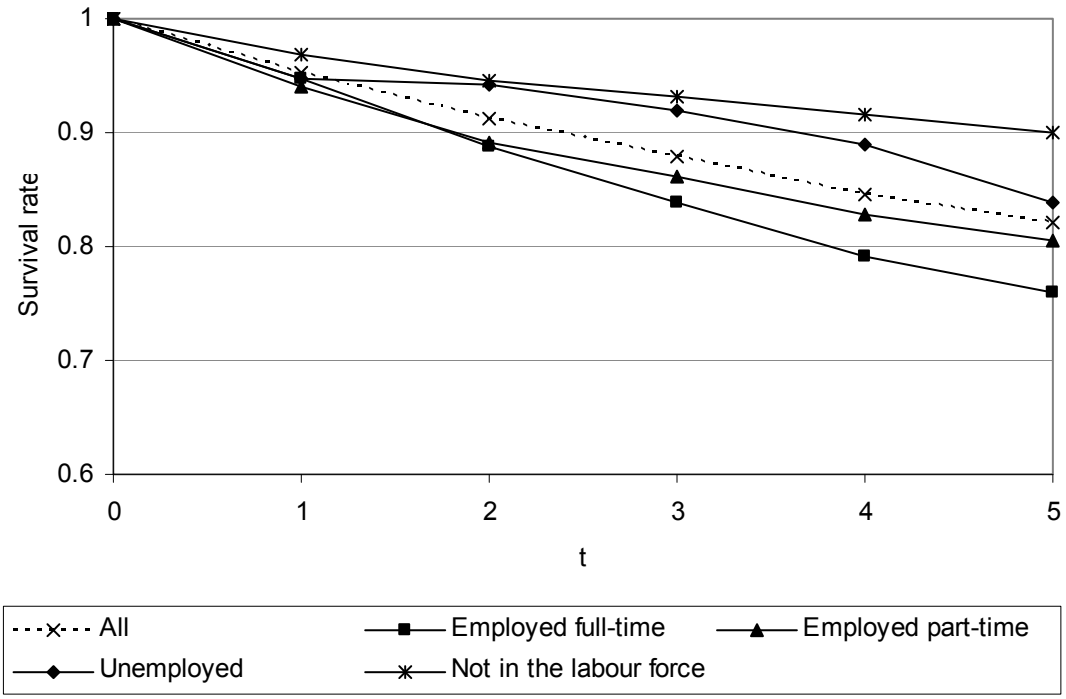


Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Survivor functions by employment status, age and income are shown in figures 5, 6 and 7 respectively. Young (under 35s) Australians have a considerably lower chance of surviving in affordable housing than other groups. Contrary to what might be

expected, these people are in full-time employment and belong to higher, not lower, income groups.

Figure 5: The duration of first spells in affordable housing, by employment status in first year of spell

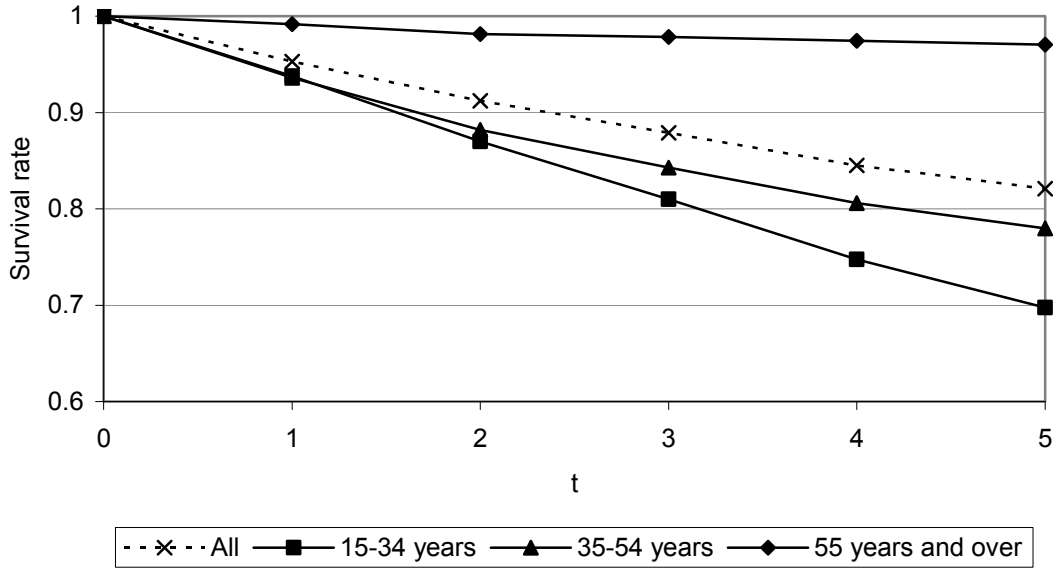


Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

What can we learn from these findings? It would seem that older Australians who have achieved outright ownership, or who reside in public housing, are much more securely located in affordable housing, despite their, typically, lower incomes. On the other hand, younger full-time employed Australians – particularly those with children – have leveraged purchases of housing during a period when house prices boomed and mortgage interest rates rose. These Australians appear to have been in precarious housing affordability circumstances.

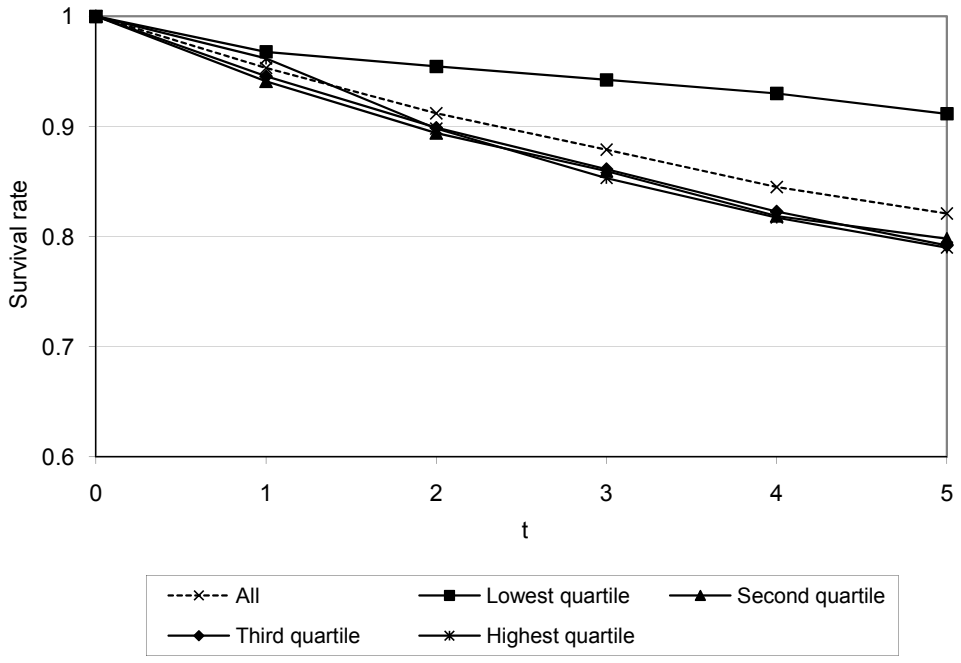
It would seem that many of these younger Australian home owners have cashed in some of their house price gains by withdrawing equity. Most people paying mortgages (62.9%) have higher outstanding mortgage debt by the end of the data collection period, but this additional borrowing is even more common (72.3%) among those paying mortgages who drop out of affordable housing. Some of this equity withdrawal is no doubt prompted by birth of children. Among mortgage payers who do not survive in affordable housing, just over one in five must meet the additional spending needs prompted by childbirth during their spell. These households might also reduce labour supply to meet the demands of child care, and the consequent reductions in earnings push them in to housing stress.

Figure 6: The duration of first spells in affordable housing, by age in first year of spell



Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Figure 7: The duration of first spells in affordable housing, by equivalised disposable income quartile in first year of spell



Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

3.5 Churning and the permanence of escapes from housing stress

A limitation of the analysis reported in section 3.3 is that only first spells of housing stress are examined. If churning in and out of housing stress is common in the time period 2001–06, the statistical patterns revealed by an analysis of first spells may not be apparent when repeat spells are included. Table 12 reports the frequency of second and third repeat spells. It turns out that among those suffering at least one spell of housing stress, more than one in five (22%) had two or three spells. There is then a considerable amount of churning, so analyses of first spells using the hazard rate approach is subject to this reservation.

Table 12: Number of spells of housing stress among those with at least one spell of housing stress

	N	***Per cent***
Persons who experienced:		
1 spell of housing stress	1206	77.8
2 spells of housing stress	316	20.4
3 spells of housing stress	28	1.8
All persons who experienced one or more spells of housing stress	1550	100.0
Mean number of spells of housing stress	1.24 spells	
Median number of spells of housing stress	1 spell	

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

The same limitation is possible with respect to analyses of first spells in affordable housing. However, Table 13 shows that churning in and out of affordable housing is less common. Among persons with at least one spell of affordable housing, only 12 per cent have repeat spells. This reflects the permanence of most first spells (see Table 11).

