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House prices, mortgage debt and labour supply: evidence from Australian households

authored by

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ACRONYMS

AHURI	Australian Housing and Urban Research Institute Limited
ABS	Australian Bureau of Statistics
CDF	Cumulative Distribution Function
DSS	Australian Government Department of Social Services
FSR	Financial Stability Review
G7	Group of 7
GFC	Global Financial Crisis
HILDA	Household, Income and Labour Dynamics in Australia
LC	Life-cycle
LCM	Life-cycle model
LFP	Labour force participation
LGA	Local Government Area
LTV	Loan to value
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PI	Permanent income
PIH	Permanent income hypothesis
RBA	Reserve Bank of Australia
UK	United Kingdom
US	United States

EXECUTIVE SUMMARY

This Positioning Paper aims to identify the nature and magnitude of the relationship between housing prices, household debt and employment decisions for Australian households by using micro-level data from the Household, Income and Labour Dynamics in Australia (HILDA) survey for the period 2001 to 2012 (waves 1–12).

The project builds on existing AHURI research in related areas, specifically: *Housing wealth and consumer spending* (Yates & Whelan 2009); *Housing, location and employment* (Bradbury & Chalmers 2003); *Downsizing amongst older Australians* (Judd et al. 2014); and *Housing equity withdrawal* (Ong et al. 2013).

The project identifies and responds to three distinct but interrelated questions:

1. What is the nature and magnitude of the relationship between housing prices and household debt and between its mortgage and non-mortgage components?
2. Does labour supply respond to changes in housing prices and mortgage debt? If so, is there a causal link?
3. If so, how large are these effects and are some types of households more responsive than others?

While this report is a preliminary report informing and setting the groundwork for the larger study it can offer several key observations from its early analyses of the HILDA Survey data:

- *A strong relationship exists between changes in house price and household indebtedness*. Our results suggest that households who experience an AUD$1000 increase in their house values on average increase their total consumer debt by approximately $170. This is a large response compared to the magnitudes found in studies in the United States (US) and United Kingdom (UK).
- *There is heterogeneity in the relationship between house prices and overall household indebtedness across the total debt distribution*. Further investigation of this heterogeneity will help us to understand the transmission mechanisms linking house prices to household debt.
- *There are important differences in the patterns of labour supply and housing debt and wealth over the life-cycle and between partnered and single Australians*. This suggests that it will be important to consider the links between labour supply, housing debt and housing prices separately for these demographic sub-groups.

This Positioning Paper outlines the research questions and methodology for an AHURI research study which utilises HILDA panel data and instrumental variable econometric techniques to interrogate the relationship between housing prices, household debt and labour supply in Australia. It provides preliminary evidence of important differences in the magnitude and expression of these relationships for partnered and single Australians over the life-course.

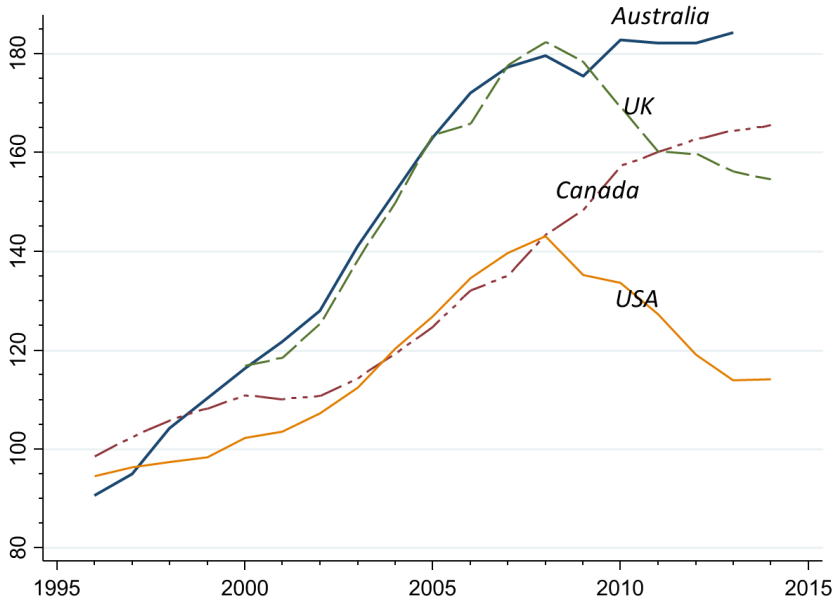
The Final Report will employ HILDA data in tandem with a historical series of median house prices at LGA level sourced from RP data. Both panel data and instrumental variable econometric techniques will be used in order to provide robust estimates of the links between house prices and household debt, and between labour supply, housing debt and house prices. Our proposed methodologies will address issues of sample selection, unobserved heterogeneity and endogeneity or simultaneity bias.

1 INTRODUCTION

1.1 Motivations and aims of the project

Australia has experienced a prolonged increase in house prices and household debt in the last two decades. The increase in household debt is largely an increase in mortgage debt held by households (ABS 2014). Reports by the Organisation for Economic Co-operation and Development (OECD) (2012) and Commonwealth Bank (2013) show that Australian housing debt ratios are relatively high by international standards (Figure 1). This potentially unsustainable growth in debt positions may suggest that households are not in a stable position to counteract negative economic shocks, for example, periods of unemployment.

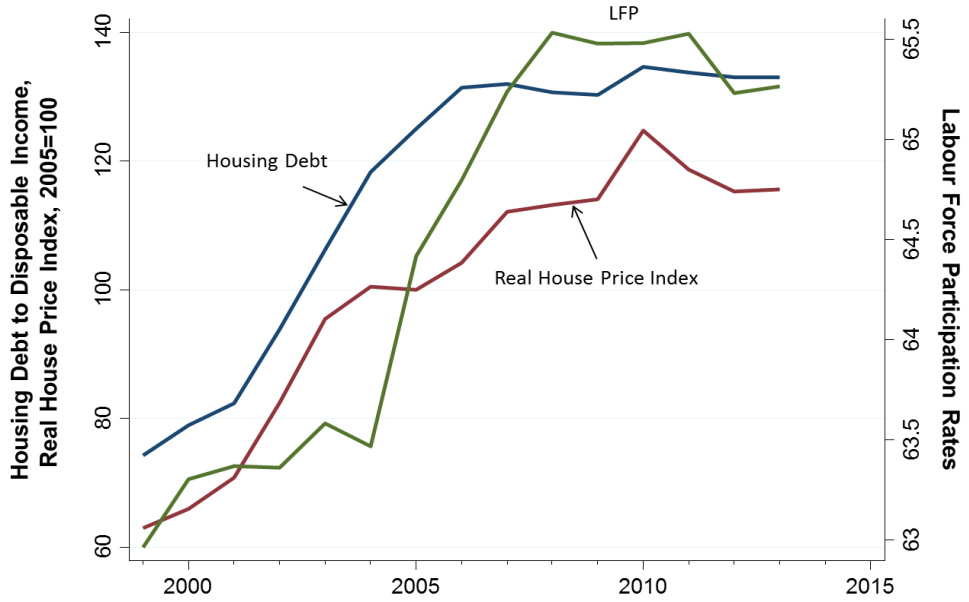
Figure 1: Size of household liabilities compared with annual income: Australia, UK, Canada and USA



Source: OECD statistics (http://stats.oecd.org/) OECD Economic Outlook, vol. 2013, Issue 2

In the same period there has been a persistent increase in labour force participation rates. Figure 2 below plots the real house price index, average housing debt to disposable income ratio and labour force participation rates for Australia for the period 1999–2013. A clear positive correlation between these three series is evident, particularly between labour force participation and housing debt.

Figure 2: House prices, housing debt and labour force participation in Australia



Source: Reserve Bank of Australia database 2014 (http://www.rba.gov.au/statistics/)

The increase in household debt, accompanied by volatile housing prices, has also been reflected in aggregate real and financial flows, such as consumption, new housing construction and home renovations. Yates and Whelan (2009) examined the variation in spending by house price across households in Australia. They showed that rising house prices have substantial effects on median-aged (aged 40 to 54) households because house price increases help to relax borrowing constraints.

From a macroeconomic perspective, the link between house prices and mortgage debt is important also because of its implications for future financial stability. For example, a key issue for monetary policy is whether greater indebtedness may affect the sensitivity of household spending to various economic shocks. For example, a given change in home prices may have a larger effect on consumer spending depending on the strength of the link between house prices and household debt. Consequently, macro-prudential regulations in a number of developed countries have been implemented to limit the growth of household indebtedness (RBA 2014) and to address concerns related to national and household wellbeing.

Housing growth in Australia has slowed substantially since the macroeconomic shocks of the 2008 financial crisis. In contrast, the increasing trend in household indebtedness continues, although at a more modest pace. The consequences of these developments, particularly for Australian housing affordability and labour markets, are largely unknown and lead to a number of key questions:

- How do these changes impact on Australian housing choices and labour supply?
- How do unemployment experiences affect a household's ability to service mortgage debt or maintain their housing services?
- Do mortgage commitments lead unemployed workers to accept any available job, which may offer poor prospects for progression or lead to a mismatch of skills to jobs and result in lost workforce productivity?

To answer these questions, we need a better understanding of the dynamics between housing prices, household debt and labour supply.

This project has several aims. Our first aim is to establish a formal relationship both between housing prices and household debt in Australia and between the mortgage and non-mortgage components of that debt. This relationship is important because although household debt and house prices continue to rise in Australia, some of the countries which previously experienced equivalent concurrent increases have seen that trend reverse with their economies suffering a host of negative influences in its wake. Understanding the links between house prices and household debt is therefore important for the health of the Australian economy and for Australian policy-making.

Several questions arise. If house prices increase, how should we expect a household to adjust their debt portfolio? How large are the effects? What are the channels through which household debt is associated with house prices? Are some types of households more responsive to house prices than others?

These are obviously important questions which will become increasingly important as house prices and household debt continue to rise in Australia. Hence, this study will aim also to examine the link between house prices and house-price induced increases in debt in Australia and to shed light on the transmission mechanisms through which house prices and debt might be linked.

Our second aim is to investigate the links between labour supply, house prices and mortgage debt. The existence of a positive correlation between these three series, as shown in Figure 2 above, is a common finding reported in the international literature. However, there is little agreement regarding the direction of causality underlying the positive correlation or the strength of the causal relationship. Hence this study will examine the nature and magnitude of the relationship between labour supply and mortgage commitments as well as housing prices in a life-cycle framework for Australian households. A critical challenge will be to identify the direction of causation: whether indebtedness or house prices prompt individuals to supply more labour; or whether individuals choose high debt because they choose also to work, work longer hours or have longer careers.

While both scenarios might well contribute to the positive correlation, they have different implications for a number of policy issues, with employment, housing credit policies and the level of long-run growth clearly prominent among these issues. For this reason it is important to distinguish between competing hypotheses in respect to the direction of causation for the positive correlation. Using HILDA panel data from 2001 to 2012, our project will therefore exploit both cross-sectional and time series variations in house prices, mortgage debt, labour force participation and work hours to identify and estimate the magnitude of the causal links.

Our study provides, therefore, important input into Australian policy-making and a useful reconciliation of the recent international literature. Moreover, the unique features of the Australian panel dataset allow us to exploit different debt measures and use a variety of instruments that are not available in other national and international datasets.

