Factors Shaping the Dynamics of Housing Affordability in Australia 2001-2006

Housing Studies

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ABSTRACT *This paper investigates factors shaping the dynamics of housing affordability in Australia over the period 2001-06. Panel model findings indicate that those with children and unwaged are more prone to persistent housing affordability stress. However, residential moves during spells of housing affordability stress alleviate housing cost burdens. Survival in affordable housing has become progressively more difficult over the 2001-06 timeframe, an unsurprising finding given a house price boom over the period of analysis. Residential moves are again influential, but those made by households during a spell in affordable housing are associated with the onset of housing affordability stress.*

KEY WORDS: *Housing affordability dynamics, housing affordability stress*

JEL Classification: R20

SHORT DESCRIPTION OF ARTICLE: This paper utilises panel models to investigate factors shaping movements into and out of housing affordability stress in Australia over the period 2001-06.

1. Introduction

This paper investigates the dynamics of housing affordability in Australia over the period 2001-06. Long-run trends indicate that housing affordability in Australia has been deteriorating over the last two decades. For example, the number of owner purchasers in housing affordability stress (HAS) - those whose net housing costs exceed 30% of gross household income - more than doubled from 168000 to 368000 households between 1982 and 2002. This represents an increase in the incidence of HAS from 10% to 15% of all owner purchaser households. Similarly, the number of private renters in HAS almost doubled over the period from 1982 to 2002, though the incidence of HAS remained relatively constant at 20% of private renters.[1] Given the long-run decline in housing affordability in Australia and the recent sharp increases in house prices and rents, housing affordability has become a key policy concern.

There are two main forms of housing assistance policies in Australia, both of which are targeted at renters. Public housing is subsidised housing that has typically been managed by state and territory housing authorities. Public housing is offered to eligible tenants at below-market rents and so the numbers applying for public housing exceed the available housing stock. It must therefore be rationed; state and territory housing authorities operate wait lists to prioritise access to public housing. Tenants pay income-related rents that are typically 25% of their assessable income, and their rents are capped at the estimated market rent of the property. In 2010, approximately 90% of public housing tenants were paying less than market rent (Steering Committee for the Review of Government Service Provision 2011). Historically Australian public housing tenants have had security of tenure so transitions in and out of Housing Affordability Stress have not affected continued residency in the tenure.

[1] Authors' own calculations using the 1982 and 2002 Surveys of Income and Housing Costs.

Commonwealth Rent Assistance (CRA) is a cash supplement provided by the Commonwealth government to private renter households who receive pensions, allowances or family payments. Specifically, private renter households without children have to receive a pension or allowance to be eligible for CRA; those with children have to receive more than a base rate of Family Tax Benefit Part A to be eligible. CRA is paid at a rate of 75 cents per dollar of rent above a specified minimum rent threshold until the maximum rate is reached. The minimum and maximum rent thresholds differ by household type, including whether the household comprises a single adult or couple, and number of children. CRA is not separately income tested and is only withdrawn when entitlement to pensions, allowances or family payments is lost. These arrangements mean that CRA is not particularly well targeted on tenants in HAS. The working poor who experience abrupt increases in rents that push them into HAS are particularly poorly served by CRA (see Forbes, Gibb and Wood, 2005).There exists a plethora of studies investigating the incidence of housing affordability and its trends through time using repeated cross-sectional data (see, for example, Green, 1996; Quigley and Raphael, 2004). However, there have been few studies examining whether individuals' housing affordability problems are transient or persistent (however, see Nordvik and Ahren 2005). This is a key question for policy-makers because the optimal policy responses appropriate for transient spells in HAS could well differ from those optimal when spells are expected to be persistent. More protracted spells could be symptomatic of housing market failures and entrenched disadvantage that warrant a more vigorous and long-lasting government response.

We exploit the longitudinal nature of waves 1 to 6 of the Household Income and Labour Dynamics (HILDA) Survey data to explore research questions on the dynamics of housing affordability. A person-period dataset is designed that contains the records of those Australians at risk of exiting (un-) affordable housing. The persistence of (un-)

affordable housing circumstances is analysed by computing hazard and survival rates over first spells of residence in (un-) affordable housing. The socio-economic and demographic factors determining the chances of escape from unaffordable housing, or survival in affordable housing, are investigated by estimating discrete time proportional odds hazard models.

First, we investigate whether HAS has increased over the period 2001-06, and whether there are differences by socio-demographic characteristics such as tenure, geography, household type and age etc. Second, we examine whether HAS is transient or persistent, that is, do those who escape HAS successfully stay out of HAS, and do those who fall into HAS remain in or shed this affordability status in subsequent years? To address this question of persistence, we adopt a hazard rate approach. Third, we employ panel models to estimate the impacts of socio-demographic characteristics on the probability of escape from a spell of HAS given HAS in the previous year, and the probability of falling out of a spell of affordable housing given affordable housing costs in the previous year. An important caveat is that this study focuses only on first spells of HAS (and first spells in affordable housing), that is, it ignores churning in and out of HAS.

We begin in section 2 by presenting an overview of the existing Australian and overseas literature on the dynamics of housing affordability. In section 3, we describe the sample design, the extent of attrition in our sample and its potential impacts on the accuracy of our findings. We also describe the measurement of housing costs net of housing assistance entitlements, income, and the housing affordability ratio (HAR) measures of housing cost burdens. Section 4 offers some descriptive statistics while section 5 presents results from discrete time hazard models that uncover key factors influencing the chances of escape from HAS, or survival in affordable housing. Section 6 concludes by summarising the key findings and directions for future research.

2. Literature Review

There has been a plethora of studies investigating 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) using data from the American Community Survey to investigate trends in housing affordability over the period 1960-2000. In Australia, Yates and Gabriel (2006) employed the Survey of Income and Housing Costs (SIHC) to examine changes in housing affordability over the period 1995-2003, while Wood, Watson and Flatau (2006) and Dalton and Ong (2007) have used the SIHC to investigate the impacts of alternative policy reforms on housing affordability outcomes. These studies typically find that larger households, sole parents, the unwaged, those with low earnings and members of ethnic minorities are particularly prone to HAS.