Table 13: Number of spells in affordable housing among those with at least one spell of affordable housing

	N	***Per cent***
Persons who experienced:		
1 spell of affordable housing	6287	87.7
2 spells of affordable housing	834	11.6
3 spells of affordable housing	45	0.6
All persons who experienced one or more spells of affordable housing	7166	100.0
Mean number of spells of affordable housing	1.13 spells	
Median number of spells of affordable housing	1 spell	

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Among those escaping a first spell of housing stress, recidivism is an important issue. Table 14 examines those 1193 persons who climb out of housing stress, and the permanence of their subsequent spell in affordable housing. The findings here are

striking; the survival rate estimates show that only 53 per cent are expected to remain in affordable housing after four years. Though most people are likely to break out of first spells of housing stress, improvements in housing affordability are typically transient for a significant proportion of those who escape a first spell of housing stress. Table 14 also reveals negative duration dependence; the hazard rate decreases from 0.189 in Year 1, to 0.110 in Year 4. The chances of falling back into housing stress are lower the longer the spell in affordable housing. However, if we select first spells that are *not* preceded by spells in housing stress, we find that more than 80 per cent survive and the hazard is very low in each year of the spell; a randomly selected individual has a 84 per cent chance of survival in Year 4, a rate that is more than 1.5 times that of persons whose spells follow an escape from housing stress (see Table 15).

Our results indicate that housing affordability circumstances are polarised. There is a group of housing consumers whose spells in affordable housing are sustainable. If members of this group are owner-purchasers they generally have lower LVRs. They and their renter counterparts have not experienced a prior spell of housing stress between 2001 and 2006. On the other hand, for those whose first spell in affordable housing has been preceded by a spell in housing stress, the spells in affordable housing is more typically unsustainable. Owner-purchasers account for 658 (55%) of these spells. Their precarious position reflects high LVRs; in 40 per cent of these 658 spells, outstanding mortgage debt is higher when spells are terminated, due to either leveraged purchases or mortgage equity withdrawal.

Renters or outright owners account for 535 spells in Table 14. One in six of these spells features a move by renters into home ownership, a transition that typically requires borrowing in order to fund purchase at a time of rising house prices and interest rates. Many are terminated by a slide into housing stress, which is unsurprising. One-third of the 535 spells belong to private renters who move into more expensive housing; typical housing costs among those who spiral into more expensive housing – from $7,075 to $10,999 by the end of their spell. Finally, a surprising number of spells were experienced by Australians who were outright owners when the spell began (20%); those slipping into housing stress do so as a consequence of mortgage equity withdrawal – cashing in housing equity by securing a mortgage against their primary residence.

Table 14: Survival in affordable housing, first spell after escape from housing stress

Year[a] (t)	***Number***			***Hazard rate*** $H_t = N_t / T_t$	***Survival rate*** $S_t = S_{t-1}(1-H_t)$
	In affordable housing during year (T)	Fell into housing stress by end of the year (N)	Censored at end of year		
0	1193	0	207		1.000
1	986	186	157	0.189	0.811
2	643	90	198	0.140	0.698
3	355	50	141	0.141	0.600
4	164	18	146	0.110	0.534

Table 15: Survival in affordable housing; no previous spell in housing stress

Year[a] (t)	*Number*			*Hazard rate* $H_t = N_t / T_t$	*Survival rate* $S_t = S_{t-1}(1-H_t)$
	In affordable housing during year (T)	Fell into housing stress by end of the year (N)	Censored[b] at end of year		
0	6734	0	23		1.000
1	6711	246	31	0.037	0.963
2	6434	257	33	0.040	0.925
3	6144	200	36	0.033	0.895
4	5908	210	46	0.036	0.863
5	5652	166	5486	0.029	0.838

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Notes:

a. Housing costs and income are measured only once per year. The wave when a person is first recorded in housing stress is then labelled Year 0 because the person cannot leave housing stress until the following wave, which is then labelled Year 1.

b. Censored means that Year t+1 occurred after the end of the data collection period. For example, a first spell of housing stress that begins in Wave 6 will inevitably be censored at the end of Year 0because Wave 6 is the last wave of data collection.

There are 1273 persons (the sum of column 3 cells in Table 11) who have first spells of affordable housing that prove unsustainable. Table 16 profiles their hazard and survival rates and reveals that over two-thirds (68.2%) reverse this deterioration in housing affordability by Year 1 of their spell in unaffordable housing. A randomly drawn person has only a 5 per cent chance of remaining in housing stress by Year 4.

Table 16: Escape from housing stress, first spell after falling out of affordable housing

Year[a] (t)	*Number*			*Hazard rate* *Ht = Nt / Tt*	*Survival rate* *St = St-1(1-Ht)*
	In affordable housing during year (T)	Fell into housing stress by end of the year (N)	Censored[b] at end of year		
0	1273	0	170		1.000
1	1103	752	74	0.682	0.318
2	277	140	30	0.505	0.157
3	107	47	22	0.439	0.088
4	38	16	22	0.421	0.051

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Notes:

a. Housing costs and income are measured only once per year. The wave when a person is first recorded in housing stress is then labelled Year 0 because the person cannot leave housing stress until the following wave, which is then labelled year 1.

b. Censored means that Year t+1 occurred after the end of the data collection period. For example, a first spell of housing stress that begins in Wave 6 will inevitably be censored at the end of year 0 because Wave 6 is the last wave of data collection.

Tables 14, 15 and 16 offer important insights into the dynamics of housing affordability. It would seem that the majority of Australians who occupy affordable housing can sustain these circumstances in the long run. However, there are a minority of Australians who reside in precarious circumstances, churning in and out of affordable housing. Those that escape housing stress are unable to sustain the improvement in housing affordability; on the other hand, most of those dropping out of affordable housing are able to quickly reverse the deterioration in their housing market circumstances. These findings raise important research questions for a future research agenda that we outline in section 5.

4 MODELLING (UN-) AFFORDABLE HOUSING SPELLS DATA

4.1 Modelling approach

The life-table analyses in Chapter 3 suggests that particular sub-groups in the Australian population are less likely to escape housing stress, and/or sustain spells in affordable housing. In this chapter we add to the evidence base by modelling spells data as a function of key housing and labour market variables, controlling for the confounding influence of various socio-economic and demographic variables. The modelling approach helps to identify the independent effects of variables in a more robust way. The findings in this chapter provide a more reliable guide to the factors shaping a person's chances of escaping housing stress, and those shaping the chances of survival in affordable housing.

Our approach models the occurrence and timing of events, where events are represented by a transition from one status to another. This approach is commonly invoked by medical researchers to gauge the success of alternative medical procedures, diets, environmental factors and so on, in determining survival rates among patients – the victims of heart disease, for instance[18]. It is used by economists to analyse the factors that determine how quickly the unemployed find jobs[19]. In the present context the events are transitions into (un-) affordable housing. These models are typically referred to as hazard or survival models, depending upon the way in which the findings are interpreted; continuation of a spell in a 'good' state is typically referred to as survival, and hazard is used to describe exit from a 'good' state.

We design a data set that contains records for each year that an individual remains in (un-) affordable housing. The start of a spell is the first year that the individual is recorded as occupying (un-) affordable housing. Every individual has at least one spell in either affordable or unaffordable housing. The models are estimated using the 'at-risk' data set; an essential feature of the risk set's definition is that once an individual experiences the event (or is censored) he or she drops out of the risk set in all future periods.

Standard logistic regression analysis is used to estimate the relationship between the probability of exiting housing stress and a range of explanatory variables[20]. It is also used to analyse the relationship between the probability of falling out of affordable housing and these explanatory variables. The explanatory variables are of two kinds, time indicators and predictors. Time indicators index the discrete time periods that comprise a spell of (un-) affordable housing. If the maximum possible duration of a spell is five years, there are five indicators $D_j \left(j = 1,2,3,4,5\right), where\, D_j = 1$ if the person's record belongs to time interval j, zero otherwise. The coefficient estimates (alpha $\left(\alpha_j\right)$) represent what is called the baseline hazard function. If there are no predictor variables, these αj can be transformed to obtain the same hazard rates (conditional probabilities) as are reported in tables 10 and 11 for the sample

[18] Felker (2000) used this method to evaluate factors affecting survival among patients with heart disease. Mukamal (2001) also used similar modelling to examine the impact of diabetes on survival among patients in hospital because of heart attacks.

[19] For a seminal study of this kind see Nickell (1979). Early reviews of the statistical techniques in this context can be found in Lancaster (1979) and Kiefer (1988).

[20] For an accessible account of the technical details see Singer and Willet (2003).

population. When predictor variables are included the baseline hazard is defined for the sub-group defined when setting all the predictor variables to zero. Addition or subtraction of predictor variables changes the definition of sub-groups that the baseline hazard profiles.