In summary, our research project aims to interrogate the interrelationship between housing prices, household debt and labour supply decisions in Australia, and the consequences of these links for long-term national and household wellbeing. The findings of the project will assist macroeconomic policy-makers by elucidating the role of household labour supply and debt decisions in developments in both the housing market and broader economy.

The research project builds on existing AHURI research, specifically reports by Yates and Whelan (2009), *Housing wealth and consumer spending*; Bradbury and Chalmers (2003), *Housing, location and employment*; Judd et al. (2014), *Downsizing amongst older Australians*; and Ong et al. (2014), *Housing equity withdrawal*. It aims also to contribute to the international research literature by utilising uniquely detailed and longitudinal household debt and wealth data available in the HILDA dataset.

1.2 Research questions

The project is structured around three distinct but interrelated sets of research questions:

1. *House prices and household indebtedness in Australia*
   - → What is the nature and magnitude of: (1) the relationship between house prices and household debt; and (2) between the mortgage and non-mortgage components of household debt?
2. *House prices, housing debt and labour supply decisions*
   - → Does labour supply respond to changes in housing prices and mortgage debt? Is there a causal link?
3. *Heterogeneity of effects*
   - → How large are these effects? Are some types of households more responsive than others?

The significance of these questions lies in their immediate policy relevance: the linkages between housing markets, household debt and labour supply have important macroeconomic implications, particularly in the context of upswings or declines in the economy and in house prices.

1.3 Structure of this report

Chapter 2 begins with a brief description of the underlying economic rationale for presuming relationships between household debt, consumption, labour supply and house prices. We outline the life-cycle model (LCM). We discuss the implications of the theory for borrowing behaviour, investigate the role of house prices in household borrowing decisions, and review the implied relationships between labour supply and borrowing behaviour. In Chapter 3 we then review the international and Australian evidence on the linkages between house prices, household indebtedness and labour supply.

Chapter 4 describes the datasets that we use for our empirical work. Chapter 5 provides a descriptive analysis of the linkages between household debt, labour supply and house prices in Australia using macro and micro data. In Chapter 6 we provide a detailed discussion of the empirical methodologies used in the econometric analysis and present our preliminary findings in regard to the links between house prices and debt in Australia. We conclude in Chapter 7 with a discussion of the next steps in our research for the Final Report.

2 CONCEPTUAL FRAMEWORK

Economic analyses of saving and borrowing decisions have traditionally been grounded in the life cycle model of consumption (LCM) or Permanent Income Hypothesis (PIH) (see Friedman (1957) and Modigliani and Brumberg (1954). In the simplest version[1] of LC/PIH, household consumption is assumed to depend on expected-life time income. Households smooth out fluctuations in current income by accumulating wealth through saving when income is relatively high, and by drawing on that wealth through dissaving when income is relatively low. It is important to note that according to the model, anticipated future changes in wealth are built into consumption plans and only unanticipated changes lead to a revision of consumption plans.

2.1 Implications of the life-cycle model on borrowing behaviour

What then are the implications of the LC/PIH model for borrowing behaviour? The LC/PIH model implies that households will borrow (dissave) when needs are high, income is low, and the rate of return on borrowings is low. Conversely, they will tend to save when needs are low, income is high or the rate of return is high. For example, we would expect households to borrow when they are young (when needs are high because of children and the acquisition of durables, e.g. a house) and in retirement (when incomes are lower), and to save in the latter part of their working life (when incomes typically are higher and needs, perhaps, lower).

As with most economic models, the LC/PIH model can be given a 'cost-benefit' interpretation, and this may be useful for thinking about policy. Households will borrow up to the point where the cost of the last (marginal) dollar borrowed equals the marginal benefit of borrowing that dollar. When current needs are high, or current income low, the 'cost' of setting aside a dollar for the future is high and hence the benefit of borrowing is high. If future income is expected to be high, or future needs low, then the marginal benefit of borrowing is high. If the available rate of return on saving is low, the marginal benefit of borrowing is high.

Alternatively, a reduction in uncertainty reduces the need for precautionary saving reserves (Deaton 1991; Carroll 1997) and tends to boost borrowing. Lastly, macroeconomic factors, such as financial liberalisation, can influence the household's ability to borrow by relaxing the borrowing constraints in the model. Any of these factors should be expected to lead to higher borrowing for households.

2.2 Effect of house prices on borrowing behaviour

The effects of house prices on household indebtedness can be studied by using this simple life-cycle model. The key feature one needs to incorporate is the dual nature of housing; as both a consumption good and an investment asset (see, e.g. Miles 1992; Iacoviello 2004; Campbell & Cocco 2007; Attanasio et al. 2011). As a consumption good, households can consume housing services either by buying or renting. An increase in house prices increases both the cost of a stream of services that is consumed over a long run of years and the life-time resources of households with a long housing position ('wealth effect'). According to the LC/PIH model, this wealth effect should cause all home owners to respond by reducing their savings or by extracting equity from their homes. In addition to the wealth effect, the LC/PIH model also identifies an indirect effect on collateralised borrowing capacity. For some households, rising prices loosens the binding borrowing constraints tied to housing ('collateral effect').

We now consider three types of households:

1. Home owners who are not credit constrained (home owners who have ability to borrow money).

[1] This simplified representation ignores a number of important and relevant extensions to the basic model such as it abstracts from uncertainty about future income and expenses, and ignores the liquidity constraints and bequest motives.

2. Home owners who are credit constrained (e.g. households with high loan to value (LTV) ratios).
3. Renters.

In the case of rising house prices, home owners who are not credit constrained experience a matching increase in their housing wealth as well as in their cost of living. These households are perfectly hedged against house price fluctuations. If they do not adjust their housing consumption (for instance, by moving or changing their tenure status), their consumption and borrowing behaviour should remain unchanged.

However, in the absence of bequest motives, life-cycle models predict that housing wealth should be dissaved in later life. Therefore, some of these households might borrow against their home equity through, for example, home equity withdrawals, refinancing existing mortgages or adjusting their existing debt portfolios. If existing home owners decide to adjust their housing consumption by downsizing or upgrading, these households will be affected by housing prices both when they are selling and buying and will therefore adjust their debt.

On the other hand, there is an additional collateral effect on the subset of home owners whose ability to borrow has been limited by the value of their wealth that can act as collateral. An increase in house prices, which causes an increase in housing wealth, allows these credit constraint households to refinance and adjust their debt portfolios.

For the renters, an increase in house prices directly increases the cost of housing services. Consequently, this can be interpreted as a negative wealth effect. In addition, renters who want to purchase housing as a result of the higher house prices need to incur more debt (bigger mortgages).

2.3 Extending the life-cycle model to include labour supply

Here we extend the simple life-cycle model outlined above to incorporate a labour supply choice. We focus on a two-period model.

An 'agent' lives for two periods and enjoys utility from consumption and leisure. The agent, a household or an individual, wishes to maximise lifetime utility but does so in the face of an asset accumulation or wealth constraint:

$$\max_{c_1,c_2,\ell_1,\ell_2} U(c_1,\ell_1) + \frac{1}{1+r}U(c_2,\ell_2)$$

$$\text{s.t.} \quad (1-\ell_1)w_1 + \frac{(1-\ell_2)w_2}{1+r} + A_1 + \frac{\mathbb{E}(A_2)}{1+r} = c_1 + \frac{c_2}{1+r}$$

c_1 and c_2 are consumption in periods 1 and 2 respectively, and likewise, ℓ_1 and ℓ_2 are leisure in periods 1 and 2. The wealth constraint indicates that, from the perspective of period 1, the present value of total consumption over the two periods of life must be equal to the present value of labour income from the two periods (where labour supply is $(1-\ell_t)$, total time minus leisure in each period) and the expected present value of net assets (A_t is the net value of assets at period *t*). We treat wages, w_t, as exogenous.

Notice that net assets in period 2 are unknown in period 1. Thus, unexpected changes or shocks to the value of assets, that is, unexpected asset price shocks, will lead to $A_2 \neq \mathbb{E}(A_2)$. As a result, after observing A_2 and recognising the wealth shock, the agent may either adjust consumption or labour supply in period 2. As Milosch (2014) points out, the response of agents to a given shock to housing prices, in particular, will vary.

We take as an example a positive housing price, or positive wealth shock. In response to such a shock, and under the assumptions of this simple model:

1. An owner-occupier household that is not planning to move or is planning to downsize in the future will increase consumption or decrease labour supply.
2. An owner-occupier household that is planning to move to a larger house (perhaps because they are planning to start or increase the size of their family), may need to decrease consumption or increase labour supply to ensure they have the requisite wealth for a larger house in a more expensive housing market.
3. A renting household planning to purchase a home in the future may need to decrease consumption or increase labour supply in order to accumulate assets for the required down payment.
4. A renting household planning to remain renting in the future may need to decrease consumption or increase labour supply if the positive housing price shock translates to higher rental prices.
5. An owner-occupier household that is borrowing constrained may use the positive house price shock to relax the constraint by accessing this additional wealth through a home equity loan or loan refinancing. This may lead also to an increase in consumption or a decrease in labour supply.

We may also wish to consider an explicit per-period borrowing constraint (see Fortin 1995). This constraint mimics the type often imposed by lending institutions in the form of a maximum gross debt: service ratio. That is, the constraint may be of the form $k[w_t(1-\ell_t)] - M_t \geq 0$, where the mortgage payment in period t, M_t, must not be greater than some predetermined share k of labour income.

The model and discussion above makes clear that the response of agents to a housing price shock will depend on their current housing tenure status as well as their stage in the life cycle. In addition, it raises potential endogeneity or reverse causality issues: Is an agent increasing their labour supply in order to save for a future housing purchase or is the change in labour supply a response to a past change in housing wealth? However, the discussion also points us towards a potential solution to this endogeneity issue. That is, if we can identify unexpected changes—true shocks to housing wealth—then these will be exogenous to labour supply. We will return to this point in further detail in Section 6.2 below.

3 LITERATURE REVIEW

This chapter provides an overview of the relevant international and domestic literature with a focus on empirical evidence regarding the nature and extent of the relationship between house prices, household debt and labour supply. Our evaluation of the findings and methodologies employed in the literature motivates the empirical analysis in our project.

3.1 Housing price and indebtedness

This section interrogates a large empirical literature on the effects of housing prices on household consumption, savings and borrowing behaviour. Early studies in this area (e.g. Debelle 2004; Dynan & Kohn 2007) present descriptive evidence on the driving factors of household debt in the 21st century. Their findings indicate that the most important factor behind the rise in household debt is the combination of financial innovation and increasing house prices.

Another strand of the literature focuses directly on the effect of house prices on home equity-based borrowing. This strand examines whether growth in house prices allows home owners to engage in debt-financed consumption. Greenspan and Kennedy (2005, 2008), using time series data, calculated that mortgage equity withdrawal averaged roughly 6 per cent of households' disposable income in the period 2000–05. Using micro level data for the same time period, Yamashita (2007) observed that households used their home equity in response to house price appreciation, with stronger responses evident for low-income households who were likely to be liquidity constrained.