However, there have been few studies examining whether individuals' housing affordability problems are transient or persistent. In Australia this has been primarily due to the lack of longitudinal data that allows researchers to track the housing affordability of a panel of individuals through time. In some countries longitudinal data sets have been available for many years; but longitudinal research by housing researchers has typically focused on residential mobility, housing careers, and how tenure transitions are intertwined with phases in the life course. Examples from the United States include Pickles and Davies (1985; 1986) and Clark, Deurloo and Dieleman (2003) using 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 longitudinal HILDA Survey allows researchers to explore the issue of persistence in Australia. In recent years two studies have investigated issues relating to

both the incidence and persistence of HAS using the HILDA Survey. Marks and Sedgwick (2008) is an Australian study that examined the incidence and persistence of HAS over the period 2001-06. To calculate the incidence of HAS, the study presented estimates of HAS (housing costs in excess of 30% of gross household income) in each of the years after the first experience of HAS. The study found that the incidence of HAS 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 HAS has actually fallen among households in the lowest income decile (defined using equivalised disposable income), and increased in the higher income quartiles. It was suggested that mortgage equity withdrawal might be partly responsible among higher income owners. The study assessed the persistence of HAS by estimating the percentage of individuals in HAS in a particular year who are also in HAS one or several years later. Among those in HAS in 2001, less than half were in HAS in 2002, approximately 40% in 2003 and down to 35% in 2006. HAS was found to persist longer among renters.

Using data from the 2002-03 SIHC, Yates and Gabriel's (2006) study showed that, of the 7.6 million households in Australia, 1.2 million or 15.8% were in HAS (paid 30% or more of gross household income in meeting their housing costs) in 2002-03. Analysis of the persistence of HAS used a balanced panel from the HILDA Survey waves 1-3. The study found that one-half of Australians in HAS in a particular year would still be in HAS in the following year. Furthermore, there is a 29% chance that Australians in HAS in a particular year would remain in HAS continuously for three years.. The study concluded, contrary to Marks and Sedgwick (2008), that HAS was a protracted rather than transient problem.

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. They reported that 28% of Canadians were in HAS (paid 30% or more of gross household income in meeting their housing costs) at some point between 2002 and 2004. Almost one third were in HAS in all three years, an estimate that is similar to the Australian findings in Yates and Gabriel (2006). The Canadian study goes beyond the descriptive analyses of the two Australian studies by estimating regression models to uncover the statistical relationship between varying socio-economic characteristics and the probability of being observed in HAS. Their first regression model estimated the probability that a Canadian would be in HAS in at least one year of the study period; the second model targeted the issue of persistence by estimating the probability that a Canadian would be in HAS 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 HAS at some point, or persistently during the three-year period. 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 HAS at one time or another during 2002-04.

This paper attempts to extend the study of housing affordability dynamics in Australia by modelling the key factors that are associated with movements into and out of HAS. We begin by describing our sample design and the measurement of key variables.

3. Sample and Measurement Issues[2]

Sample Design – the Attribution Approach

The sample has been designed using the *attribution approach* – 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

[2] Additional details can be obtained from Wood and Ong (2009).

[3] An income unit comprises one or more persons whose command over income is shared between the people comprising the unit (Australian Bureau of Statistics, 1997). Income sharing is assumed to take

period - wave 1(2001) – there were 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 had a 6-year old daughter Carol and were home purchasers in wave 1. The daughter is not an adult and is not therefore included in the sample frame. But both John and Kate are included in the sample frame. Their housing affordability position is calculated by measuring their combined income, and calculating mortgage repayments as a percentage of their combined income (the HAR). Both John and Kate enter the sample and each has the same HAR. If John and Kate were to divorce in wave 4 the attribution approach retains both of them in the sample, but because they now form separate income units they will no longer share the same housing affordability measure. When 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. The sample for analysis is then persons, and the rate of say HAS is the percentage of all persons with HARs in excess of 30%, but the income unit (that the person belongs to) is the unit of measurement.

There are 1136 dependent persons in wave 1 who subsequently become independent. There are 719 independents that stay in the household they previously occupied as a dependent. They are added to the sample frame from the wave/year in which they become an independent income unit; because they are an income unit their housing affordability position is calculated separately from that of the other income unit(s) that occupies 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.[5]

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place among couples, and between parents and dependents. 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.

[4] In practice these independent income units are adult sons and daughters living 'rent free' with their parents.

[5] There is a small number (106) that achieves independence, but then return to their dependent status before the end of the study period. This churning complicates sample design and increases data

There are a couple of groups that have been included in the sample design who warrant discussion because similar studies have decided to omit them. Persons with zero housing costs are included, though the wage discounts of those living in employer provided housing have been estimated and included as a housing cost in housing affordability measures (see Wood and Ong, 2009, pp. 15-16). Persons residing in group households, that is, dwellings occupied by two or more unrelated income units, are included. Their exclusion can be justified on the grounds that rent must be apportioned using arbitrary criteria. On the other hand, group sharing is a potentially important way singles can economise on housing costs and so deserve attention.

We omit persons belonging to income units with zero or negative disposable incomes because such outcomes are typically the result of tax minimization strategies, or temporary losses from self-employment that disguise underlying financial positions. Residents of non-private dwellings and boarders are not included because housing costs are not recorded. The homeless are a typical and important omission.

Table 1 describes the sample design. There are 13748 persons who were either responding adults in wave 1 or who were dependents in wave 1 but became independents in subsequent waves. The exclusion of boarders and others where tenure cannot be identified; 'churning' dependents; and income units with zero or negative incomes leaves a wave 1 sample of 11334.