Predictor variables are measures of the factors that we believe should be influential in shaping the probability of escaping housing stress (or sustaining spells in affordable housing)[21]. The coefficient estimates (Betas βk) can be transformed to obtain the increments in hazard rates (conditional probabilities) in every time period, controlling for the other predictors in the model. It is common and more intuitively appealing to transform the βk estimates into odds ratios. When the predictor variable is dichotomous – for example a variable such as 'moved' that indicates whether the individual moved in any Year j of a spell – the odds ratio is the odds of event occurrence when a person moves, relative to the odds of event occurrence when a person continues to reside in the same dwelling[22]. The odds ratio is then a measure of how likely movers are to exit from housing stress (for instance), relative to non-movers. If the odds ratio is two, movers are twice as likely to exit housing stress at any given stage in a spell of un-affordable housing. We follow this practice of using odds ratios in the results section below.

The remainder of this chapter is organised as follows. Section 4.2 describes variable measures, and the rationale for their inclusion. This is followed in section 4.3 by a presentation of our findings. A final section offers some thoughts on the significance of these findings.

4.2 Data and model specification

The data set is organised as a person-period data set, which has a separate record for each time period when a person is at risk of event occurrence. These are records for years up to and including the year in which 'events' occur (escape from housing stress, or dropping out of affordable housing). Censored spells are ones where events have not occurred, and include records up to and including the final year of data collection[23]. For example, consider an individual who is in affordable housing in Wave 1 of the HILDA Survey. Suppose the individual continues to be in affordable housing in each subsequent time period but is observed to have fallen into housing stress in Wave 6. The individual's wave 1 observation corresponds to Year 0 of an affordable housing spell. The individual is at risk of falling out of affordable housing from Wave 2 or Year One onwards (see Chapter 3). In Wave 6 or Year 5, the individual has fallen out of affordable housing. In the person-period data set, the individual has five records in which the individual is at risk, Year 1 to Year 5, with event occurrence taking place in Year 5. Consider another individual who is still in affordable housing by Year 5. This individual also has five records, but event occurrence would not have taken place by Year 5.

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[21] See section 4.2 below for further discussion.

[22] Odds are obtained from the quotient;

$$odds = \frac{probability}{1 - probability}$$

In hazard analyses the quotient contains conditional probabilities (the hazard. If hazard is 0.8 in a particular time interval of a spell, the conditional odds of event occurrence are four.

[23] Individuals with censored spells are identified by a series of zeros in each year of the spell; individuals who experience the event will have a series of zeros that are terminated by a one in the final year of their spell.

A typically important issue in studies of event occurrence is duration dependence – is the risk of event occurrence independent of duration? Negative duration dependence is evident in Tables 10 and 11. The inclusion of time indicators allows the researcher to scrutinise whether such conclusions are robust when predictor variables are added. Our chosen model specification also recognises that time has an historical dimension; a two-year spell of housing stress covering 2002–2003 may have a different hazard profile as compared to one covering 2003–2004, because unmeasured housing and labour market conditions could change. Accelerating house price inflation rates and rising mortgage interest rates suggest that this hypothesis should be tested by inclusion of a vector of calendar year dummy variables (see Table 17).

Housing market variables are of particular importance because policy relevant inferences can be drawn from coefficient estimates. The tenure that a person has chosen is relevant because owner-purchaser outlays on housing costs decline as they 'retire' mortgage debt, but tenants must meet rents that typically increase. Housing assistance arrangements also vary by tenure; public housing is expected to be successful in sustaining spells in affordable housing because of the concessional rent formula that typically limits rents to 25 per cent of income. Geographical variation in housing prices and rents is common; prices and rents are generally higher in urban areas because superior access to services and employment opportunities push up land values. Whether a person has moved can influence the chances of living in (un-) affordable housing. How this 'plays out' is an empirical question; a spell in housing stress can motivate moves into cheaper housing, but if moves by those residing in affordable housing are prompted by increases in the demand for housing, residential mobility could be associated with lower survival rates (in affordable housing).

Labour market and human capital characteristics should be influential factors, but in ways that are more complicated than might be expected. Economists have tended to emphasise permanent income rather than current measured income as the relevant variable in relation to the demand for housing[24]. Permanent income is the financial return on human capital (plus interest, dividends and other returns on assets) that a person expects over their lifetime. Those with skills, qualifications and enterprise will have relatively high permanent incomes, though their current measured incomes might be relatively low because they are in the early years of their career, or bad luck could lead to temporary dips in income. The argument that people will consider their permanent incomes when considering long-term commitments (such as housing arrangements) is widely accepted. Qualifications variables are therefore prominent in our model specification, as are variables that could be correlated with temporary slumps in current measured income[25] and variables that capture precarious labour market circumstances (e.g. casual contracts). Workers with high levels of human capital and correspondingly high permanent incomes could nevertheless confront uncertain labour market prospects that warrant caution with respect to long-term commitments to cost outlay.

[24] Technically permanent income is an estimate of a person's long-run average income level.

[25] While current income may not determine housing cost outlays, events such as unemployment will affect the chances of HAS because current income is the denominator in housing affordability measures.

Table 17: Variable definitions

Variable	*Definition*	*Unit of measurement*	*Time-invariant or time-varying*
Time indicators			
Year of spell			
First year of spell	First year in (un-) affordable housing	Dichotomous	Time-varying
Second year of spell	Second year in (un-) affordable housing	Dichotomous	Time-varying
Third year of spell	Third year in (un-) affordable housing	Dichotomous	Time-varying
Fourth year of spell	Fourth year in (un-) affordable housing	Dichotomous	Time-varying
Fifth year of spell	Fifth year in (un-) affordable housing	Dichotomous	Time-varying
Calendar year			
2003	Observation from 2003 calendar year	Dichotomous	Time-varying
2004	Observation from 2004 calendar year	Dichotomous	Time-varying
2005	Observation from 2005 calendar year	Dichotomous	Time-varying
2006	Observation from 2006 calendar year	Dichotomous	Time-varying
Housing market variables			
Outright owner	Home owner without mortgage at start of spell	Dichotomous	Time-invariant
Owner-purchaser	Home owner with mortgage at start of spell	Dichotomous	Time-invariant
Private renter	Private renter at start of spell	Dichotomous	Time-invariant
Public renter	Public renter at start of spell	Dichotomous	Time-invariant
Rent-free	Rent-free at start of spell	Dichotomous	Time-invariant
Moved	Whether moved since last year	Dichotomous	Time-varying
Major city	Collection districts with an average Accessibility/Remoteness Index of Australia[1] (ARIA) index value of 0 to 0.2.	Dichotomous	Time-varying
Inner region	Collection districts with an average Accessibility/Remoteness Index of Australia (ARIA) index value of > 0.2 to ≤ 2.4.	Dichotomous	Time-varying
Outer, remote or very remote regions	Collection districts with an average Accessibility/Remoteness Index of Australia (ARIA) index value of > 2.4.	Dichotomous	Time-varying
Labour market and human capital variables			
Postgraduate	Masters or doctorate degree	Dichotomous	Time-varying
Graduate	Graduate diploma or graduate certification	Dichotomous	Time-varying
Bachelor		Dichotomous	Time-varying
Advanced diploma / diploma		Dichotomous	Time-varying

Variable	*Definition*	*Unit of measurement*	*Time-invariant or time-varying*
Certificate III or IV		Dichotomous	Time-varying
Certificate I or II		Dichotomous	Time-varying
Certificate not defined		Dichotomous	Time-varying
Year 12		Dichotomous	Time-varying
Year 11 and below		Dichotomous	Time-varying
High-level qualifications	Postgraduate, graduate or bachelor degrees	Dichotomous	Time-varying
Medium-level qualifications	Diplomas, certificates I, II, III, IV or not defined	Dichotomous	Time-varying
Low qualifications	Year 12 or below	Dichotomous	Time-varying
Full-time permanent contract	Employed full-time on an ongoing basis	Dichotomous	Time-varying
Full-time fixed-term contract	Employed full-time on a contract with an end date	Dichotomous	Time-varying
Part-time permanent contract	Employed part-time on an ongoing basis	Dichotomous	Time-varying
Part -time fixed-term contract	Employed part-time on a contract with an end date	Dichotomous	Time-varying
Casual or other contract	Employed with no paid holiday or sick leave provisions	Dichotomous	Time-varying
Self-employed		Dichotomous	Time-varying
Unemployed		Dichotomous	Time-varying
Not in the labour force		Dichotomous	Time-varying
Socio-demographic variables			
Age		Continuous, years	Time-varying
Australian-born non-Indigenous		Dichotomous	Time-invariant
Australian-born Indigenous		Dichotomous	Time-invariant
Born in main English-speaking countries	Main English-speaking countries[2]	Dichotomous	Time-invariant
Born in non-English-speaking countries	Non- English-speaking countries.	Dichotomous	Time-invariant
Disabled	Has a disability or long-term health condition	Dichotomous	Time-varying
Married	Legally married	Dichotomous	Time-varying
De facto	Living with partner but not legally married	Dichotomous	Time-varying
Divorced		Dichotomous	Time-varying
Separated		Dichotomous	Time-varying
Widow		Dichotomous	Time-varying
Single never married		Dichotomous	Time-varying
Number of dependent children age 0–4 years		Continuous, number	Time-varying
Number of dependent children age 5–9 years		Continuous, number	Time-varying

Variable	*Definition*	*Unit of measurement*	*Time-invariant or time-varying*
Number of dependent children age 10–14 years		Continuous, number	Time-varying
Number of dependent children age 15–24 years		Continuous, number	Time-varying

1. The ARIA index categorises non-contiguous geographical areas within each state or territory into areas that share common remoteness characteristics (ABS, 2001).
2. New Zealand, United Kingdom, Ireland, Canada, US and South Africa.