Disney and Gathergood (2011) present evidence that roughly one-fifth of the growth in household indebtedness in the US can be attributed to rising housing prices during the 2000s. Cooper (2010, 2013) provides supporting evidence of home equity withdrawal in the US. A related study by Disney, Bridges and Gathergood (2010) suggests that house price movements appear to have an effect on unsecured debt in the UK. They argue also that rising house prices allow borrowing constrained households to refinance and increase their indebtedness.

A key empirical challenge to investigating the link between housing prices and household debt is finding a substantial and plausibly exogenous source of variation in house prices, and thus ensuring that omitted variables (or simultaneity) does not confound the relationship. Aggregate factors, such as interest rates or financial market innovations, may jointly determine both household borrowing (especially mortgage debt) and house prices, so that one alone cannot determine the casual relationship.

An influential paper by Mian and Sufi (2011), followed by papers by Aladangady (2014) used physical supply constraints as instruments for extracting the exogenous variation in local house prices. Nevertheless, these studies identify that home owners respond to rising house prices by extracting equity from their homes. Moreover, their results also identify that there are substantial differences in equity extraction depending on the creditworthiness of households, suggesting that it is the collateral effect rather than the wealth effect that is the main driving force for the increase in household debt.

A closely related life-cycle literature has investigated consumption responses to house prices. This literature identifies three main potential mechanisms by which an increase in house prices leads to higher consumption. First, unanticipated increases in house prices lead directly to an increase in consumption: the direct wealth effect (Muellbauer & Murphy 1990; Poterba 2000; Campbell & Cocco 2007). Second, changes in real interest rates or income expectations arising from productivity shocks that affect both consumption and house prices may explain the observed correlation between increases in house prices and consumption (King 1990; Attanasio & Weber 1994; Disney et al. 2010). Households perceive accelerating productivity growth and hence expect higher future incomes and higher lifetime wealth. Life-cycle consumers consume some of this higher wealth today in consumption: the 'common cause' channel.

The third mechanism is the 'housing collateral channel', reflecting the role of housing as collateral for loans. For households relying on housing to provide collateral against secured loans, increases in housing prices facilitate increased borrowing and hence consumption capacity through mortgage equity withdrawal (Hurst & Stafford 2004). Moreover, if improvements in household balance sheets result in access to cheaper finance than would otherwise have been possible, this can give rise to a financial accelerator effect as changes in net worth affect external finance premiums and the cost of credit.

Attanasio and Weber (1994) showed how micro data could be used to explore consumption and house price linkages. If productivity growth ('common cause') is the explanation, then consumption growth should be highest among the young, who will benefit from the increased productivity over their lifetimes. Older cohorts experience a smaller shock than younger cohorts. In contrast, a wealth effect should be apparent largely in the consumption of households that hold stocks or houses. Using such methods and data the authors were able to show that both house prices and productivity growth contributed to the consumption growth in the UK in the late 1980s.

Using similar methodologies, a number of more recent papers have investigated whether consumer debt increases as a response to housing prices, focusing on the effect of the collateral constraint channel on the consumption boom. These studies have attempted to identify the role of collateral constraints by using indirect proxies for identifying credit constrained households, such as credit histories, incomes, tenure status and the age of household members. For example, a rise in house prices that increases housing wealth arguably would increase the scope for mortgage equity withdrawal, implying that home owners' consumption, but not that of the renters, should respond (Campbell & Cocco 2007). However, because older home owners are more likely to own their houses outright or have considerably higher housing equity, they would also be more likely to be less constrained in their ability to withdraw equity than young or middle-aged households (Jappelli 1990; Ortalo-Magné & Rady 2006; Lustig & van Nieuwerburgh 2005). Hence the existence of a strong relationship between house price and consumption for young and middle-aged home owners would suggest an important role for collateral constraints.

Using these methods, Iacoviello (2004), Aoki et al. (2001), Aron and Muellbauer (2006) and Campbell and Cocco (2007) found evidence for the presence of collateral constraints. Aron et al. (2012) used time series data to demonstrate that accounting for changes in the availability of credit in the US and UK reduces estimated wealth elasticises.

Hurst and Stafford (2004) showed that consumption is much more sensitive to housing wealth among Americans, who are prone to being credit constrained. Similarly, Disney et al. (2010) found that increases in UK house prices allowed borrowing constrained households to refinance and substitute secured debt for more costly unsecured debt. Browning et al. (2013) found evidence of collateral constraints in Denmark and argued that house prices affect total expenditure and hence household debt.

Australian evidence on the relationship between housing prices and debt is scarce. Schwartz et al. (2008) found that middle-aged households in Australia were more likely to withdraw equity from their housing wealth by increasing mortgage debt. Wood and Nygaard (2010) found that wealth effects and credit constraints were the most important drivers of equity withdrawal in Australia in 2002 and 2003. They also pointed to the extent to which binding income constraints limit the extent to which young households are able to withdraw equity. Ong et al. (2013) and Judd et al. (2014), in recent AHURI reports, present evidence of the rising share of older households with mortgages and the incidence of home equity withdrawal in Australia. Windsor, Jääskelä and Finlay (2013) provide evidence also of changing patterns of debt for home owners and investors.

Yates and Whelan (2009) and Atalay et al. (2014) examined the effects of house prices on general consumption spending in Australia in the late-1990s and mid-2000s. Their analyses aim

to distinguish between the alternative transmission channels that have been hypothesised to link house prices and consumption, and identify 'collateral' as the main channel in the Australian context. Another study by Windsor et al. (2013) looked at the same question for the late 2000s and similarly stressed the importance of the collateral channel for household spending.

This AHURI project focuses on the impact of house prices on household indebtedness. To our knowledge it is the first major Australian study to do so formally. By using a true panel dataset we aim to investigate both the wealth and collateral channels that link house prices and household debt. Finally, our question looks at the impact of house prices on the household debt portfolio with particular reference to its mortgage and non-mortgage components.

3.2 Labour supply, house prices and housing debt

Australian evidence on the relationship between housing prices, household debt and labour supply is limited to cross-sectional descriptive studies and aggregate analyses of macroeconomic data (see, e.g. Connolly 1996; Connolly & Kirk 1996). The high level of aggregation in the macroeconomic analyses means that it is not possible to examine the distribution of responses by income or across demographic groups. The cross-sectional analyses (see, e.g. Kidd & Ferko 2001) are also problematic because of their 'unobserved heterogeneity'. That is, an unobserved characteristic such as 'taste' or time preference of individuals associated with household debt behaviour might also be directly related to the labour supply decisions of individuals. Thus it is difficult to disentangle the pure effect of household indebtedness in cross-sectional studies.

An alternate approach to existing cross-sectional and aggregate macroeconomic analyses is to utilise panel data (longitudinal data). Since panel data include repeated observations of the same individual over time, it is possible to control for unobserved heterogeneity through the use of econometric techniques. In addition, since panel data contain time series as well as cross-sectional variation, one can study life-cycle transitions in labour, housing and debt decisions.

To the best of our knowledge two existing studies have used Australian panel data to investigate the relationship between housing debt and labour supply. Drago, Wooden and Black (2009) found that the total household debt to income ratio had a positive effect on the propensity to work longer hours. Belkar et al. (2007) examined the importance of household indebtedness to labour force participation for married males and married females, finding a small but positive effect of debt on the extent of engagement with paid work.

However, both of these studies have several shortcomings. In addition to being somewhat dated, the analyses cover only a short time period (2001–05). As a result, the time series variation is limited, yet this variation is crucial in addressing econometrics issues and identifying causal effects. More importantly, their examination period does not include periods in which we see major changes in housing prices, household debt and labour supply behaviour (i.e. after 2008).

Within the international literature there are two clear strands. The earlier strand, including papers by Fortin (1995), Worswick (1999), Aldershof et al. (1999), Del Boca and Lusardi (2003) and Bottazzi (2004), examines the relationship between housing debt and labour supply in a range of countries using cross-sectional and panel data. Many of the papers in this strand focus on the labour supply of partnered females and find that debt and debt servicing have a positive and significant effect on labour supply by partnered women.

The later strand, represented by the more recent work of Disney and Gathergood (2014) and Milosch (2014), for example, has been motivated by the decline in housing prices experienced in the UK in 2008 and US in 2009. These authors have studied the impact of housing wealth shocks on labour supply for married and single men and women (each independently) using panel data and local house price variation. Both studies have found that married young to middle-aged women and men close to retirement respond to housing wealth shocks. Milosch

(2014) separately has considered the effects of positive and negative shocks on housing wealth, finding that positive house price shocks cause married women to decrease their labour supply, while negative house price shocks lead to an increase in labour supply among older males as they delay their entry into retirement.

Our study of the link between house prices and household debt will add to this literature. By utilising panel data which tracks individual households over a significant time period during which substantial variation on house prices were experienced, we will provide new evidence on the responses in households' labour supply choices, and their saving and debt position.

4 DATA

This chapter briefly describes the three key datasets used in our empirical analysis: the Household Income and Labour Dynamics in Australia (HILDA) survey; historical house price data collected by 'RP Data' company; and ABS local labour demand data.

4.1 HILDA survey

The HILDA survey is a population-based panel study of household labour market and family dynamics funded by the Australian Government since 2001. The panel feature of HILDA and study design is unique among the general population surveys in Australia for its focus as a life-course study on individuals, their families and descendants and follow-up of study participants in annual surveys (‘waves’) (Melbourne Institute 2014, p.iv).

Each wave of HILDA includes a rich set of repeat topics with detailed questions on household income, economic wellbeing, measures of labour market activity and a broad array of socio-demographic characteristics, along with a set of special topics (‘modules’) which are one-off or repeated over longer intervals. Housing-related information such as housing tenure, the value of residential properties and mortgage debt is collected in each wave.

The wealth modules are particularly pertinent to our research. They ask respondents detailed questions about their holdings of assets and liabilities and enable us to look at the dynamics of household debt and the borrowing behaviour of Australian households. For the purposes of this study, they include data collected in 2002 (wave 2), 2006 (wave 6) and 2010 (wave 10). Analysing two wealth modules before the 2008 Global Financial Crisis (GFC) and one subsequent to the GFC will enable us to also investigate changes in the housing and total wealth of households associated with that period.

The first wave of the HILDA dataset (2001) contains information on approximately 7500 households and over 13 000 responding individuals. Subsequent waves contain similar numbers of observations. Section 5.2 provides summary statistics from 12 waves. In Section 5.3 we describe the trends in financial variables and the information in the wealth modules, while in Section 5.4 we present summary statistics on labour supply, house prices and housing debt over the life-cycle. Our analysis will use waves 1 to 12 of the HILDA dataset, namely data collected between 2001 and 2012.

4.2 RP house price data

In addition to the self-reported house values in the HILDA dataset, our analysis utilises an historical record of house prices collected by a company called RP data. The records include monthly median house and unit prices across Australia from January 2000. We use the records at the local government area (LGA) level at an annual or quarterly frequency as needed.

4.3 ABS local labour demand data

Data on local labour demand sourced from the ABS National Regional Profile series (cat. no. 1379.0.55.001) are also used in our study. These data comprise unemployment rates and average wage and salary earnings at the annual frequency by LGA. These series data will be merged with HILDA data using LGA identifiers.

4.4 Other data

Various aggregate data series compiled from ABS, Reserve Bank of Australia (RBA) and international data series are included as relevant.