Table 1

Attrition and Missing Values

Of the 11334 persons in the sample, 7217 (64%) continued in the panel through waves 1 to 6; on the other hand there is attrition amounting to 4117 (36%) persons who

processing requirements. In view of their small number, and the resource cost associated with inclusion, they have been omitted from the sample design.

either refused interview or could not be contacted in one or more waves. If the attriting sample are a 'random draw' from the wave 1 sample frame they do not pose a serious concern for the empirical analysis, as the sample will remain representative of the population. However, we find that persons particularly prone to attrition were marginally younger, lived in cities, single, indigenous and not working when the data collection began. Those less prone to attrition were female, Australian-born, employed and living with a partner at the onset of the panel study. These differences are generally small, but nevertheless statistically significant at the 1 or 5% level.[6] While these findings are cause for concern, these worries are allayed if the chances of attrition are unrelated to housing affordability status. We examine whether attrition rates are significantly different when calculated for housing consumers in HAS (as measured by net housing costs in excess of 30% of income in the first wave they are observed to be independent) and housing consumers occupying affordable housing (paying 30% or less income to meet net housing costs in the first wave they are observed to be independent). The attrition rate is 36.1% for the former and 38.7% for the latter group. The difference in attrition rates is not statistically significant (sig. level = 0.141), a finding that is reassuring.[7]

Missing values can also be a serious problem in panel data. Designing a panel where all persons must have a complete set of records in waves 1-6 for all variables can result in a considerable drop in sample size. We utilise information in the data base to impute a value for a variable in the wave(s) when it is missing. In the case of all variables,

[6] The most notable difference is singles – they make up 22.1% of the sample interviewed in all 6 waves, but a larger 27.2% of the sample that refuse interview or cannot be traced in one or more waves.

[7] We also conducted descriptive analyses using two samples drawn from the first 4 waves of data – a sample that includes those persons that subsequently refuse interview, or cannot be tracked down – and a second sample that excludes these persons. Our findings are generally unaffected when alternatively including and omitting the wave 5 and 6 attriting persons, lending some credence to the view that attrition is unlikely to bias our findings (see Wood and Ong, 2009 for details).

missing values affect less than 10% of *individuals* in the person-period dataset.[8] For details, refer to appendix A1.

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 CRA. Public renters' housing costs are estimates of rebated rents. The rent-free typically have zero housing costs. But some are living in employer-provided housing as part of their job compensation and Engeland et al (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. Hence, 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. Our results indicate that the rent 'paid' in foregone earnings can be large for those living in employer-provided housing, ranging from 19% to 39% of earnings.[9]

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

[8] For example, at one extreme only 38 (2%) private renters do not report their rent payments in one or more waves. On the other hand, 724 (10%) owner purchasers fail to report their mortgage repayments in one or more waves.

[9] More details on the coefficient estimates and the number and percentage of the employed living in rent-free employer provided housing is available from the authors upon request.

dependent child. The HAR is the ratio of net housing costs to equivalised disposable income.[10] A person is in HAS if HARs exceed 30%.

Cross-section studies typically define a household as being in housing stress when housing costs exceed 30% of income and the household is in the bottom 40% of the income distribution (Landt and Bray, 1997 and the cross-section analysis in Yates and Gabriel, 2006 for example). However, in longitudinal analysis (Yates and Gabriel, 2006; Marks and Sedgwick, 2008 and Engeland et al 2008), households are usually defined as being in housing stress when housing costs exceed 30% of income, regardless of household income. This is because the composition of households in the bottom 40% of the income distribution changes over time as households move up and down the income distribution. Income mobility figures from the HILDA data confirm that there has been considerable mobility across the income distribution over the period 2001–06. Of those in the bottom 40% in 2001, around 20–25% were in higher income quintiles in subsequent waves. Similarly, of those who were in the top three quintiles in 2001, 13% had moved into the bottom two quintiles by 2002 and 19% had descended into these bottom two quintiles by 2006. Clearly, with such income mobility difficulties will arise if restricting the definition of stressed status to low-income persons in some reference year.

To be consistent with other longitudinal studies, we have defined a person as being in housing stress when the person's income unit housing costs exceed 30% of income regardless of position in the income distribution. However, given considerable mobility across the income distribution, we have also re-estimated the hazard models under an alternative definition of housing stress, where a spell in HAS only begins if a person is observed to have housing costs in excess of 30% of income *and* is in the bottom 40% of the income distribution. Such a spell ends if a person's housing costs fall below

[10] 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 and hence the amount of housing consumed.

30% of income, but it also terminates if a person moves out of the bottom 40% of the income distribution.

The two main forms of housing assistance in Australia are CRA for private renters and public housing rent rebates. CRA entitlements are not reported separately in HILDA. 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. Both forms of housing assistance are computed using the tax-benefit module of AHURI-3M, a housing market microsimulation model. The tax-benefit module uses the reported private incomes (from earnings, interest, dividends and so on) of HILDA survey respondents to calculate eligibility and entitlements to income support programs, including housing assistance and tax liabilities under personal income tax arrangements in each year from 2001 to 2006. This enables researchers to estimate the consequences for housing affordability of changes to housing assistance parameters for renters over the period 2001-06 (Wood and Ong, 2008). The take up rate of public housing rent rebates and CRA is assumed to be 100%. All public renters receive rent rebates because they are delivered in the form of income related rents. CRA is integrated into the income support payment program which facilitates a higher take up than if it were administered separately.

4. Descriptive Statistics – A Hazard Rate Approach

To address the issue of persistence, we take a hazard rate approach. The estimates are based on a sample of persons that have at least 1 year of HAS in the time frame 2001-06, and measures the proportion who escape their spell of HAS in each subsequent year, given HAS in the previous year. The lower is the hazard rate profile the more persistent is HAS. A steep fall in the hazard rate suggests that while many quickly ‘escape’ HAS, there is negative duration dependence among those remaining in HAS beyond the first

year. We also examine those 'at risk' of tumbling into HAS by selecting persons with at least one year residing in affordable housing over the period 2001-06. We then compute the proportion of persons that 'survive' in affordable housing in each subsequent year given occupation of affordable housing in the previous year. The higher is the survival rate profile the lower is the risk of falling into HAS. A convex survival curve implies that the risk of falling into HAS falls as spells lengthen and suggests that residence in affordable housing offers increasing protection against HAS. These research exercises use the first experience of a housing affordability status and analyse the persistence of that status. They ignore subsequent transitions across housing affordability states.[11] Our sample comprises 7206 persons. In total these persons experience 1550 (first) spells of HAS and 7166 (first) spells of affordable housing within the data collection period.