The role of human capital and labour market variables in shaping the duration of spells in (un-) affordable housing is a subtle one. Good qualifications and an associated rising earnings profile as careers progress will encourage people to take on large mortgages, as they expect to pay them off drawing on future growth in earnings. But such behaviour should be moderated by uncertainty, and those in precarious labour market circumstances are more vulnerable in this regard. Finally loss of job or unavoidable interruptions to careers as a result of pregnancy, injury or illness will cause temporary dips in current income, and people who in these circumstances are more likely to be caught in housing stress.

To precisely identify and measure the contribution of these housing and labour market variables we need to account for the confounding influence of socio-economic and demographic variables. We therefore include controls for stage in the life course (e.g. age), migrant status, presence of children and marital status.

The predictor variables are of two types. There are time-invariant variables that take the same value regardless of when they are measured. For example, country of birth is necessarily a constant. In the case of housing tenure, we have chosen to measure the variable in a time invariant way – it is tenure in the first year of a spell. This is because we wish to judge whether a spell that originates in a particular tenure is more or less permanent than spells that originate in other tenures. The other type of predictor variable is time varying – they can take different values in each year. In some cases – age, for example – the variable will always change value. In others – qualifications, for example – the variable changes abruptly but infrequently. A list of variable definitions and their chief characteristics can be found in Table 17.

The models are known as discrete time hazard models because the models estimate the conditional probability of escaping housing stress or falling out of affordable housing using a discrete time measure, where time is measured once every year rather than using a smaller time measure, such as day, week or month. The model specification allows the estimation of the odds of escaping housing stress or falling out of affordable housing. We take the natural logarithm of the odds when conducting the estimation. Hence, the model specification is a ‘log odds’ or logit model specification (Singer and Willett, 2003). The hazard model estimates are generated with respect to first spells only – first spells in housing stress or first spells in affordable housing. We are therefore analysing events or transitions that are the mirror image of each other – transitions out of un-affordable housing and transitions out of affordable housing. The variables that we include as predictors are the same in each hazard model, but their interpretation may differ, as we will discover in the next section.

4.3 Findings

Table 18. presents estimates for a discrete time hazard model of first spells in housing stress; the sample has no outright owners or persons living in rent-free housing, as by definition their housing costs are zero. The (conditional) odds of exiting housing stress in the first year of a spell are 2.8 times higher than the (conditional) odds of exiting during the remaining years of a spell, and this estimate is statistically significant at 1 per cent. This is very high and confirms the table 8 finding that the majority of stressed Australian housing consumers evade housing stress within one year of the onset of a spell. The odds ratio remains relatively high in Year 2, but then dips below 1, and is as low as 0.51 in the fifth year of a spell[26]. This negative duration dependence is qualified by the observation that time indicators other than Year 1are statistically insignificant. The calendar year variables are mostly insignificant, the exception being 2004 where the (conditional) odds ratio is 1.5.

Findings on housing market variables suggest that tenure has no impact on the chances of escaping housing stress, contrary to the descriptive analyses which indicated that private renters have a higher hazard (see Figure 1). This could be because private renters in housing stress are more likely to move (within the same tenure),[27] and movers have odds of exiting housing stress that are 2.5 times the odds of 'stayers'. Indeed, residential mobility is the second most important variable as measured by the odds ratio. It would seem that many spells of unaffordable housing are terminated by households trading down to cheaper housing. The higher transaction costs of owners deter mobility in this tenure and so adjustment of housing demand to accommodate housing cost pressures is more feasible in private rental housing. Whether tenants are forced to unduly compromise housing standards is an important future direction for research[28].

Labour market variables are generally unimportant. The unemployed and most forms of employment status have odds ratios that are statistically insignificant. There are a couple of exceptions; those employed full time on permanent contracts have odds 34 per cent higher than those not in the labour force (NILF). Surprisingly, those employed full time but on casual contracts are even more likely to exit housing stress, as compared to NILF. Small sample numbers in some of these employment categories could be responsible for statistically insignificant coefficients. If we merge the employment categories into a dichotomous employment variable it would be statistically significant at the 5 per cent level, with the odds ratio of 1.338 indicating that employed persons are 34 per cent more likely to escape housing stress than those not working. If the employment variable was disaggregated on a full-time/part-time basis, only the full-time employed variable would be significant at the 5 per cent level, with full-time workers having odds 35 per cent higher than those not working. However, the part-time variable would be insignificant.

Among the controls, presence of dependent children is particularly important[29], and this is most evident when dependent children are aged 0–4 years. Housing stressed

[26] The panel extends over the timeframe 2001–2006 but transitions occur from 2002 onwards, leaving a maximum length of spell of five years.

[27] During their first spells of HAS 38% of private renters move on one or more occasions, but only 4% of owner-purchasers move.

[28] Between 2001 and 2006 nearly two-thirds (70%) of stressed private renters (owner-purchasers) who made intra-tenure moves moved to cheaper rental (owner-occupied) housing during or at the end of their first spell of HAS. Among stressed private renters who have moved, mean net housing costs fall from $12,056 before the move to $5,868 after the move. For stressed owner-purchasers who have moved, their mean net housing costs fall from $18,252 to $13,621 after the move.

[29] Only one other control – migrants born in non-English speaking countries – is significant.

Australians with very young children have odds of escaping housing stress that are 40 per cent lower than the odds of Australians with no dependent children. This is typically a period in the life course when households experience acute spending needs; the majority (86.6%) of those with dependent children at the start of the spell were owner-purchasers during the first year of their spells, and among these owner-purchasers 55 per cent have withdrawn equity by adding to their mortgages on one or more occasions during their spell of housing stress. It would seem that large numbers of stressed owner-purchasers with dependent children have been encouraged by booming house prices and mortgage innovation to release housing equity to meet the expenses accompanying a growing family. But as a consequence they have reduced chances of escaping housing stress, which is to be expected, given rising interest rates over the 2001–2006 timeframe.

Table 18: Discrete hazard model estimates – escape from first spell of housing stress

Explanatory variables	*Coefficient*		*Odds ratio*
First year of spell	1.016	**	2.762
Second year of spell	0.249		1.282
Third year of spell	-0.110		0.896
Fourth year of spell	-0.298		0.743
Fifth year of spell	-0.680		0.507
2003	0.274		1.315
2004	0.423	**	1.527
2005	0.203		1.225
2006	0.254		1.289
Private renter	0.059		1.061
Public renter or rent-free	0.445		1.560
Moved	0.926	**	2.525
Inner region	0.311	*	1.364
Outer region	0.290		1.336
Age	-0.004		0.996
Born in main English-speaking countries	0.050		1.052
Born in non-main English-speaking countries	-0.416	**	0.660
Disabled	0.214		1.239
De facto	0.055		1.056
Divorced, separated or widowed	-0.163		0.850
Single never married	0.394		1.482
Number of dependent children aged 0–4 years	-0.581	**	0.560
Number of dependent children aged 5–9 years	-0.311	**	0.732
Number of dependent children aged 10–14 years	-0.265	**	0.767
Number of dependent children aged 15–24 years	-0.436	**	0.647
High-level qualifications	-0.073		0.930
Medium-level qualifications	-0.058		0.943
Full-time permanent contract	0.290	*	1.336
Full-time fixed-term contract	0.444		1.559
Part-time permanent contract	0.141		1.152
Part-time fixed-term contract	0.959		2.610

Explanatory variables	*Coefficient*		*Odds ratio*
Casual or other contract	0.577	**	1.781
Self-employed	0.110		1.116
Unemployed	-0.150		0.861
Diagnostics			
Observations	2112		
Cox & Snell R-square	0.181		
Nagelkerke R-square	0.242		
Chi-square	422.808	**	

Source: Authors' own estimates from confidentialised unit record files of the HILDA Survey waves 1-6 Release 6

Notes:
The default categories are year 2002, owner-purchaser, major city, Australian-born, married, low-level qualifications and not in the labour force.