5 MOTIVATING EVIDENCE AND DESCRIPTIVE STATISTICS

This chapter begins with a description of the aggregate trends in household borrowing and house prices in Australia. In Section 5.2 we describe the key features of the estimation sample that we will use in our empirical work. Section 5.3 presents the summary statistics related to our first research question, house price and household indebtedness, using three wealth modules of the HILDA dataset. Section 5.4 provides evidence of labour supply, house prices and household debt relationships using micro-level data. Section 6.3 complements these summary statistics with preliminary analyses from empirical specifications. The project's Final Report will include a number of related further analyses addressing each of the three research questions.

5.1 House prices and indebtedness: evidence from aggregate data

In this section we describe the changes in Australian household debt since the mid-1990s. Our analysis focuses on time series data and hence describes the aggregate picture at the macro level. Household micro-level evidence from the HILDA survey is provided in Section 6.3.

Our findings can be summarised in four points:

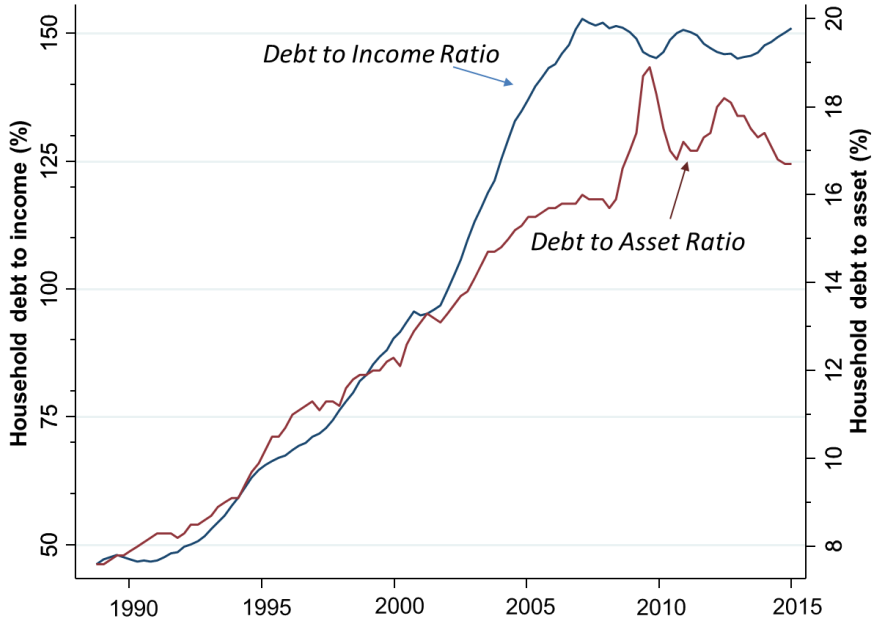
1. Household debt is increasing in Australia. The household debt to income ratio in Australia, is higher than all other Group of 7 (G7) countries including Canada, the US and the UK.
2. Household debt is overwhelmingly composed of mortgage loans and the housing debt to income ratio is increasing.
3. During our observation period real house prices grew by an average of more than 3 per cent per annum until 2006. After the GFC, a slowdown was evident in the pace of growth but house prices continue to increase in Australia.
4. Aggregate statistics suggest that house prices contribute to increases in household wealth and liabilities.

5.1.1 Trends in household indebtedness in Australia

Figure 1 (Chapter 1) implies that Australian households hold relatively large levels of household liabilities. For instance, the debt to disposable income ratio, which indicates the ability of households to service their debt, has increased gradually over time and was 1.8 times that of household disposable income in 2013: a 60 per cent increase on that of 15 years ago. By way of international comparison, UK household debt is a slightly more modest 1.5 times that of household disposable income, while in the US it is just 1.2 times that of household disposable income. The rate of increase in real household debt per person in Australia averaged around 10 per cent per year between 2001 and 2007, falling to 2 per cent after 2008 due to the tightening of mortgage standards (RBA 2014).

Another issue is the frequently neglected asset side of the household balance sheet. By considering the Australian debt to assets ratio, we obtain a more comprehensive understanding of Australia's overall household financial situation. Debt to assets ratios are commonly used as indicators of financial health and summarise the extent to which debt is covered by the value of assets, and whether assets are of sufficient value to repay debt by selling those assets if necessary. From Figure 3 below we observe that the debt to assets ratio has increased in line with the debt to disposable income ratio. Expressed as a percentage of the value of household assets, household debt increased from 8 per cent in 1990 to peak at nearly 18 per cent at the end of 2009, before falling slightly to 16.7 per cent in June 2014. This means that over the past two decades household debt has increased more than twice as fast as the value of household assets.

Figure 3: Australian household debt



Source: Reserve Bank of Australia database 2014 (http://www.rba.gov.au/statistics/)

It is important also to consider the composition of debt. Figures 4 and 5 below investigate where the growth in debt has occurred in Australia. Figure 4 shows that although credit aggregates tend to move in line with each other, for housing credit the rate of growth was steadier and larger than that of personal and business credit for most of the 21st century. Specifically, unlike business and personal credit, the rate of growth of housing credit was always positive in Australia in that period.

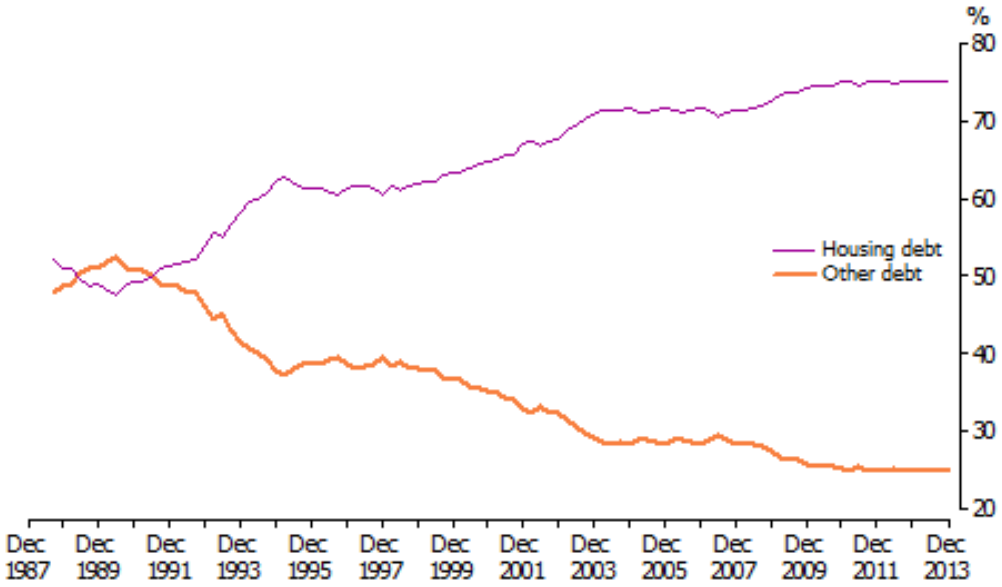
Figure 5 shows that in 2013, 75 per cent of all household debt was housing debt, an increase from 65 per cent in 2001. In contrast, there is a declining trend in the share of other debts (credit card, study, vehicle, investment and other consumption loans). This figure is suggestive of some rebalancing in debt portfolios.

It is clear from these figures that the majority of the growth in household debt during the 2000s is attributable to the upsurge in housing-related debt. By considering housing income and asset positions, we are able to develop a greater understanding of the importance of housing to other forms of debt and whether households are in a position to finance the typical housing loan.

Figure 4: Reserve Bank of Australia credit aggregates

Source: RBA 2014

Figure 5: Housing debt and other debt as a percentage of total household debt



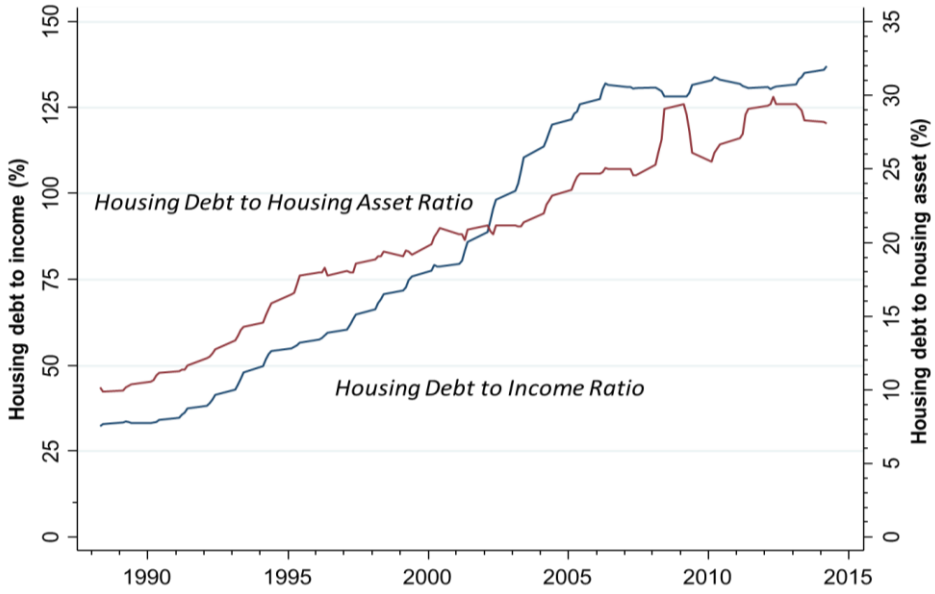
Source: RBA 2014

5.1.2 Trends in housing debt

Figure 6 below shows a similar picture to Figures 1 and 3. Australian housing debt ratios are large compared to international standards. For instance, the housing debt to disposable income ratio indicates that the housing debt burden is quite large and has increased significantly over time, peaking at historically high levels of 137.1 per cent in June 2014. In recent years the ratio has stabilised, primarily as a result of the household savings ratio reaching 10 per cent. For the same period, the housing debt servicing ratio has also increased steadily overtime (Figure 7). This ratio is an estimate of the ratio of housing debt payments to disposable personal income.

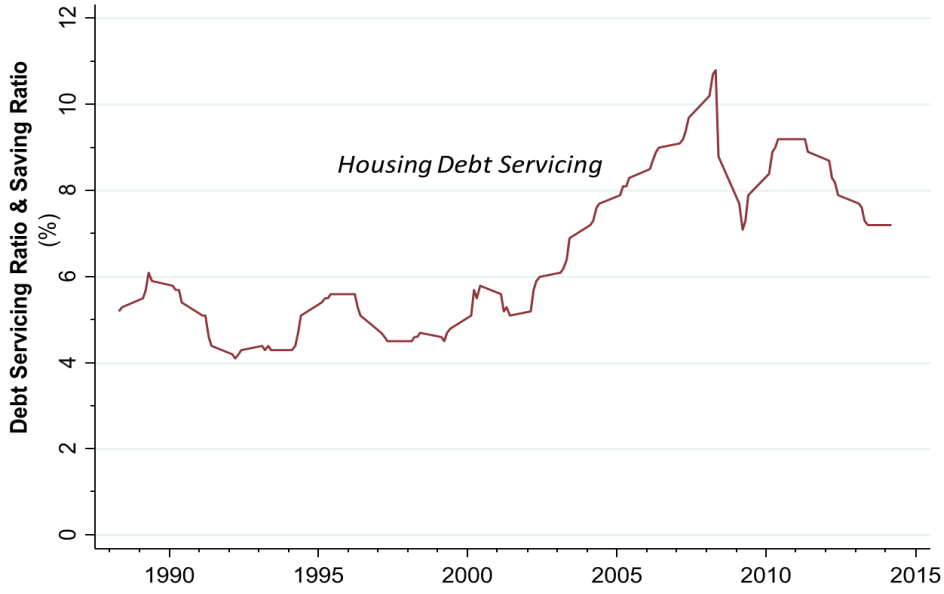
These aggregates show that there is some evidence that housing debt levels are increasing at a higher rate than household income and asset prices. This is consistent with evidence of strong demand for high-risk loans since the GFC, that is, loans where the down-payment is less than 20 per cent of the value of the home (McGrath 2014). It is also suggestive that the number of households with high debt levels has also increased. Our examination of the micro-level data will shed more light on this issue.