Table 2 is a 'life table' that tracks the event histories of 'stressed' individuals from the first year of their spell of HAS, through to the end of the data collection period (wave 6). We define the beginning of time as the first wave during which a person is recorded in HAS; interest focuses on whether, and if so, when the spell of HAS ends. At the beginning of time, year 0, all 1550 persons are in HAS and 172 persons' spells are censored in year 0 because year 0 of their spell occurred in wave 6. This leaves 1378 (1550-172) to enter the next time interval, that is, year 1. By the start of year 5 there are only 47 persons left in the risk set, and censoring at 37 exacts a heavy toll, only 10 escaping during that year. The hazard rate is the key measure of the likelihood of escaping HAS in each time period. It is the conditional probability that a person will escape HAS given that he or she did not escape in an earlier time period. We learn from Table 2 that a majority of those in HAS during year 0 are likely to exit HAS during year 1 – the hazard is 0.66. There is then a sharp decline in the hazard to 0.43 in year 2 that is

[11] Subsequent transitions offer important insights into the permanence of escapes from HAS, or the transience of tumbles into HAS. Investigations into churning are outside the scope of this paper, but see Wood and Ong (2009) for some findings and suggestions for further research.

followed by further modest declines to 0.21 in year 5. In sum, those starting a spell of HAS between 2001 and 2006 have a high chance of escaping HAS by year 1, but there is negative duration dependence. Nevertheless, as the survival rate profile indicates, the vast majority can expect to escape by year 5.

Table 2

Figure 1 compares hazard rates by tenure; the hazards of owner purchasers and private renters are both high in year 1. But after year 2, an owner purchaser still in HAS 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 costs burdens and thereby avoiding HAS. Evidence on moves confirms this hypothesis. In each year a much higher proportion of 'stressed' private renters move; for example, in 2001 38% (4%) of stressed private renters (owner purchasers) moved to other housing in the same tenure. In 2005 the proportions are 29% and 6% of stressed private renters and owner purchasers respectively. 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 their first spell of HAS.

Figure 2 explores the risks faced by different household types and indicates that the presence of children is associated with more protracted first spells in HAS. Over 80% of couples without dependent children have escaped HAS by year 1, and by year 4 they have all escaped. But just under 60% of couples with children escape HAS by year 1, and the hazard rate declines to about 0.3 by year 5.

Figure 1

Figure 2

We now turn our attention to spells in affordable housing and the risk of falling into HAS. Table 3 analyses the first spells of 7166 Australians that 'survive' at least one year in affordable housing between 2001 and 2006. Only 4.7% of the at risk group plunge into HAS in year 1, and so the survival rate is very high at 95.3%. In fact the survival rate remains very high; by year 5 the probability that an individual survives in affordable housing is 82%. 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.

Table 3

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 HAS. Figures 3 and 4 confirm the importance of tenure and children. Owner purchasers and couples with children are considerable less likely to survive in affordable housing. These are Australians typically in the early stages of labour 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% of those who fail to survive in affordable housing; only 25.4% are renters. The owner purchasers that drop out of affordable housing have mean LVRs that are 54.6% in the last year of their spell. This is much higher than a mean LVR of 32.8% in the last year of the uncompleted spells of 'survivors'.

Figure 3

Figure 4

5. Modelling (Un-) Affordable Housing Spells

In this section 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 models are estimated using the at risk data set with respect to first spells. 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.

In modelling first spells in HAS, the target event is escape from HAS; in modelling first spells in affordable housing, the target event is falling out of affordable housing. The hazard (h) for person i in discrete time period j is the probability that s/he will experience the target event T in time period j conditional on the event not having occurred before time period j and his/her values for the P predictors in time period j (Singer and Willet, 2003):

$$h(t_{ij}) = \Pr[T_i = j | T_i \geq j \text{ and } X_{1ij} = x_{1ij}, X_{2ij} = x_{2ij}, \ldots, X_{Pij} = x_{Pij}, \ ] \qquad (1)$$

Equation (1) can be expressed as a logit (log of odds) function:

$$\text{logit } h(t_{ij}) = [\alpha_1 D_{1ij} + \alpha_2 D_{2ij} + \ldots \alpha_J D_{Jij}] + [\beta_1 X_{1ij} + \beta_2 X_{2ij} + \ldots \beta_P X_{Pij}] \qquad (2)$$

The explanatory variables are of two kinds, time indicators (D) and predictors (X). Both sets of variables are assumed to be exogenous, an assumption that is perhaps more plausible with respect to the time-invariant variables measured at the start of a spell, which cannot be simultaneously determined by future movements in and out of HAS. 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.[12] The coefficient estimates (α_j) represent the baseline hazard function.

Predictor variables are measures of the factors that should be influential in shaping the probability of escaping HAS (or sustaining spells in affordable housing). These include housing market variables such as housing tenure, region and mobility; labour market and human capital variables such as educational qualifications, employment status and job contract type; socio-demographic variables such as age, ethnicity, marital status and number of dependent children. Our chosen model specification also recognises that time has an historical dimension; a 2 year spell of HAS 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. This hypothesis can be tested by inclusion of a vector of calendar year dummy variables as predictors. The predictor variables can be time-invariant or time-varying. For example, country of birth is necessarily a constant and therefore time-invariant. Time varying variables can take different values in each year. In some cases – age, for example – the variable will always change value. Though housing tenure is time-varying, 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 coefficient estimates (β_k) 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 β_k estimates into odds ratios. When the predictor variable is dichotomous - for example a

[12] The panel extends over the timeframe 2001-06 but transitions occur from 2002 onwards, leaving a maximum length of spell of 5 years.

variable such as *moved* that indicates whether the individual moved in any year *j* of a spell – the odds ratio is a measure of how likely movers are to exit from HAS (for instance) relative to non-movers. If the odds ratio is 2 movers are twice as likely to exit HAS at any given stage in a spell of un-affordable housing. A variable with an odds ratio greater (less) than one is then *relatively* more (less) likely to escape HAS.