** Significant at the 1% level; * Significant at the 5% level

First spells of residence in affordable housing are also relevant because analysis of the duration of these spells identifies those with precarious housing circumstances such that they have a high (conditional) probability of slipping into unaffordable housing circumstances. Table 19 presents coefficient estimates and odds ratios where the hazard is now the conditional probability of making a transition into housing stress (unaffordable housing). The (conditional) odds ratio with respect to, for example, 'moved', is the movers' odds of falling into unaffordable housing relative to stayers' odds of falling into unaffordable housing. A variable with an odds ratio greater than one is then relatively less likely to survive in affordable housing; one with an odds ratio less than 1 is relatively more likely to survive in affordable housing. The benchmark for measurement of odds ratios is the omitted (default) categories (see note to table 19). The estimated hazard and odds ratios with respect to time indicators have a somewhat different interpretation. For example, the odds ratio with respect to the first year of a spell is the odds of slipping into unaffordable housing in the first year, relative to the odds of slipping into unaffordable housing at any point in the remaining years (second to the fifth) of a spell. The odds ratio with respect to the second year has the odds in year 1, and years three to five as the benchmark, and so on for years three, four and five.

The time indicator odds ratios show that survival in affordable housing becomes more likely the longer a spell has lasted. This confirms the protective effect of a spell as it lengthens (see also table 11). The duration of spells in affordable housing is clearly affected by calendar year effects; there is a strong indication that as house prices, rents and interest rates increased over the 2002–2006 period, the chances of survival diminished. By 2006 the odds of dropping out of affordable housing are nearly five times the odds in 2002. Housing cost pressures intensified and were driving more and more Australians into housing stress over the 2002–2006 period.

Housing market variables are all-important. At any given point in a spell, owner-purchasers are more exposed to the risk of housing stress than private renters and these tenants are in turn more exposed to the risk of housing stress than either those living in rent-free accommodation, or public housing tenants[30]. The moved variable plays a different role to that in relation to spells in housing stress. Survival in

[30] When interpreting the tenure odds ratio estimates, note that;

- → Tenure is measured at the start of a spell
- → Outright owner spells are included in the sample and are the omitted category

affordable housing is – at any given stage in the spell – less likely if the person has moved. It seems that if a move occurs during a spell in affordable housing it is generally to more expensive rather than cheaper housing. In contrast, movers during a spell of housing stress trade down rather than up.

Labour market and human capital variables are influential in shaping the duration of spells in affordable housing. Regardless of the contract type, whether full-time or part-time, the employed have a better chance of surviving in affordable housing as compared to the NILF. On the other hand, the unemployed have poorer chances of survival; the odds ratio estimate indicates that the unemployed odds of falling into unaffordable housing are nearly 1.8 times those of the NILF. Our human capital variables require careful interpretation. They suggest that better qualified Australians' spells of affordable housing are more precarious than those of Australians who left school by Year 11. We are probably picking up permanent income factors; those with high levels of human capital can expect rising (real) earnings profiles that prompt a correspondingly high demand for housing, and encourage the leveraged purchase of housing.

The control variable coefficient estimates confirm the importance of dependent children, particularly the very young. This is, then, a sub-group of the Australian population that is more likely to fall into unaffordable housing circumstances, and once these spells in housing stress begin, it is more difficult for families with young children to escape the clutches of housing stress (see table 18). We also gain valuable insights into the role of other socio-economic and demographic variables. Despite economies of scale in housing consumption, the married have lower chances of survival in affordable housing than the single – regardless of the latter's previous marital history. Age is also a factor; the young are more vulnerable to the risk of falling into housing stress. We could be picking up a labour market related impact here as age and work experience are correlated and experience attracts an earnings premium. Finally, migrants from non-English speaking countries find it more difficult to sustain spells in affordable housing.

Table 19: Discrete hazard model estimates – survival in first spell of affordable housing

Explanatory variables	*Coefficient*		*Odds ratio*
First year of spell	-4.371	**	0.013
Second year of spell	-4.974	**	0.007
Third year of spell	-5.437	**	0.004
Fourth year of spell	-5.671	**	0.003
Fifth year of spell	-5.839	**	0.003
2003	0.808	**	2.243
2004	1.141	**	3.130
2005	1.504	**	4.497
2006	1.545	**	4.689
Owner-purchaser	2.100	**	8.163
Private renter	1.896	**	6.657
Public renter	1.133	**	3.104
Rent-free	1.840	**	6.293
Moved	0.678	**	1.970
Inner region	-0.303	**	0.738
Outer region	-0.487	**	0.615
Age	-0.021	**	0.980
Australian-born and Indigenous	-1.266	**	0.282

Explanatory variables	*Coefficient*		*Odds ratio*
Born in main English-speaking countries	0.088		1.092
Born in non- English-speaking countries	0.369	**	1.446
Disabled	-0.088		0.916
De facto	-0.425	**	0.654
Divorced	-0.595	**	0.551
Separated	-0.441	*	0.643
Widowed	-0.492		0.612
Single never married	-0.962	**	0.382
Number of dependent children aged 0–4 years	0.507	**	1.661
Number of dependent children aged 5–9 years	0.265	**	1.303
Number of dependent children aged 10–14 years	0.330	**	1.391
Number of dependent children aged 15–24 years	0.310	**	1.364
Postgraduate	0.449	**	1.567
Graduate	0.464	**	1.591
Bachelor	0.467	**	1.594
Advanced diploma / diploma	0.547	**	1.728
Certificate III or IV	0.285	**	1.330
Certificate I or II	0.473		1.605
Certificate not defined	0.344		1.410
Year 12	0.078		1.082
Full-time permanent contract	-0.519	**	0.595
Full-time fixed-term contract	-0.641	**	0.527
Part-time permanent contract	-0.561	**	0.571
Part-time fixed-term contract	-0.694	*	0.500
Casual or other contract	-0.390	**	0.677
Self-employed	0.449	**	1.567
Unemployed	0.596	**	1.815
Diagnostics			
Observations	31930		
Cox & Snell R-square	0.671		
Nagelkerke R-square	0.895		
Chi-square	35530.186	**	

Source: Authors' own estimates from confidentialised unit record files of the HILDA Survey Waves 1–6 Release 6

Note:

The default categories are Year 2002, outright owner, major city, Australian-born and non-Indigenous, married, below Year 12qualifications, and not in the labour force.

** Significant at the 1% level; * Significant at the 5% level

4.4 Summary

These discrete time hazard models yield important findings. They indicate that lengthy spells in housing stress are uncommon – affecting only a small minority of those beginning a first spell of housing stress. Families with dependent children, particularly young dependent children, are more prone to protracted spells in unaffordable housing. Owner-purchasers find it more difficult to 'climb out' of housing stress because high transaction costs impede moves that private renters can make in order to accommodate housing cost pressures. Finally, there is some evidence to suggest

that employment promotes escape from housing stress, but generally, labour market and human capital variables are unimportant.

Analysis of survival in affordable housing identifies sub-groups in the Australian population more or less able to sustain affordable housing circumstances in the long run. But other important by-products of the survival analysis are findings that the chances of survival in affordable housing declined between 2002 and 2006 – most likely because housing cost pressures intensified. Importantly, longer first spells in affordable housing have a protective effect, regardless of the calendar years these spells encompass.

Most Australians can expect to sustain spells in affordable housing – but there seem to be two groups whose survival is more precarious. One group is the young, well qualified, mobile parent who is stretching the family budget to meet the housing and other needs of a growing family. Large numbers of these families seem to be releasing housing equity to meet these needs, but this comes at the expense of rising mortgage repayments that increasing interest rates have inflated. The other group comprises the unemployed and those inactive in the labour market. Migrants from non-English speaking countries are also prominent in this group. Low income is frequently a permanent rather than a transient feature over their life cycle, and is likely to be a principal cause of this group's predicament. We discuss policy implications and future directions for research in the next chapter.

5 KEY FINDINGS, POLICY IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

Our panel analyses of housing consumers in housing stress between 2001 and 2006 demonstrate that most escape within a year. However, there is a 'hard core' – albeit small in number – for whom housing stress is a more permanent feature. Furthermore, among those exiting unaffordable housing circumstances there is a high chance of return. Interesting dynamics are also observed when investigating 'survival' in affordable housing. Most Australians survive in affordable housing over a spell of five or so years, and the minority that drops into housing stress managed to climb back quickly into affordable housing. There is, then, a polarised set of housing circumstances; on the one hand the majority of Australians can sustain affordable housing, on the other, a minority churns in and out of housing stress, and an even smaller number experiences long-term unaffordable housing.

Employment, the presence of children, moves and mortgage equity withdrawal are particularly important factors shaping the dynamics of affordable housing. Those that have no earnings – because they are non-participants in the labour force or are unemployed – are more prone to persistent housing stress. But earnings related variables such as qualifications have a subtle and perhaps unexpected role; because people consider their long-term earnings prospects before taking on longer-term spending commitments such as housing, younger, better qualified Australians have a higher chance of housing stress, but this group experienced these difficulties on a transient basis before the 'credit crunch' and economic crisis, whereas the unemployed and non-participants were more likely to make up the hard core that suffer housing stress on a more permanent basis. Residential moves made during spells in unaffordable housing tend to alleviate housing cost burdens because such households trade down in the housing market. Renters are much more likely to move and hence they have better chances of escaping housing stress than home buyers who tend to be less mobile – higher transaction costs for home owners are likely to be a relevant factor here.