Figure 6: Australian housing debt



Source: Reserve Bank of Australia database 2014 (http://www.rba.gov.au/statistics/)

Figure 7: Australian housing debt servicing ratio

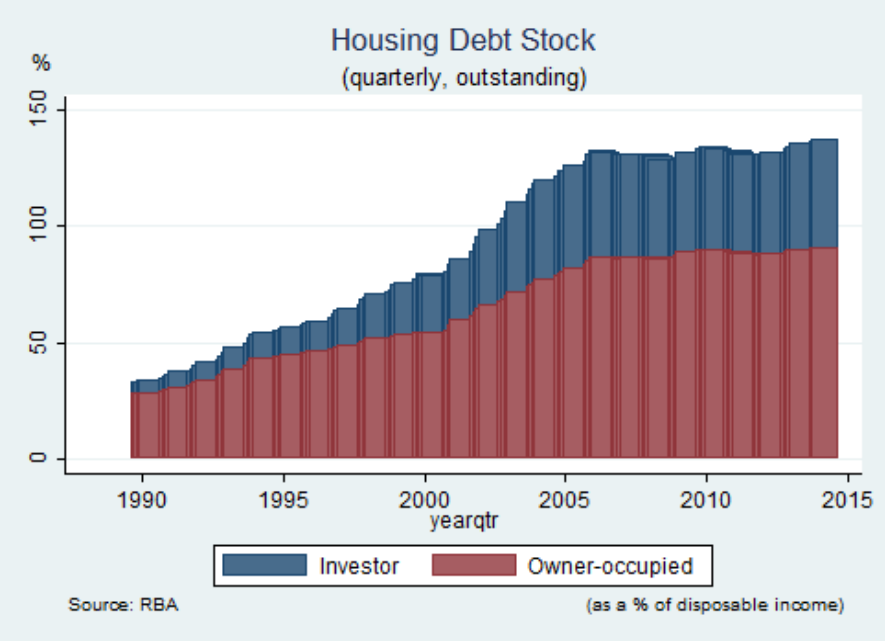


Source: Reserve Bank of Australia database 2014 (http://www.rba.gov.au/statistics/)

Figure 8 illustrates the composition of housing debt as a percentage of income. It exemplifies the increasing trend over time in owner-occupied and investor debt levels. As at March 2013 owner occupied debt was $867 billion, more than double the investor debt level of $413 billion. As a

percentage of disposable income, owner-occupied debt at June 2014 was 90.9 per cent compared to investor debt of 46.2 per cent.

Figure 8: Australian housing debt stock



Source: RBA 2014

According to ABS income and housing costs surveys, the proportion of households with other property loan debt increased slightly between 2003–04 (10%) and 2011–12 (12%), whereas the average amount of such debt increased considerably between 2003–04 ($239 000) and 2011–12 ($357 000). This also suggests that some households are borrowing to invest in property in order to take advantage of rising house prices. In the next section, we look at the changes in house prices and household wealth during our observation period.

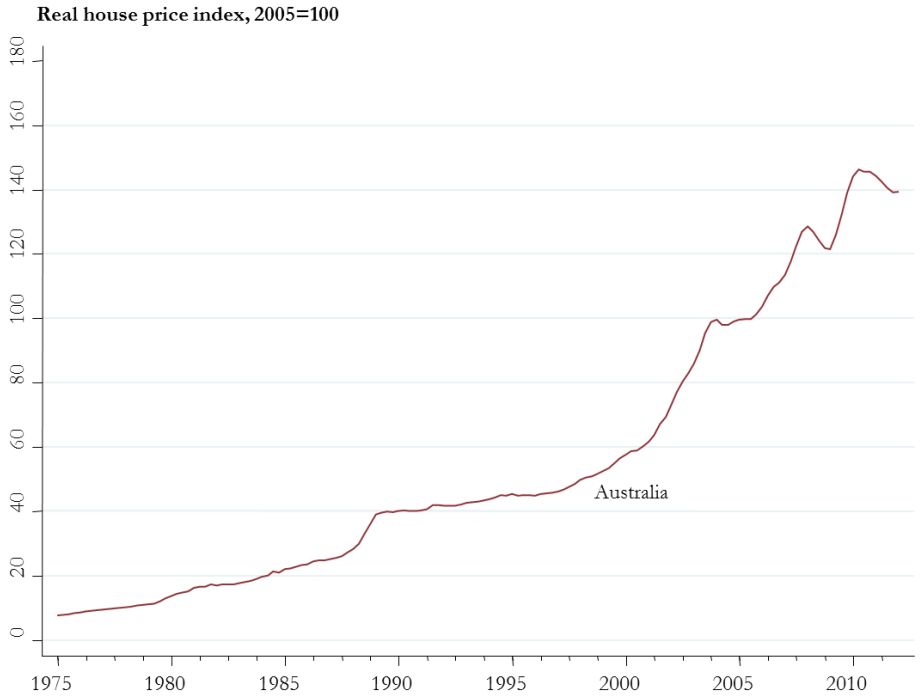
5.1.3 Trends in house prices and household wealth

The period 2001–11 was notable for significant increases in real household wealth per household, primarily as a result of increases in real house prices. The pattern of growth in real dwelling prices at the national level is presented in Figure 9 below.

Increases in real house prices in Australia in the early part of the 21st century were considerably greater than experienced previously. After the GFC this trend slowed but house prices continued to increase. Australia also experienced strong growth in consumption in this period (Figure 10).

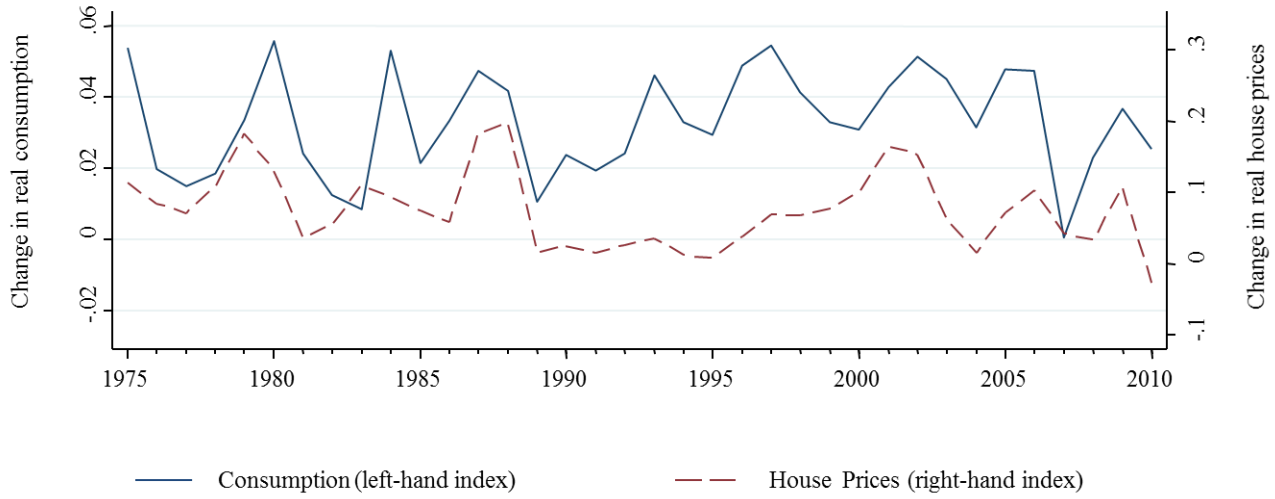
Hiebert (2006) illustrates the close correlation between asset price inflation and declines in the saving rates for Australia, the US and UK in the mid-2000s. Using micro data, Atalay et al. (2014) also conclude that in Australia and Canada the consumption of middle-aged home owners seems most responsive to increases in house prices. Such a pattern is consistent with higher house prices relaxing credit constraints and thereby financing higher consumption.

Figure 9: Australian real housing price indices



Sources: House prices are from the Federal Reserve Bank of Dallas International House Price Dataset. The dataset is described in Mack and Martínez-García (2011).

Figure 10: Australian annual real house price growth and consumption growth



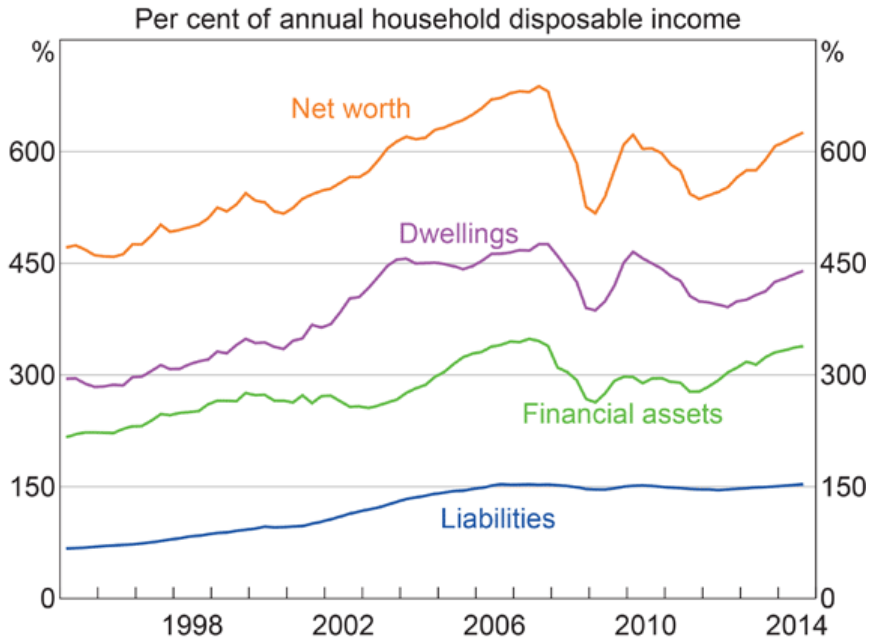
Sources: House Prices are from the Federal Reserve Bank of Dallas International House Price Dataset. The dataset is described in Mack and Martínez-García (2011). Consumption data is from OECD statistics (http://stats.oecd.org/)

This increase in real house prices contributed to a significant increase in the housing wealth of Australian households in the 21st century. In the five-year period 1998–99, median household wealth surged by more than 50 per cent to $585 000 in 2003–04, and then increased further to $667 000 in 2005–06. After the GFC in 2011–12, median household net worth increased by 9 per cent to $728 000.