We conduct our modelling using two alternative definitions. In the first instance, a person is defined to be in HAS if housing costs exceed 30% of income. Then models are re-run with a person in HAS if housing costs exceed 30% of income and also positioned in the bottom 40% of the income distribution. As conclusions are largely unaffected by the choice of definition, we report detailed findings based on the first definition only.[13]

Table 4 presents estimates for a discrete time hazard model of first spells in HAS. The model is statistically significant at the 1% level based on the Chi-square statistic. The benchmark for measurement of odds ratios is the omitted (default) categories (see note to table 4). The estimated odds ratios with respect to time indicators have a somewhat different interpretation. The odds ratio with respect to the first year of a spell is the (conditional) odds of exiting HAS in the first year, relative to the (conditional) odds of exiting at any point in the remaining years (second to the fifth) of a spell. The (conditional) odds of exiting HAS 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%. The odds ratio remains relatively high in year 2, but then dips below 1, and is as low as 0.51 in the 5th year of a spell. This negative duration dependence is qualified by the observation that time indicators other than year 1 are statistically insignificant. The calendar year variables are mostly insignificant, the exception being 2004 where the (conditional) odds ratio is 1.5.

[13] Results based on the second definition are shown in Appendix A2.

Findings on housing market variables suggest that tenure has no impact on the chances of escaping HAS, contrary to the descriptive analyses which indicated that private renters have a higher hazard (see Figure 1). This could be because private renters in HAS are more likely to move. Indeed movers have odds of exiting HAS that are 2.5 times the odds of 'stayers'. Residential mobility is the second most important variable as measured by the odds ratio. It would seem that many spells in 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.[14] These findings and their interpretation are subject to the *caveat* that housing tenure and mobility are interrelated and hence endogenous.[15]

Those employed full time on permanent contracts have odds 34% higher than those not in the labour force (NILF). Surprisingly those employed full time but on casual contracts are even more likely to exit HAS. The unemployed and most forms of employment status have odds ratios that are statistically insignificant. 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 is statistically significant at the 5% level, with the odds ratio of 1.338 indicating that employed persons are 34% more likely to escape HAS than those not working. If the employment variable is disaggregated on a full-time/part-time basis,

[14] As stated previously, the model findings are largely unchanged when we restrict HAS status to those whose housing costs exceed 30% of income and are in the bottom 40% of the income distribution. For example, under both HAS definitions, findings on housing market variables suggest that tenure has no impact on the chances of escaping HAS while those who move are more than twice as likely to escape HAS as compared to stayers.

[15] The correlation coefficient between the homeowner (private renter) and residential mobility variable is -0.301 (0.308) and this is significant at the 1% level. The homeowner variable is defined as a binary variable that equals one if a person is an outright owner or owner purchaser, and zero if a person is in any tenure other than homeownership. Similarly, the private renter variable is a binary variable that equals one if a person is renting privately, and zero if the person is in any other tenure (homeownership, public renting and rent-free).

only the full-time employed variable remains significant at the 5% level, with full-time workers having odds 35% higher than those not working.

Among the socio-demographic controls, presence of dependent children is particularly important, and this is most evident when dependent children are aged 0-4 years. Housing stressed Australians with very young children have odds of escaping HAS that are 40% 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% have withdrawn equity by adding to their mortgages on one or more occasions during their spell of HAS. 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 HAS (see Parkinson et al 2009).

Table 4

Table 5 presents coefficient estimates and odds ratios where the hazard is now the conditional probability of making a transition into HAS (unaffordable housing). The model is again statistically significant at the 1% level based on the Chi-square statistic. The time indicator odds ratios show that slipping into HAS becomes less likely the longer a spell has lasted, which confirms the idea that spells have a protective effect as they lengthen. 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 5 times the odds in 2002.

Housing market variables are very important. At any given point in a spell, owner purchasers are more exposed to the risk of HAS than private renters and these tenants are in turn more exposed to the risk of HAS, than either those living in rent-free accommodation, or public housing tenants. The moved variable plays a different role to that in relation to spells in HAS. Survival in 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. Since mobility and private renting are more strongly correlated it would appear that owner purchasers more precarious affordability status is not due their greater propensity to trade up through housing moves.[16]

Labour market and human capital variables are influential in shaping the duration of spells in affordable housing. The employed have a better chance of surviving in affordable housing as compared to the NILF. On the other hand the odds ratio estimate indicates that the odds of the unemployed falling into unaffordable housing are nearly 1.8

[16] The correlation coefficient between the homeowner (private renter) and residential mobility variable in table 5 is only -0.070 (0.280) though this is significant at the 1% level.

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 that had 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 socio-demographic coefficient estimates confirm the importance of dependent children, particularly the very young. This is a sub-group of the Australian population that are more likely to fall into unaffordable housing circumstances. 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 likely to make transitions into HAS. 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 5

6. Conclusion and Future Research Directions

Our panel analyses of housing consumers in HAS between 2001 and 2006 demonstrates that a majority escape within a year, and most Australians that begin a spell in affordable housing are able to sustain it over five or more years. However, there is a 'hard core' - albeit small in number - for whom HAS is a more protracted feature of their lives. There is then a polarised set of housing circumstances; on the one hand there is the majority of Australians that can sustain affordable housing, and a minority segment for whom unaffordable housing circumstances are a long term experience.

The presence of children, employment and moves are particularly important factors influencing the chances of escaping HAS. Those that have no earnings – because they are non-participants in the labour force or unemployed – are more prone to persistent HAS. But earnings related variables such as qualifications have a subtle and perhaps unexpected role; because people consider their long term earnings prospects before entering longer term spending commitments such as housing, younger better qualified Australians' have a higher chance of HAS. But this is a group who are likely to experience these difficulties on a transient basis, whereas the unemployed and non-participants are more likely to make up the hard core that suffer protracted spells of HAS. Residential moves during spells in HAS tend to alleviate housing cost burdens. Renters are much more likely to move and hence they have better chances of escaping HAS than home buyers who tend to be less mobile, probably due to higher transactions costs.