Survival in affordable housing became progressively more difficult over the 2001–2006 timeframe. This finding is perhaps unsurprising given a house price boom and rising mortgage interest rates, but even taking these trends into account, owner-purchasers are less likely to survive in affordable housing. When we looked more carefully at these households we discovered that large numbers were adding to mortgages in order to cash in some of their housing equity. Residential moves are again influential, but those made by households during a spell living in affordable housing are associated with the onset of housing stress. Thus, moves initiated during a spell of affordable housing tend to involve trading up in the housing market, in contrast to moves initiated during spells in unaffordable housing. Earnings from employment are important for survival in affordable housing, as expected, but the better qualified were found to be in more precarious housing affordability circumstances, as they banked on future increases in wages and salaries to leverage purchases. These precarious housing affordability circumstances are particularly evident among younger couples with dependent children, who were at a stage in the life cycle that is associated with pressing spending needs.

Thus policy-makers who responded to growing concerns about a housing affordability crisis were correct in diagnosing deterioration in housing affordability. However, it is fair to say that only a minority experience housing stress on what seems to be a long-term basis. Typically, this minority consists of the unemployed and non-participants in the labour force; their housing affordability problems appear chronic and warrant long-

term support and assistance if their situation is to be improved. Social housing support is most likely to be appropriate here. Such groups may also deserve complementary labour market assistance in order to reverse their disadvantage in the housing market.

Among the group that quickly escape housing stress, a surprisingly large number churn in and out of unaffordable housing. This finding indicates an important direction for future research. While most Australians experience a first spell of housing stress exit within a year, an improvement in housing affordability tends to be temporary for a sizeable number. It is not clear why this is so. Government support to help sustain improvements in housing affordability such as the housing lifeline proposal discussed elsewhere (Gans and King, 2003) may be appropriate. But further research is necessary before clear guidelines can be established for eventual policy decisions. This finding of our research may reflect the house price boom and interest rate increases over the 2001–2006 period. If so, churning might become less significant in a period when house prices stagnate and mortgage interest rates stabilise. Decomposition of the housing cost and income changes that accompany movements into and out of housing affordability could provide further insights.[31]

Our modelling estimates revealed the significance of residential moves. When moves occur during a spell in unaffordable housing, typically housing costs burdens become lower and, significantly, the prospects of escape from housing stress are improved. Since mobility is higher among private renters than among home owners, moves are particularly important for terminating renter spells in housing stress. An important question for future research is whether stressed Australians are accommodating housing cost burdens by trading down into housing of low standards and inferior location given household type and size. Crippling housing cost burdens that displace the unemployed or non-participant who have future employment aspirations into weak labour market regions could exacerbate labour market problems. This outcome would be of particular concern as employment conditions are expected to deteriorate throughout 2009.

Residential moves during a spell of affordable housing have a positive impact on the chances of slipping into housing stress. Since young couples with children are particularly vulnerable, it is likely that such moves would involve trading up to housing, in areas convenient to schools, that can accommodate a growing family. . Many such couples are home buyers and those who do not move frequently expose themselves to increased risk of housing stress by adding to mortgages. Such a decision will probably reflect urgent spending needs, including house renovations as an alternative to trading up to meet increased space needs. However, the elevated risk that these couples face of plunging into housing stress is perhaps less of a policy concern in view of the findings that such people tend to be better qualified and able to return to affordable housing circumstances most quickly.

Indeed, home buyers falling into housing stress have typically been regarded as a lesser policy concern than renters falling into housing stress, because of expectations that future price gains will allow home owners to accumulate housing wealth, and continued earnings growth will allow mortgages to be paid off. But we now know that

[31] Another potentially important future research direction relates to the housing stress measure employed in our analysis. Because of considerable mobility across the income distribution over time, we have defined a person as being in housing stress if they more than 30% of income in housing costs. As mentioned before, cross-sectional studies have typically employed a more narrow definition, where an individual is in housing stress only if they pay more than 30% of income in housing costs and if the individual is in the bottom 40% of the income distribution. Our broader measure has its own limitations as an indicator of stressed status in that we are capturing some high-income persons who are paying high housing costs relative to their income levels because of personal preferences.

these expectations will prove optimistic for many home buyers. A very different policy scenario is emerging. There is a suggestion in our findings that young Australian couples are trading-in house price gains or stretching budgets to trade up, and banking on future growth in earnings and house prices to 'see them through' in the medium to long-term. It now looks as if home owners will face a prolonged period of house price slump, and a rapidly deteriorating labour market will leave some of these couples with reduced incomes, negative equity and large mortgages. Some will become tomorrow's renters as they are forced to sell in order to make housing costs more manageable, or, in more extreme circumstances, they default on mortgages. Their predicament could become a serious source of concern in the coming months as their search for alternative housing options places increasing strains on private and social rental housing, and as forced sales and foreclosures add to downward pressure on house prices. Losing one's own home through repossession is a devastating experience; it is also a threat to housing market stability and consumer confidence. Evidence from the United States suggests that as repossessions increase as a share of housing market transactions, they seriously depress house prices (Case and Quigley, 2009, forthcoming). We have recently witnessed the destruction of large amounts of pension and shareholder wealth as a result of falling share markets. The destruction of large amounts of housing wealth would be a 'double whammy' that could erode remaining consumer confidence and increase the risks of a serious recession in the Australian economy. Federal and State Governments should now be considering blueprints of policy interventions that could be introduced in the event that housing stress for large numbers of home buyers is transformed into an even more serious predicament that threatens their continued home ownership. These policy interventions can be grouped into two categories. First, there are debt-based solutions that involve assistance with repayments, either through financial institutions granting deferral of mortgage repayments, or by governments extending financial assistance in the form of direct subsidies. Second, there are equity-based solutions, such as shared ownership. This latter measure has been introduced in the past, but a wider range of policy instruments is now being advocated. Equity loans would allow home buyers to trade-in some share of future price appreciation for lower current repayments, while home-equity insurance programs would offer some protection of housing equity, based on regional or neighbourhood house price indices. Early intervention to keep owner-occupiers in their homes might not only help the individuals threatened, but substantially alleviate the effects of the recession that seems unavoidable.

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APPENDICES

Appendix 1: Does attrition matter?

Table 20 compares the attrition and non-attrition sample on a number of key Wave 1 individual and household[32] characteristics that measure stage in the life cycle, gender, location, household type, marital status and labour market history. Persons particularly prone to attrition were marginally younger, lived in cities, were single, Indigenous and not working when the data collection began. Those less prone to attrition were female, Australian-born and were employed and living with a partner at the beginning of the panel study. Persons who had spent a longer proportion of time in paid work were also less prone to attrition. These differences are generally small, but nevertheless statistically significant at the 1 or 5 per cent level.[33]

Table 20: Mean characteristics of persons lost to the panel due to attrition, 2001

Wave 1 characteristics		***Non-attrition sample***		***Attrition sample***		***Statistical significance of difference***
		Mean	N	Mean	N	
Age (years)		46.0	7217	44.6	4117	***
Female (%)		53.9	7217	51.1	4117	***
City (%)		60.7	7217	63.6	4117	***
Income unit type (%)	Couple with dependents	33.4	7217	32.4	4117	
	Couple without dependents	36.9	7217	33.4	4117	***
	Sole parent	4.8	7217	5.1	4117	
	Single	24.9	7217	29.0	4117	***
Marital status (%)	Married	61.1	7210	55.2	4104	***
	De facto	10.0	7210	11.8	4104	***
	Divorced	3.3	7210	3.5	4104	
	Separated	6.2	7210	4.6	4104	***
	Widow	5.4	7210	5.4	4104	
	Single never married	14.1	7210	19.6	4104	***
Indigenous (%)		1.3	7217	2.4	4107	***
Country of birth (%)	Australia	77.0	7217	69.0	4107	***
	Main English-speaking countries	11.5	7217	12.3	4107	
	Other	11.5	7217	18.8	4107	***
Disabled (%)	Disabled	22.5	7217	25.0	4117	***

[32] It should be remembered that our attribution approach uses the household (income unit) as the unit of measurement and the person as the unit of analysis. For *household* characteristics each adult member is included in the sample of persons, and each one is assigned the same household characteristic.

[33] The most notable difference is singles – they make up 22.1% of the sample interviewed in all six waves, but account for 27.2% of the sample that refused interview or could not be traced in one or more waves.