Figure 11 below presents the changes in the financial and non-financial wealth in household portfolios in the period 1995–2014. While clear increases in dwelling and financial wealth are

observed, this period was associated also with sharp increases in the level of household liabilities.

Figure 11: Household wealth and liabilities 1995–2014



Sources: RBA 2014 (http://www.rba.gov.au/chart-pack/household-sector.html)

While clearly there are a number of factors that affect household borrowing, the close relationship between these aggregate measures has led to increased interest in the question of how house prices are related to household debt. As indicated in the beginning of this chapter, the primary aim of our first research question is to estimate the strength of this relationship and shed light on the transmission mechanisms through which house prices and debt might be linked. The approach and underlying empirical methodology used to identify potential transmission mechanisms are outlined in the following section.

5.2 HILDA estimation sample

This section describes the key features of the estimation sample that will inform our empirical work. Our HILDA estimation sample will comprise individuals between 20–75 years of age (see Table 1 for sample summary statistics).

Across all 12 HILDA waves we have 138 500 observations in a panel of approximately 23 000 individuals with an average age of 44 years. Just over 50 per cent are female and over 50 per cent have more than a high school education. Some 70 per cent of respondents are married or cohabiting with an average of 0.2 children aged four years or younger and 0.7 children aged five years or more. Average annual household income is $74 000 (at 2001). Seventy-two per cent of individuals are in the labour force and work an average of 26 hours per week (or 38 hours per week excluding those who work zero hours).

Across all ages, some 70 per cent of respondents are owner-occupiers with an average outstanding mortgage of just over $90 000. Their self-reported home value is close to $400 000 on average, somewhat higher than the average of the local area median house price of $315 000.

As Table 1 below indicates, our estimation sample is a subsample of the available HILDA data. Columns 3 and 4 provide the summary statistics for the broader sample. We have selected our estimation sample to exclude observations for respondents in years in which fewer than 30 home sales in their postcode were recorded in the RP house price data. We do so to ensure that

the median house prices recorded are a reliable measure for each local area. The final column of the table provides the p-values for the t-test of differences in means between the estimation and broader samples. None of the p-values are close to indicating a significant difference in means between the broader and selected samples.

Table 1: Sample summary statistics, 2001–12

	Estimation sample waves 1–12		Unselected waves 1–12		Test of differences in means
	Mean	Std. Dev.	Mean	Std. Dev.	p-value
Age (in years)	44.3	14.9	44.3	14.9	0.90
Gender (female=1)	0.52	0.50	0.52	0.50	0.90
Education, University	0.24	0.43	0.24	0.43	0.59
Education, Diploma	0.31	0.46	0.31	0.46	0.96
Education, Yr 12	0.15	0.35	0.15	0.35	0.81
Education, Less than Yr 12	0.30	0.46	0.31	0.46	0.52
Annual household income ($)	73,945	65,155	73,796	65,432	0.55
Married or de facto	0.69	0.46	0.69	0.46	0.74
Divorced	0.07	0.25	0.07	0.25	0.90
In the labour force	0.72	0.45	0.72	0.45	0.88
Weekly work hours	26.3	21.6	26.3	21.6	0.90
Spouse in the labour force	0.69	0.46	0.69	0.46	0.84
No. of children 0–4 yrs of age	0.2	0.5	0.2	0.5	0.95
No. of children 5 yrs and older	0.7	1.0	0.7	1.0	0.89
Home owners	0.70	0.46	0.70	0.46	0.50
Renters	0.30	0.46	0.30	0.46	0.50
Self-reported home value ($)	395,009	316,647	394,341	316,954	0.64
Local Area Median House Price ($)	313,649	171,743	312,859	171,703	0.23
Outstanding Mortgage ($)	92,917	146,949	92,601	146,749	0.64
Number of observations	138,500		139,638		

Source: Author calculations from HILDA panel data 2001–12

Notes: The estimation sample comprises males and females from waves 1–12 of HILDA between the ages of 20 and 75 years. The estimation sample is a subset of the unselected sample in which we exclude observations for respondents in years in which fewer than 30 home sales in their postcode were recorded in the RP house price data.

Financial variables are reported in 2001 Australian dollars. Outstanding Mortgage ($) is the self-reported value of home loans with the exception of those reported in waves 2, 6 and 10, where we use the Melbourne Institute's imputed home loan values.

5.3 House prices and indebtedness: evidence from micro-level data

Next we focus on household wealth portfolios. Household descriptive statistics are drawn from the 12 waves of the HILDA survey (2001–12), with HILDA wealth module data for waves 2, 6 and 10 providing more comprehensive evidence of household debt and wealth holdings. Our sample is restricted to households whose 'head' (most senior person in household) is not older

than 70 years or younger than 20 years.[2] All monetary values are deflated to 2001 dollar values (AUD). Table 2 below presents some housing-related statistics from the HILDA data, including home ownership rate, self-reported value of primary residence, household income, mortgage debt accrued to primary residence and loan to value (LTV) ratio (defined as the ratio of mortgage debt to home asset value). Mean values of home asset, mortgage debt and LTV ratio are calculated conditioning on home ownership.

The reported household debt holdings in Table 2 are restricted to mortgage debt. Nevertheless, it is clear that home ownership rates have declined over the period, while households on average are holding larger debt levels accompanying an increasing LTV ratio over time. For example, where 68 per cent of the HILDA sample in 2001 are home owners, by 2012 this number had fallen by 6.4 percentage points. During the same period the average LTV ratio increased to 28 per cent (from 22.6%). These results are consistent with the aggregate figures presented in Section 5.1.

Table 2: Household financial and housing statistics, 2001–12

Year	Age of household head	Household income	Homeownership rate (%)	House value	Mortgage debt	LTV ratio (%)
2001	46.2	58,298	68.0	261,381	49,929	22.6
2002	46.4	58,414	68.1	296,283	54,714	21.5
2003	46.4	58,553	67.4	340,171	65,651	22.0
2004	46.5	59,478	66.9	371,099	70,403	21.2
2005	46.4	62,413	65.4	381,990	76,768	22.4
2006	46.5	65,910	64.8	404,653	82,795	23.1
2007	46.6	67,854	64.8	420,594	89,916	24.3
2008	46.7	68,584	64.5	421,818	96,442	25.9
2009	46.7	70,541	63.3	422,659	100,042	26.8
2010	46.8	70,647	63.1	439,264	101,171	26.1
2011	47.0	71,222	62.2	430,946	103,969	26.9
2012	47.0	72,156	61.6	422,567	106,127	28.0
Average (2001–12)	*46.6*	*65,599*	*64.9*	*383,754*	*83,321*	*24.3*

Source: Author calculations from HILDA panel data (2001–12). All monetary values are deflated to AUD 2011 values

Figures 12 and 13 take advantage of HILDA household level information and plot cumulative distribution functions of mortgage debt and LTV ratios for each survey year. With these figures one can read off the percentage of the sample that has more or less mortgage debt (or larger or smaller LTV ratio) in a particular year. For example, 80 per cent of the sample in 2001 had a mortgage at most equal to $100 000, whereas by 2012 the share had fallen to 59 per cent. Figures 12 and 13 together show that the whole distribution function shifts right over time, reflecting general increases over time in both mortgage debt and LTV ratios.

[2] This is to abstract as much as possible from the issues regarding educational choice and dissaving in retirement. However, we believe those aged more than 70 years are an important group and we are planning to include them in the final analysis.

Combining the information in these figures with that in Table 2 we arrive at the following preliminary observations:

- Around 30 per cent of Australians are renters rather than home owners and this share is increasing over time.
- The percentage of $0 mortgage debt holders decreased from 50 per cent in 2001 to 41 per cent in 2012 (Figure 12). This is consistent with the conjecture that outright home owners are extracting from their housing equities.
- Home owners are increasing their mortgage debt levels over time either because of the increase in initial mortgage debt or via equity extractions.

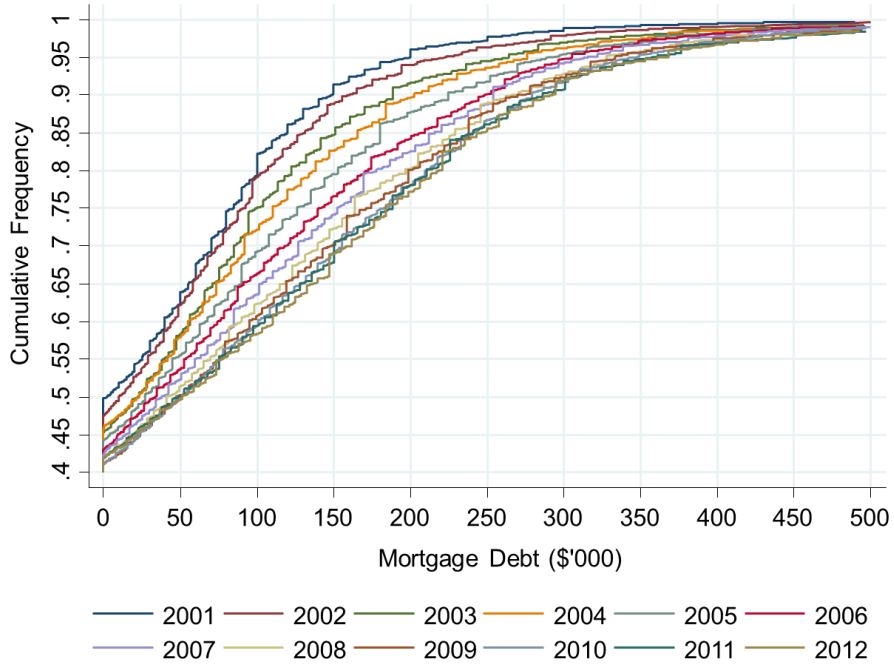
In order to examine borrowing behaviours for outright home owners, and hence to validate our preliminary observation in the second point above, we restrict our sample to households who are outright home owners in 2002 or 2006 and examine their borrowing behaviour, respectively, in 2006 and 2010.

Figure 14 below plots the evaluation of mortgage debt over the life course, where each connected line represents a different birth cohort. The birth cohorts are defined by the age of the household head in 2001. There are eight age groups: 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59 and 60–64 years. The plot is obtained from regressing mortgage debt on age groups and birth interactions, which gives 96 coefficients each representing the average mortgage debt of the particular cohort at a particular year.

Figure 14 presents a 'noisy' life-cycle pattern. For mortgage debt, the age profile is hump shaped over the life-cycle. The picture is consistent with the hypothesis that households purchase homes when young via mortgage contracts and repay the mortgage over the course of their working life. Households often upsize their dwelling in the middle phase of their working life and downsize their dwellings after their children leave home or when they retire. Another clear pattern to emerge is that the mortgage debt of each birth cohort is clearly rising. These trends indicate that the high portion of households who face collateral constraints should therefore be middle-aged (35–49 years).