Survival in affordable housing has become progressively more difficult over the 2001-06 timeframe, a finding that is perhaps unsurprising given a housing price boom and rising interest rates. But even taking these trends into account owner purchasers are less likely to survive in affordable housing. Residential moves are again influential, but those made by households during a spell living in affordable housing are associated with the onset of HAS. Thus moves initiated during a spell of affordable housing tend to involve trading up in the housing market, a pattern that is the opposite of moves initiated during spells living in unaffordable housing. Earnings from employment are important to securing survival in affordable housing, as expected, but the better qualified are found to be in more precarious housing affordability circumstances as they may bank on future increases in wages and salaries to leverage purchases. These 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.

A limitation of the analysis is that only first spells of HAS are examined. If churning in and out of HAS 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. It turns out that among those suffering at least one spell of HAS, more than 1 in 5 (22%) had two or three spells. There is then a considerable amount of churning; it is a topic deserving of attention from researchers.

The conclusions presented in this paper could be reversed in weaker economic conditions where expectations of growing earnings prove to be optimistic. There is a suggestion in the 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 stagnant house prices, and a rapidly deteriorating labour market would leave some of these couples with reduced incomes, but owing large amounts on their mortgages. An important future research direction is to conduct a similar analysis using future waves of the HILDA Survey that will cover a period characterised by weaker housing market conditions. Another 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 into weak labour market regions could exacerbate labour market problems.

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Appendix A1: The Treatment of Missing Values

A careful examination of the variables that we employ in analyses of housing affordability reveals that there are no missing values for the following variables:

- Age
- Gender
- Income unit type
- Number of dependent children
- Country of birth
- Location
- Labour force status
- Highest educational qualification
- English proficiency
- Whether moved since last wave

The simplest approach to address the missing values problem is to assume that variable values are unchanged from wave to wave so that when a variable is recorded in (say) wave 1, but not in wave 2, the former value is used as the estimate for wave 2. This procedure is clearly less appropriate for variables whose values are volatile – house prices, for example.

For certain key variables (e.g. market rent, earnings) that vary from year to year we have 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. In the case of market rent, hedonic rent regressions have been designed that include property and personal characteristics. The models 'fit' the data quite well; the predicted values from such regression models are then a reasonably reliable imputed value. [17]

[17] Model estimates are available from authors upon request.

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. Some variables are also 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 intergenerational 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.

There are variables like disposable income that we construct ourselves using the AHURI-3M tax-benefit simulator. The method involves use of reported private sources of income and application of Australian Taxation Office tax provisions and Centrelink 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. 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.

Tables and Figures

Table 1: Composition of the Sample (Persons in Responding Income Units Only)[a]

	Number of persons
Independents in wave 1:	10705
In private non-group households in all waves	
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 that 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 non-positive 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 boarder could also have non-positive incomes

Table 2: Rates of 'Escape' from a First Spell of HAS

Year[a] *(t)*	*Number*			*Hazard rate* $H_t = N_t / T_t$ [c]	*Survival rate* $S_t = S_{t-1}(1-H_t)$ [c]
	In HAS at start of year (*T*)	Escaped HAS 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

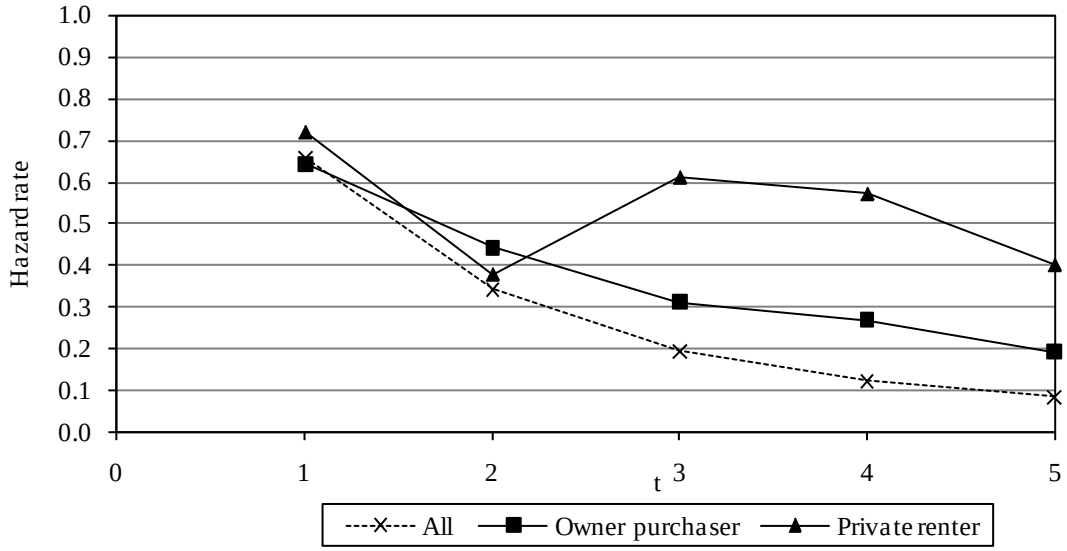
Notes:

a. Housing costs and income are measured only once per year. The wave when a person is first recorded in HAS is then labelled year 0 because the person cannot leave HAS 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 HAS 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.

c. T_t is the number of persons in HAS at the start of year *t*, N_t is the number of persons who escaped HAS during year *t*, H_t is the hazard rate in year *t*, S_t is the survival rate in year *t*, S_{t-1} is the survival rate in year preceding *t*.