Wave 1 characteristics		*Non-attrition sample*		*Attrition sample*		*Statistical significance of difference*
		Mean	N	Mean	N	
	Employed full-time	44.3	7217	44.8	4107	
	Employed part-time	19.1	7217	16.0	4107	***
	Unemployed	2.7	7217	4.1	4107	***
	NILF	33.9	7217	35.1	4107	
Labour market history (% of time since leaving full-time education)	In paid work	76.2	7173	73.2	4054	***
	Unemployed	2.7	7173	3.6	4054	***
	NILF	21.2	7173	23.2	4054	***

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Note: ***: 1%; **: 5%; *: 10%; no asterisk: insignificant

In table 21 attrition is examined from a somewhat different vantage point; the number of Wave 1 responding persons that are continuously present in the panel are tabulated to Wave 1+j (where j = 1,2,…4). If Waves 5 and 6 are dropped and housing dynamics are analysed using the first four waves only, the balanced panel number increases from 7028 to 7795. One way of examining the sensitivity of our measurements to attrition is to repeat our research exercises using this shorter panel.

Table 21: Balanced panel sample numbers by wave

	Interviewed successfully and continuously until				
	Wave 2	***Wave 3***	***Wave 4***	***Wave 5***	***Wave 6***
Number of Persons	9477	8546	7795	7362	7028
% of Wave 1 responding sample	85.8	77.4	70.6	66.6	63.6

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

The tables below present descriptive analyses using two samples drawn from the first four waves of data. The first sample includes those persons that subsequently refuse interview, or cannot be tracked down. The second sample excludes these persons. If our findings are unaffected when alternately including and omitting the Wave 5 and 6 attritions, this would tend to support the view that attrition does not matter.

Table 22: Housing affordability as housing affordability as housing careers unfold, balanced panel waves 1–4

	2001	*2002*	*2003*	*2004*
Balanced panel excludes attritions in Waves 5 or 6 (N=7016)				
Median housing affordability ratio (%)	7.3	6.7	7.1	6.5
Incidence of housing stress	6.6	6.1	7.0	6.9
Balanced panel includes attritions in Waves 5 or 6 (N=7778)				

	2001	*2002*	*2003*	*2004*
Median housing affordability ratio (%)	7.2	6.6	7.0	6.4
Incidence of housing stress	6.5	6.1	7.0	6.9

Table 23: Median housing affordability ratio (%), by contemporaneous socioeconomic characteristic, balanced panel Waves 1–4

Socio-economic characteristic	*2001*	*2002*	*2003*	*2004*
Balanced panel excludes attritions in Waves 5 or 6				
Home Purchasers	15.0	14.6	15.9	16.3
Renters	11.5	11.8	11.9	11.4
Couples with children	15.5	15.0	15.9	15.8
Couples no children	0.0	0.0	0.0	0.0
Singles and sole parents	5.7	5.6	5.8	5.5
Males	7.1	6.7	7.1	6.6
Females	7.4	6.6	7.1	6.4
Employed	9.2	9.1	9.8	9.6
Unemployed	14.5	13.4	12.2	10.8
Not in labour force	0.0	0.0	0.0	0.0
Major city	8.1	8.1	8.3	8.0
Inner region	6.4	5.3	5.7	5.3
Outer or remote regions	3.6	1.0	2.0	3.6
Balanced panel includes attritions in Waves 5 or 6				
Home Purchasers	15.0	14.7	15.9	16.2
Renters	11.3	11.7	11.8	11.3
Couples with children	15.5	15.0	15.9	15.7
Couples no children	0.0	0.0	0.0	0.0
Singles and sole parents	5.5	5.5	5.7	5.3
Males	7.1	6.7	7.0	6.5
Females	7.3	6.5	6.9	6.3
Employed	9.4	9.2	9.7	9.6
Unemployed	13.6	13.3	12.3	11.1
Not in labour force	0.0	0.0	0.0	0.0
Major city	8.1	8.0	8.2	7.9
Inner region	6.2	5.3	5.6	5.0
Outer or remote regions	4.0	1.6	2.7	3.6

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1-6

Appendix 2: The treatment of missing values

Socio-demographic, labour market and family history variables

A careful examination of the socio-demographic, labour market and family history (proxies for inter-generational transfers) variables that we employ in analyses of housing affordability reveals that there are no missing values for the following variables:

Socio-demographic variables

- Age
- Gender
- Income unit type
- Number of dependent children
- Country of birth
- Location

Labour market variables

- Labour force status
- Highest educational qualification
- English proficiency

Mobility variables

- Whether moved since last wave

We list below how we have dealt with each variable where missing values is a problem. Table 24 describes the pattern of missing values in each wave.

Table 24: Pattern of missing values across waves

Variable name	***Person / partner***	***Number of missing values***					
		Wave 1	***Wave 2***	***Wave 3***	***Wave 4***	***Wave 5***	***Wave 6***
Indigenous	Person						
	Partner			1	1	1	1
Marital Status	Person	7					
Disability	Person				1		
	Partner						
Labour market history	Person	1	1	2	3	4	5
	Partner	1	1	1	1	5	6
Job contract	Person	1	0	2	1	5	0
	Partner	1	0	1	1	4	0
Early death of parents	Person	1	1	1	1	1	1
	Partner	1	1	1	1	1	1
Whether parents separated/divorced	Person	14	14	14	14	14	14
	Partner	11	12	12	12	12	12
Number of siblings	Person	14	14	14	16	17	17
	Partner	6	6	6	6	6	5

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1-6

Indigenous

One partner entered the sample in Wave 3 but did not state whether he was Indigenous or not. As the partner's father was Ukrainian (mother Australian), it has been assumed that he is non-Indigenous (Option 5 (O5).

Marital status

Seven persons (see Table 24) refused to report their marital status in Wave 1 (W1). A combination of Option 5 (O5) and Option 1 (O1) is used in the following order:

(i) O1: Match W1 marital status to W2 marital status if it results in the W1 marital status being consistent with W1 income unit type (e.g. a person cannot be both married and a single income unit at the same time).

→ W1 income unit type and W1 imputed marital status are consistent for persons B to G.

(ii) O5: If step (i) above would result in W1 marital status being inconsistent with income unit type, then W1 marital status should be imputed by matching to the 'number of times married' variable

→ If W1 income unit type = couple, assume 'married' if 'number of times married'>0

→ If W1 income unit type = single, assume 'divorced' if 'number of times married'>0. This is the case for person A.

Table 25: Treatment of missing marital status values

Person	*Wave 1 marital status*	*Wave 1 income unit type*	*Wave 2 marital status*	*Wave 1 number of times married*	*Imputed wave 1 marital status*
A	Unknown	Single	De facto	2	Divorced
B	Unknown	Couple no children	Legally married	2	Legally married
C	Unknown	Couple no children	Legally married	2	Legally married
D	Unknown	Couple with children	Legally married	1	Legally married
E	Unknown	Single	Separated	Unknown	Separated
F	Unknown	Single	Widowed	1	Widowed
G	Unknown	Couple no children	Legally married	2	Legally married

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

Disability status

One person refused to report his/her disability status in W4. This person was not disabled in all other waves. Hence, O1 is used to impute this person's W4 disability status as 'not disabled'.

Labour market history

Option 3 (O3) is used to time-index missing labour market history variables by making use of information derived from a combination of one or more of the following variables:

→ Current labour force status;

→ Dependent person status indicator.

The time-indexing is carried out in the following order:

(i) If an individual becomes independent for the first time in Wave *t*, the individual is assumed to have been in his/her Wave *t* labour force status for one year.

→ For example, suppose an individual is dependent in W1–W5 but is observed to be independent in W6 and employed in W6. The individual's time in paid work in W6 is one year (even though the individual might only have been employed for, say, six months).

(ii) If an individual is employed (unemployed) (NILF) in Wave *t*, the individual is assumed to have been employed (unemployed) (NILF) since the Wave *t*-1, that is, since one year ago.

→ e.g. suppose an individual is observed to have spent ten years in paid work in W1 and is employed in W1. The individual is observed unemployed in W2 but does not have a value for time in paid work in W2. Because the individual is unemployed in W2, the individual is assumed to have been unemployed since W1 or one year ago, even though the individual might only have become unemployed, say, two months ago. Hence, time in paid work in W2 remains at ten years.

The method above resolves the missing values problem for most cases. However, missing labour market history values remain for one case in W1–W4, five cases in W5 and six cases in W6, resulting in missing values in one or more values for one person and seven partners in the sample. These cases with missing values are omitted from the sample in the descriptive and modelling sections, wherever the labour market history variables are required for analysis.

Job contract type

Nine persons and seven partners refused to indicate job contract type in at least one wave.

If a person's employer does not provide holiday and sick leave, O5 is used to impute the person's missing contract type as casual. If a person's contract type is not known in Wave t, but the person's contract type is known in Wave t+1, the person's labour force status has remained unchanged between Waves t and t+1, and the person is employed with the same employer in Waves t and t+1, then O5 is used to impute the person's missing contract type in Wave t as the known contract type in Wave t+1.