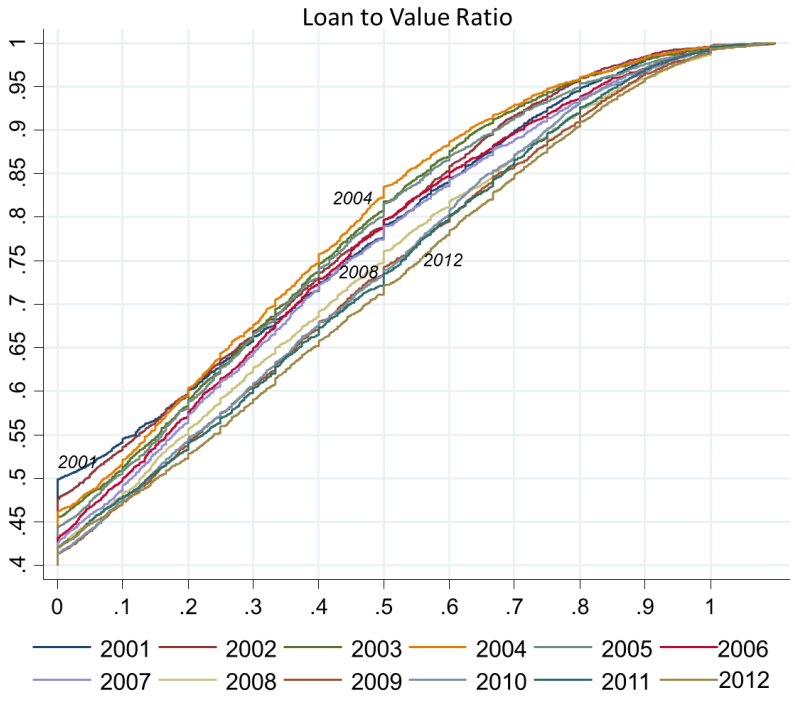
Next we proceed to examine the three HILDA waves (2, 6 and 10) which contain the wealth module. These waves correspond to the years 2002, 2006 and 2010. The modules include a consistent set of financial questions concerned with household wealth including, for example, non-mortgage debt. An unbalanced panel of households is constructed from the HILDA dataset which excludes households where the household head is less than 20 years or older than 70 years.

Figure 12: Cumulative distribution functions for mortgage debt, 2001–12



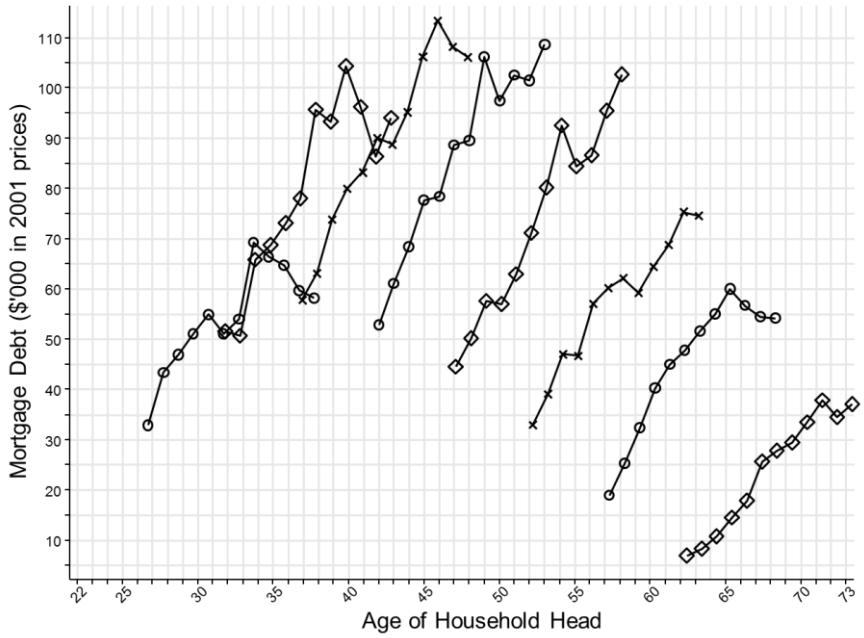
Source: Author calculations from HILDA panel data (2001–12)

Figure 13: Cumulative distribution functions for loan to value ratios, 2001–12



Source: Author calculations from HILDA panel data (2001–12)

Figure 14: Life-cycle patterns in mortgage debt, 2001–12



Source: Author calculations from HILDA panel data (2001–12)

It is important to note that for financial variables we use self-reported values where possible. Notably, in constructing the household 'total properties' value, we define it as the sum of the self-reported value of the home in which the household lives and imputed values of other properties. The obvious problem is measurement error in self-reported values. We correct for this by using LGA level median house prices in place of the self-reported values. Second, loan to value ratios (LTV) are our variables of interest. The LTV ratio is defined as the debt value divided by the property value. For our current analysis we exclude those households that have LTV ratios of 'all properties' greater than 1.1. Third, unsecured debt, that is debt not collateralised against property, is the sum of credit card debts, HECS/HELP debts and overdue household bills.

Table 3 below provides summary statistics of the household finances for the panel. As this is an unbalanced panel, the mean age of the household head increases over time but not exactly by four years. Real household income grew at 3 per cent per annum over the four-year period 2002–06, and mean financial wealth increased by 30 per cent over the same period. However, growth in household wealth is dominated by the value of housing: the mean house value increased from $200 000 to $258 000. From 2006 to 2010, household income increased by 7.2 per cent, financial wealth declined by 18.1 per cent and mean house values continued to increase but at a slower rate (by 6.8%). These changes indicate that, following the GFC, unlike other financial variables housing values continued to rise in Australia.

Changes in house values are matched by the increase in mortgage debt, which increases at the mean by approximately $49 000 between 2002 and 2006, and by $32 000 between 2006 and 2010. Consequently, the mean LTV ratio increased by 5.4 percentage points over the eight-year period, with the majority of the increase occurring between 2006 and 2010, largely the period after the GFC. The picture is very similar when we examine the total debt from all properties.

The average value of unsecured debt in the whole sample is small relative to secured debt. It follows a similar trend to mortgage debt, although the increase in non-mortgage debt between 2006 and 2010 is much smaller than for mortgage debt (9% compared to 21%).

Table 3: Means of financial variables: 2002, 2006, 2010

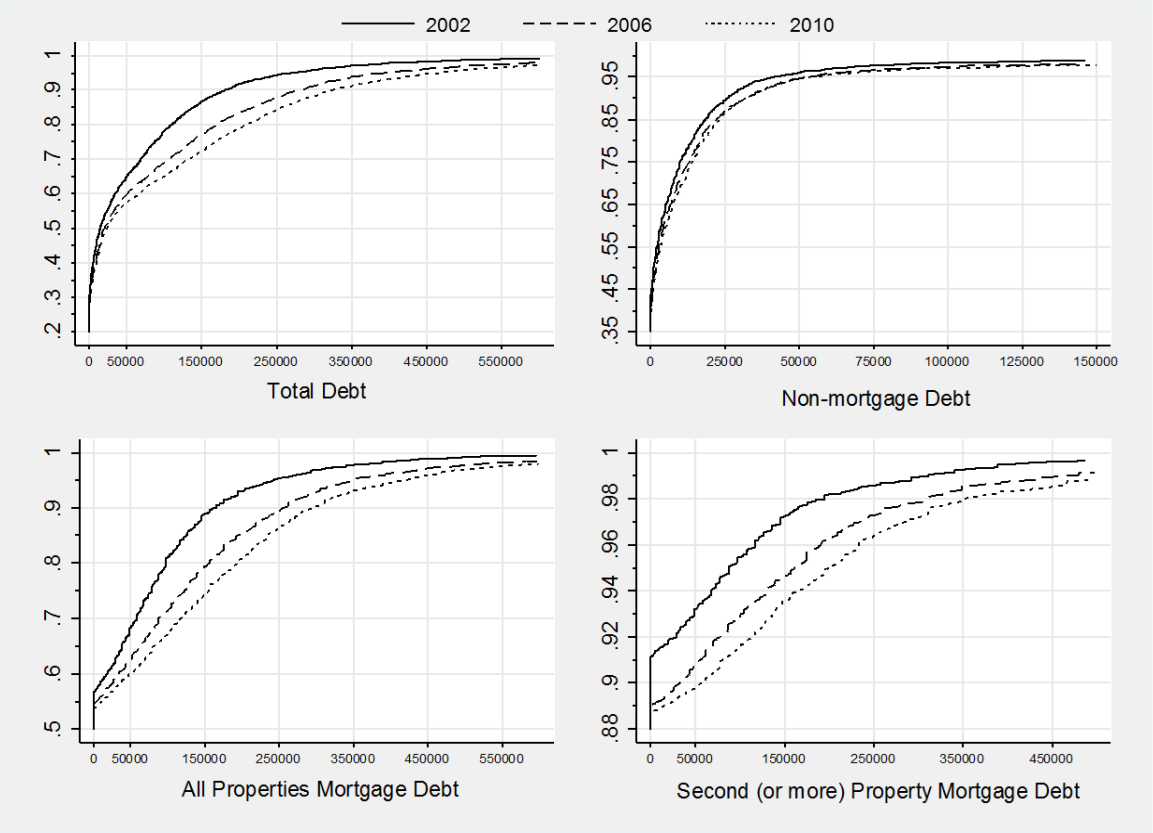
Year	2002	2006	2010
No. of households	*4,096*	*3,819*	*3,788*
(financial variables in AUD at 2001 prices)			
Age	44.7	44.9	45.2
Household income	60,564	68,022	72,943
Financial wealth	58,718	76,572	62,696
Home value	200,370	257,882	275,435
Values of all properties	253,975	381,781	379,622
Total debt	87,346	136,538	168,864
Mortgage debt for primary residence	40,866	59,367	71,848
Debt for all properties	53,951	82,531	100,394
Non-mortgage debt	11,874	17,956	19,665
Net worth	399,151	541,077	508,905
% of household with debt	72.2	76.4	77
% of household with non-mortgage debt	57	61.2	62.1
LTV ratio for primary residence only (%)	24.2	26	29.6
LTV ratio for all properties (%)	24.4	25.6	29.3

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

To illustrate the distribution of household debt positions, Figures 15 and 16 below plot cumulative distribution functions for debt and household 'net worth' in the three waves of HILDA data (2002, 2006, 2010). In 2002 approximately 20 per cent of the sample had no outstanding debt. The distribution shifts to the right or 'inwards' as the ratios generally increase as new home owners take on larger mortgages. This trend is much clearer when we consider the cumulative distribution functions for mortgage debt. The lower left part of the figure shows that distribution of mortgage debt shifts inwards and becomes more concave across the waves of data. This indicates an increasing concentration of households with larger mortgage debt.

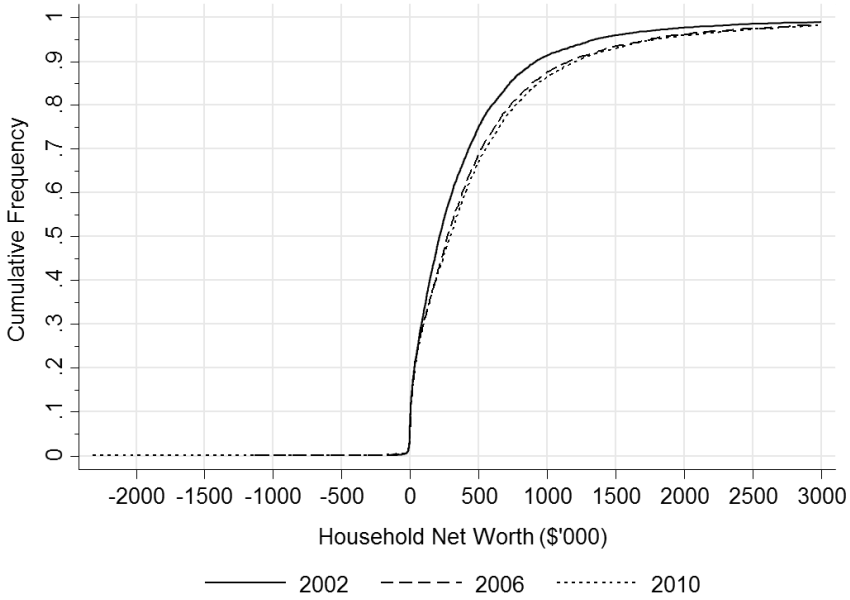
It is interesting also to note that there is substantial change in second property debt. Figure 16 below illustrates the distribution of net worth among households. 'Net worth' is defined as financial wealth plus house value minus secured debt minus unsecured debt. The figure shows a clear shift in the distribution of debt from 2002 to 2006, but a very small change between 2006 and 2010. The sample indicates a concentration of high net worth households. In 2006 and 2010 there is a significant minority of households with negative net worth. These observations may be explained by depressed house prices after the GFC.