Figure 1: All Individuals 'At Risk' of Escaping a First Spell of HAS, by Housing Tenure in First Year of Spell

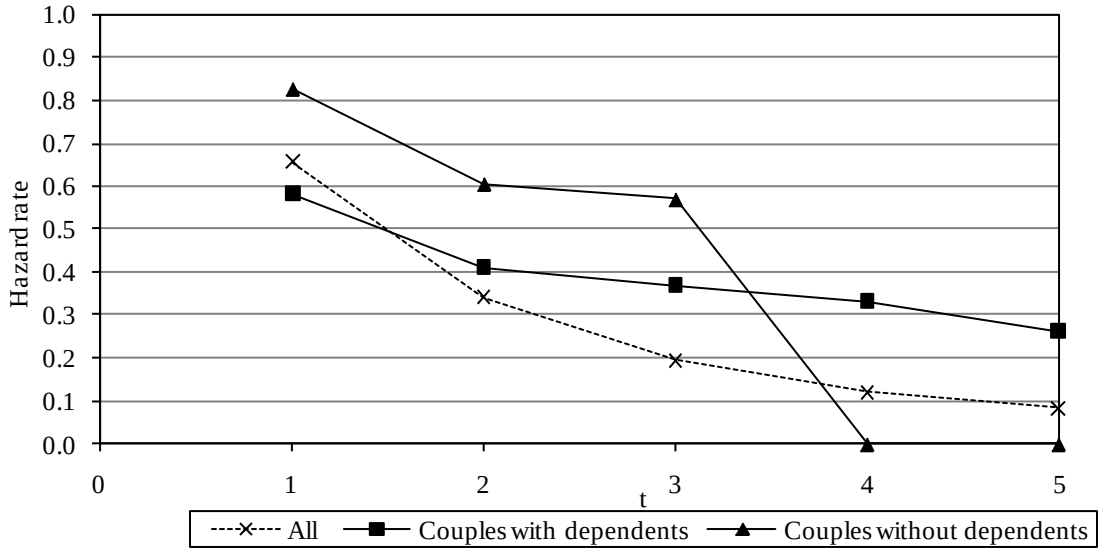


Source: Authors' calculations using confidentialised unit record files of the HILDA Survey waves 1-6

Note:

a. The 'All'category refers to all first spells in HAS, including spells in HAS by public renters and rent-free persons.

Figure 2: All Individuals 'At Risk' of Escaping a First Spell of HAS, by Income Unit Type in First Year of Spell



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

Table 3: The Duration of First Spells in Affordable Housing

Year[a] *(t)*	*Number*			*Hazard rate* $H_t = N_t / T_t$ [c]	*Survival rate* $S_t = S_{t-1}(1-H_t)$ [d]
	In affordable housing during year (*T*)	Fell into HAS 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

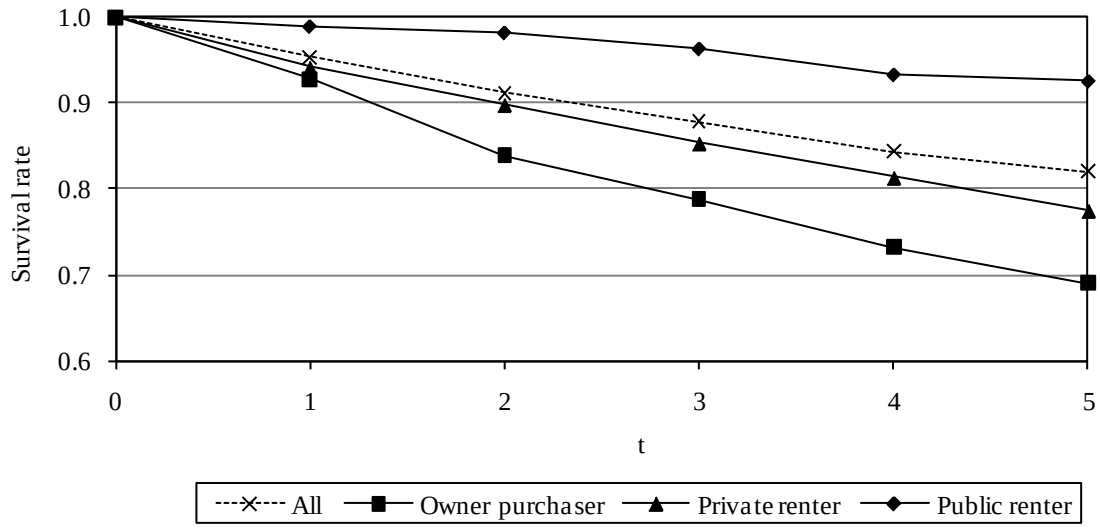
Notes:

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 0 because 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.

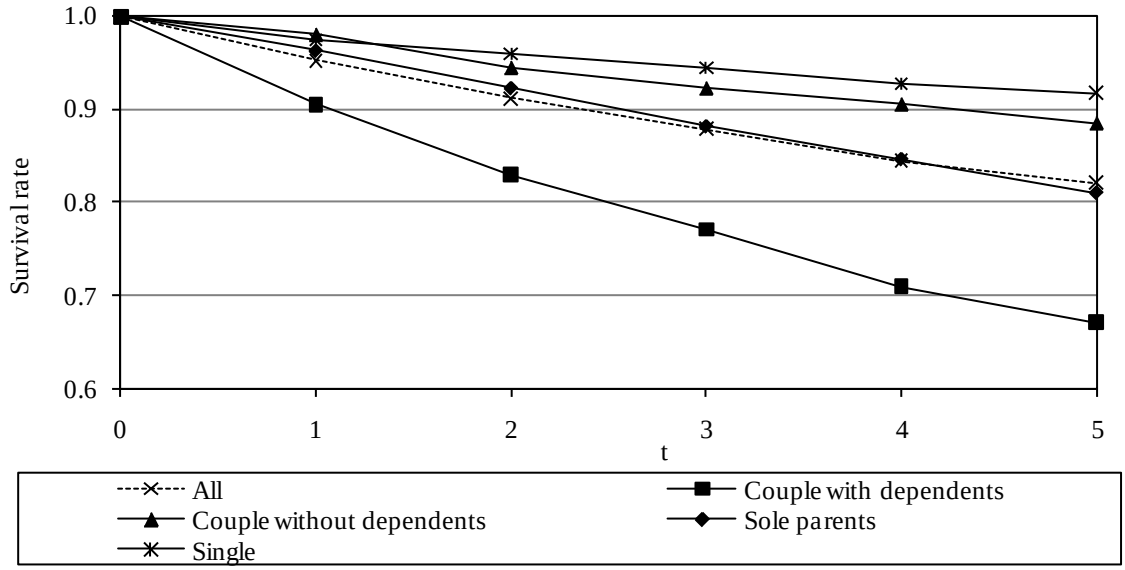
c. T_t is the number of persons in HAS at the start of year *t*, N_t is the number of persons who escaped HAS during year *t*, H_t is the hazard rate in year *t*, S_t is the survival rate in year *t*, S_{t-1} is the survival rate in year preceding *t*.