If a person's contract type is not known in Wave t but the person is an employee in all six waves (that is, not self-employed) and has the same contract type in all waves for which the person has a reported contract type, then O1 is used to impute the person's missing contract type as his/her contract type in the other waves. These methods resolve the missing values problem for the two persons and two partners. These remaining cases with missing values are omitted from the sample in the descriptive and modelling sections wherever job contract variables are required for analysis.

Early death of parents

One person refused to indicate (in any wave) whether his parents had died by the time he was aged 14. However, he reported that his father and mother were employed when he was aged 14, so O5 has been used to infer that his parents were alive when he was aged 14.

Whether parents separated or divorced

Where a respondent does not report whether his parents separated or divorced, his/her parents' marital states are inferred using O5:

(i) if the respondent reports that s/he was living with both his/her parents at age 14 it is assumed that his/her parents did not separate or divorce

(ii) if the respondent reports that s/he was fostered or adopted, it is assumed his/her parents did not separate or divorce because there are often other reasons for a child being fostered/adopted.

(iii) This method resolves the missing value problem for all but 8 persons and 7 partners who are omitted from the sample wherever parents' marital history is required in the analysis.

Number of siblings

Seventeen respondents and six partners of respondents refused to report number of siblings in at least one wave. These people are omitted from the sample wherever number of siblings is required in the analysis.

Housing cost and income variables

All the income and housing cost variables have missing values. The table below describes the pattern of missing housing cost values in each wave.

Table 26: Pattern of missing housing cost and income values across waves

Variable name	***Number of missing values***					
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Gross income	83	96	120	101	109	76
Disposable income	83	96	120	101	109	80
Mortgage repayments	184	208	189	167	178	139
Private renters' rent	10	8	2	7	5	11
CRA	12	20	16	19	11	12
Public housing rent	9	14	25	19	19	9

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey, Waves 1–6

Mortgage repayments

Among 3831 persons who had ever been owner-purchasers in one or more waves, 724 (10%) did not report mortgage repayment values in at least one wave.

Where there are missing mortgage repayment values, O5 is used to impute repayment values by multiplying the amount of reported outstanding mortgage loan in Wave t by the home loan interest rate in Wave t to impute a mortgage repayment value.

The home loan interest rates, obtained from the Reserve Bank's bulletin statistical tables, are as follows:

W1: 6.80% (July 2001)

W2: 6.55% (July 2002)

W3: 6.55% (July 2003)

W4: 7.05% (July 2004)

W5: 7.30% (July 2005)

W6: 7.55% (July 2006)

This leaves 12 cases with missing values and these cases are omitted from the sample in the descriptive and modelling sections.

Private renters' rent

Among 2206 persons who had been private renters in one or more waves, 38 (2%) did not report rent in at least one wave.

The imputation of missing rent values is carried out using O2. A hedonic rent regression has been used to predict the rent for properties with missing values. This method resolved the missing values problem for all but four cases. Rent could not be imputed for the four remaining cases because of missing values in variables that enter the hedonic rent regression as explanatory variables. Details are given below.

Table 27: Missing values in hedonic rent regression for private renters

Wave of missing rent value	*Hedonic regression explanatory variable with missing values*	*Number of missing values*
4	Condition of dwelling	1
4	Number of bedrooms	1
5	Condition of dwelling	2

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

For most cases, the missing values are in the 'condition of dwelling' variable. In such cases, the property is assigned an 'average' condition so that an approximate rent can still be predicted from the hedonic rent regression. For one case, the missing value comes from the 'number of bedrooms' variable. For this case, the number of bedrooms is assumed to be three, which is the average number of bedrooms in private renter households.

Private renters' CRA entitlements

For eighty-one private renters it is not possible to compute their CRA entitlements using AHURI-3M. AHURI-3M computes CRA entitlements by using reported benefit type and private income in HILDA. Where a person reports receipt of a benefit that is a passport to CRA eligibility, Disability Support Pension (DSP), for example, the person's DSP entitlement is computed using his/her reported private income. If the person's DSP entitlement is greater than zero on the basis of sufficiently low private income levels, then AHURI-3M assumes the person is eligible for CRA and calculates the person's CRA entitlements using the CRA rent thresholds and rates for the relevant tax-benefit year. Where CRA entitlements cannot be calculated using the standard AHURI-3M procedure detailed above, due to missing reported private income, a modified AHURI-3M procedure is employed, which bypasses the use of reported private income in the computation of CRA. Under the modified approach, where a person reports receipt of a benefit that is a passport to CRA eligibility, such as DSP, AHURI-3M immediately assumes the person is eligible for CRA, then calculates the person's CRA entitlements using the CRA rent thresholds and rates for the relevant tax-benefit year.

The table reports the percentage of private renters who are eligible for CRA using the standard and modified AHURI-3M approaches. The percentages are calculated only for private renters for whom it is possible to determine CRA eligibility using both methods, that is, private renters with no missing private income values. Under each approach, a private renter is assigned a value of one if CRA eligible, and zero otherwise. The correlation coefficient reports the extent to which CRA eligibility under the two approaches is correlated. The coefficients are very high, ranging from 0.807 upwards, and are all statistically significant at the 1 per cent level, indicating a high correlation between CRA eligibility computed under the standard and modified AHURI-3M approaches.

Table 28: CRA imputation method

CRA imputation method	*Wave 1*	*Wave 2*	*Wave 3*	*Wave 4*	*Wave 5*	*Wave 6*
Standard AHURI-3M	35.5	37.5	38.8	46.4	46.8	41.1
Modified AHURI-3M	38.7	41.1	41.9	49.2	40.9	48.9
Correlation coefficient	0.832***	0.853***	0.869***	0.916***	0.807***	0.845***

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1-6

*** Significant at 1% level

Public housing rent

AHURI-3M is used to compute the public housing rent each public housing tenant should pay, applying detailed assessable income rules that each state/territory housing authority employs (see Wood, Ong and Dockery 2007). If a tenant's public housing rent is greater than market rent, then the tenant's rent is capped at the market rent level. A hedonic rent regression is used to predict the market rent for public housing properties.

It has not been possible to compute the public housing rent using AHURI-3M for fifty-one public housing tenants, either because of missing income details or missing values in variables that enter the hedonic rent regression. Where the missing values problem is due to missing income details, public housing rent has been computed as a proportion of their reported income unit gross or disposable income, using the following broad state/territory housing rules derived from the Housing Assistance Act annual reports and state/territory public housing policy documents.

Table 29: Broad state/territory housing authority rules, 2001–06

Income component	*NSW*	*VIC*	*QLD*	*SA*	*WA*	*TAS*	*NT*	*ACT*
Non-FTB income measure (2001–2006)	Gross	Gross	Disposable	Gross	Gross	Gross	Gross	Gross
Per cent of non-FTB income (2001–2006)	25	25	25	25	25	25	23	25
Per cent of FTB(A)								
2001, 2002	11	11	13.9	10	10	15	10	10
2003, 2004	11	11	13.9	15	10	15	10	10
2005, 2006	15	11	15	15	10	15	10	10
Per cent of FTB(B)								
2001, 2002	11	11	0	0	5	5	0	0
2003, 2004	11	11	0	0 for couples; 13 for sole parents	5	5	0	0
2005, 2006	15	11	0	0 for couples; 13 for sole parents	5	5	0	0

Where there are missing values in the 'hedonic regression' variables, these are found in the 'condition of dwelling' variable. In such cases, the property is assigned an

‘average’ condition so that an approximate rent can still be predicted from the hedonic rent regression. Details are found below:

Table 30: Missing values in hedonic regression for public renters

Wave of missing rent value	*Hedonic regression explanatory variable with missing values*	*Number of missing values*
2	Condition of dwelling	3
3	Condition of dwelling	8
4	Condition of dwelling	3
5	Condition of dwelling	4

Source: Authors’ calculations using confidentialised unit record files of the HILDA Survey Waves 1-6

Appendix 3: Mobility across the income distribution

Table 31 below shows considerable mobility across the income distribution over time. There were 3.9 million persons in the bottom two quintiles of the income distribution in 2001. Of these, around 20 to 25 per cent were subsequently in higher income quintiles. Similarly, over six million people were in the top three quintiles in 2001. Of these, 13 to 19 per cent had moved into the bottom two quintiles by subsequent waves.

Table 31: Mobility across the income distribution

	Population number ('000s)	***Per cent***
Number of persons in bottom 40% in Wave 1	3899.0	
Number and per cent that moved out of the bottom 40% in:		
W2	767.5	19.7
W3	831.1	21.3
W4	894.5	22.9
W5	907.4	23.3
W6	964.2	24.7
Number of persons in top 60% in Wave 1	6360.7	
Number and per cent that moved into the bottom 40% in:		
W2	807.7	12.7
W3	1004.8	15.8
W4	1135.4	17.8
W5	1143.7	18.0
W6	1224.2	19.2

Source: Authors' calculations using confidentialised unit record files of the HILDA Survey Waves 1–6

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