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

Table 4: Discrete Hazard Model Estimates – Hazard with Respect to First Spell of HAS[a]

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
Defacto[b]	0.055		1.056
Divorced, separated or widowed	-0.163		0.850
Single never married	0.394		1.482
Number of dependent children age 0-4 years	-0.581	**	0.560
Number of dependent children age 5-9 years	-0.311	**	0.732
Number of dependent children age 10-14 years	-0.265	**	0.767
Number of dependent children age 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

Explanatory variables	*Coefficient*		*Odds ratio*
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
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

Notes:

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

b. Defactos are partners that belong to unmarried cohabiting couples.

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

Table 5: Discrete Hazard Model Estimates – Survival in First Spell of Affordable Housing[a]

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
Born in main English-speaking countries	0.088		1.092
Born in non-main English-speaking countries	0.369	**	1.446
Disabled	-0.088		0.916
Defacto	-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 age 0-4 years	0.507	**	1.661

Explanatory variables	*Coefficient*		*Odds ratio*
Number of dependent children age 5-9 years	0.265	**	1.303
Number of dependent children age 10-14 years	0.330	**	1.391
Number of dependent children age 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

Notes:

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

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

Appendix A2: Modelling Results under an Alternative Definition of HAS

Table A1. Discrete hazard model estimates: hazard with respect to first spell of HAS[a]

Explanatory variables	Coefficient	Odds ratio
First year of spell	1.690 **	5.420
Second year of spell	0.679	1.971
Third year of spell	0.871	2.390
Fourth year of spell	0.588	1.801
Fifth year of spell	-1.002	0.367
2003	0.415	1.515
2004	0.475 *	1.609
2005	0.695 **	2.004
2006	0.387	1.473
Private renter	-0.342	0.710
Public renter or rent-free	-0.267	0.765
Moved	0.760 **	2.138
Inner region	0.196	1.216
Outer region	0.010	1.010
Age	-0.009	0.991
Born in main English-speaking countries	0.069	1.071
Born in non-main English-speaking countries	-0.384 *	0.681
Disabled	0.061	1.063
De facto	0.136	1.145
Divorced, separated or widowed	-0.525 *	0.592
Single never married	0.111	1.117
Number of dependent children aged 0–4 years	-0.720 **	0.487
Number of dependent children aged 5–9 years	-0.287 **	0.750
Number of dependent children aged 10–14 years	-0.352 **	0.703

Explanatory variables	Coefficient		Odds ratio
Number of dependent children aged 15–24 years	-0.230		0.795
High-level qualifications	0.074		1.077
Medium-level qualifications	-0.058		0.944
Full-time permanent contract	0.732	**	2.080
Full-time fixed-term contract	0.768		2.156
Part-time permanent contract	0.456		1.577
Part-time fixed-term contract	1.118		3.059
Casual or other contract	1.098	**	2.997
Self-employed	-0.043		0.958
Unemployed	-0.178		0.837
Diagnostics			
Observations	1203		
Cox & Snell R-square	0.269		
Nagelkerke R-square	0.359		
Chi-square	377.280	**	

Notes: [a] 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.

Source: Authors' estimates from confidentialised unit record files of the HILDA Survey waves 1–6.

Table A2. Discrete hazard model estimates: survival in first spell of affordable housing[a]

Explanatory variables	Coefficient		Odds ratio
First year of spell	-4.111	**	0.016
Second year of spell	-4.978	**	0.007
Third year of spell	-5.637	**	0.004
Fourth year of spell	-5.479	**	0.004
Fifth year of spell	-5.707	**	0.003
2003	1.090	**	2.976
2004	1.569	**	4.800

Explanatory variables	Coefficient		Odds ratio
2005	1.668	**	5.302
2006	1.601	**	4.959
Owner-purchaser	1.546	**	4.693
Private renter	1.230	**	3.421
Public renter	0.435		1.545
Rent-free	0.809	**	2.245
Moved	0.542	**	1.719
Inner region	-0.099		0.906
Outer region	-0.274	*	0.760
Age	-0.024	**	0.976
Australian-born and Indigenous	-1.021	*	0.360
Born in main English-speaking countries	0.109		1.115
Born in non- English-speaking countries	0.520	**	1.682
Disabled	-0.052		0.949
De facto	-0.021		0.979
Divorced	-0.312		0.732
Separated	0.250		1.284
Widowed	-0.418		0.659
Single never married	-0.336	*	0.715
Number of dependent children aged 0–4 years	0.584	**	1.793
Number of dependent children aged 5–9 years	0.290	**	1.337
Number of dependent children aged 10–14 years	0.337	**	1.401
Number of dependent children aged 15–24 years	0.261	**	1.299
Postgraduate	-0.006		0.994
Graduate	0.076		1.079
Bachelor	0.241		1.272
Advanced diploma / diploma	0.353	*	1.423
Certificate III or IV	0.280	*	1.323
Certificate I or II	0.495		1.640

Explanatory variables	Coefficient		Odds ratio
Certificate not defined	0.081		1.084
Year 12	0.095		1.100
Full-time permanent contract	-1.306	**	0.271
Full-time fixed-term contract	-1.008	**	0.365
Part-time permanent contract	-1.187	**	0.305
Part-time fixed-term contract	-0.830	*	0.436
Casual or other contract	-0.683	**	0.505
Self-employed	0.276	*	1.318
Unemployed	0.673	**	1.959
Diagnostics			
Observations	33357		
Cox & Snell R-square	0.699		
Nagelkerke R-square	0.932		
Chi-square	40070.576	**	

Notes: [a] The default categories are year 2002, outright owner, major city, Australian-born and non-Indigenous, married, below year 12 qualifications and not in the labour force.

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

Source: Authors' estimates from confidentialised unit record files of the HILDA Survey waves 1–6.