Figure 15: Cumulative distribution functions of household debt: 2002, 2006, 2010



Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Figure 16: Distribution of net worth: 2002, 2006, 2010

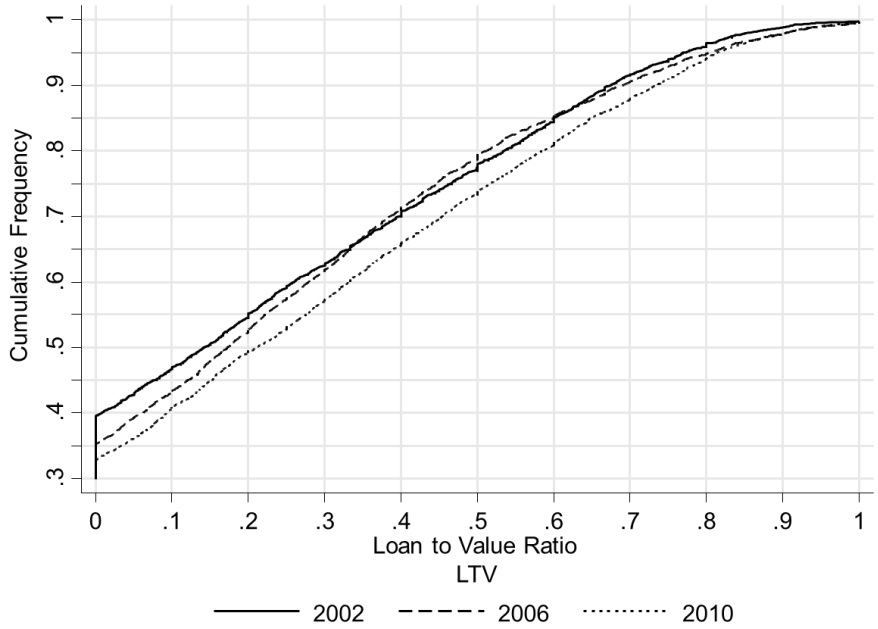


Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

The Cumulative Distribution Functions (CDFs) of the LTV ratios are shown in Figure 17 below. We see that increases in housing values are outweighed by increases in the average value of mortgage debt, especially during the 2006–10 period. The distribution of LTV ratios reveals that

8 per cent of households had ratios greater than 0.9 and fewer than 25 per cent of households had LTV ratios over 0.5 in 2002. By 2006, these proportions were similar but in 2010 they were significantly larger. Hence the shift in the self-reported values suggests that there is a higher incidence of collateral constrained households after the GFC.

Figure 17: Distribution of loan to value ratio



Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Table 4 below disaggregates households by LTV ratio and reveals substantial variation in both the composition and level of debt. The first numbers in each row report the mean and the second number is the median value. Households with high LTV ratios (higher than 0.7) have, on average, not only more mortgage debt but also more unsecured (non-mortgage) debt. This heterogeneity across the LTV ratios accentuates the importance both of the collateral transmission mechanism and of considering the debt portfolio allocation when examining the effect of house prices on household debt. It may be the case that some collateral constrained Australian households adjust their unsecured debt holdings. This is a question that will be investigated further in the Final Report.

In summary, the descriptive statistics from the 12 waves of the HILDA survey (2001–12) and HILDA wealth module data for waves 2, 6 and 10 confirm the increase in household debt and housing wealth for households in Australia in the 21st century. Even after the GFC, house values continue to rise and are accompanied by increases in household debt: specifically, mortgage debt. These findings suggest a close relationship between house prices and household debt. Household level data also indicate that households vary greatly in their collateral positions, as measured by the LTV ratio. A significant proportion of households were potentially collateral constrained during the 2000s and their share in the population increased following the GFC.

Finally, we observe an association between house prices and non-mortgage debt. Nevertheless, there are clearly many other factors in addition to house prices that affect household borrowing. In the next section, we use regression analysis to control for these factors in order to isolate the link between house prices and household debt.

Table 4: Summary statistics for three wealth modules by loan to value range: 2002, 2006, 2010

	LTV<0.1	0.1≤LTV<0.3	0.3≤LTV<0.5	0.5≤LTV<0.7	0.7≤LTV<0.9	LTV≥0.9
			Year 2002			
Mortgage debt	3,350	62,207	109,718	133,924	128,445	167,416
	0	48,613	87,503	116,671	106,948	131,255
Non-mortgage debt	7,309	14,037	17,015	16,255	18,178	17,986
	0	1,653	2,139	3,889	5,931	10,002
Total debt	11,570	96,340	163,681	192,312	187,840	237,044
	0	72,919	117,643	143,894	141,950	175,979
Financial asset	116,406	49,967	53,597	28,375	19,892	12,217
	26,752	12,153	9,593	6,320	3,889	3,111
House value	307,475	330,474	274,123	222,082	159,758	181,638
	243,065	272,232	233,342	194,452	140,978	140,978
Net wealth	701,399	556,744	443,011	267,120	178,859	120,095
	467,701	397,071	283,316	180,743	101,115	62,504
			Year 2006			
Mortgage debt	4,812	87,109	145,030	190,102	214,660	239,938
	0	68,891	122,085	170,919	207,545	248,531
Non-mortgage debt	10,988	21,723	25,404	27,329	22,748	23,612
	0	1,744	2,965	4,360	8,023	16,743
Total debt	18,930	143,894	235,919	285,652	314,532	305,242
	74	95,052	159,583	220,626	239,549	277,221
Financial asset	163,124	81,036	67,587	33,864	21,874	33,609
	27,905	12,209	8,720	7,048	4,841	3,663
House value	406,216	420,729	349,079	299,765	268,796	253,494
	317,422	348,815	322,654	283,412	261,611	270,332
Net wealth	1,048,047	813,844	584,143	318,779	200,471	98,726
	603,807	541,066	395,382	259,440	136,177	54,328
			Year 2010			
Mortgage debt	5,946	96,622	164,664	226,285	224,827	231,519
	0	74,551	139,784	209,676	217,441	229,478
Non-mortgage debt	10,356	25,101	34,853	23,232	22,422	29,180
	0	2,097	3,611	5,630	7,766	9,319
Total debt	18,551	161,297	270,656	334,111	341,160	305,280
	23	109,497	193,923	251,048	256,581	270,229
Financial asset	129,698	62,486	59,309	43,081	39,703	16,560
	31,063	14,367	9,707	8,947	5,951	5,533
House value	440,368	486,363	400,902	361,282	281,472	241,370
	357,225	388,288	359,166	335,869	279,567	234,914
Net wealth	981,538	865,568	603,806	412,339	257,954	122,572
	648,342	600,099	408,838	295,743	145,026	60,868

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

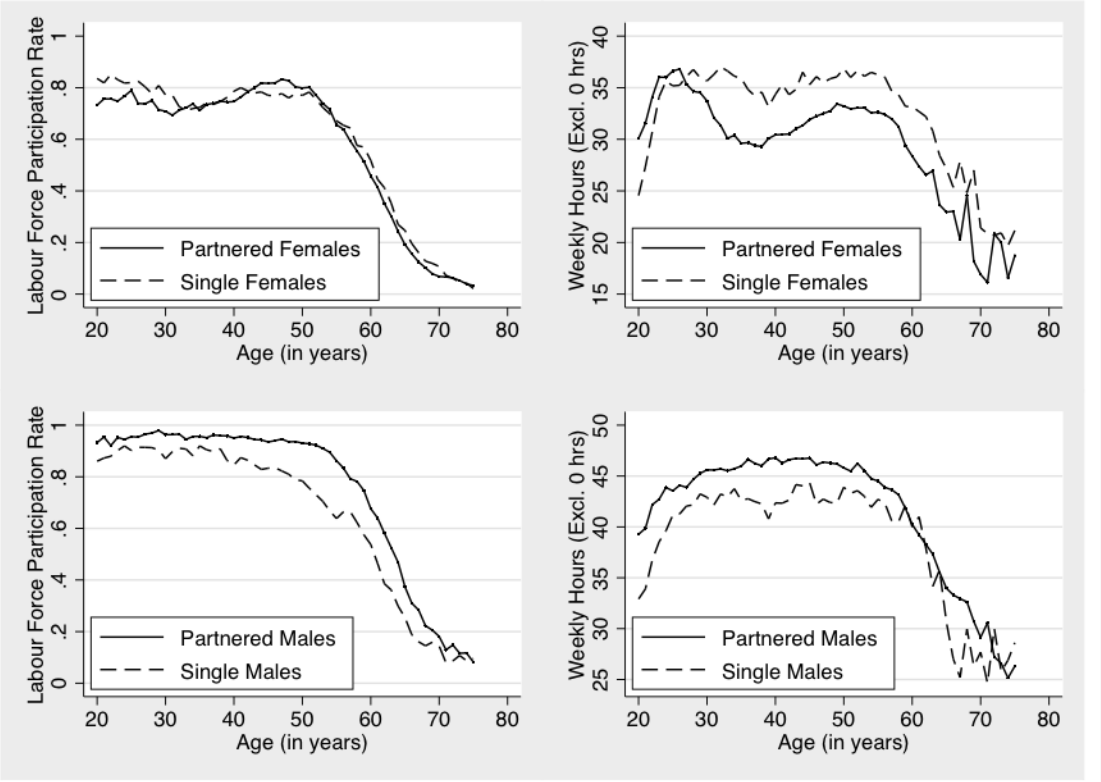
5.4 Labour supply, house prices and housing debt over the life-cycle: evidence from micro-level data

Figure 18 below explores the labour supply of men and women over the life-cycle by marital status (partner or single). The sub-figures in the left-hand column show the labour force participation rates for the estimation sample by age in years, while those in the right-hand column show the average number of hours worked for those working positive hours.

For all women, we observe the expected M-shaped variation in labour supply over the life-course, although this feature is stronger in hours worked than in participation, especially among partnered women. Partnered women tend to work around three to four fewer hours per week than single women during their prime childbearing years, while the gap in hours remains but narrows to roughly 1.5 hours in their later years.

Partnered men participate in the labour force in greater numbers than single men and work longer hours. Male participation rates start to decline for partnered men from their mid-50s, and earlier for single males, while average hours per week for those working positive hours average around 44 hours until they reach roughly 60 years of age.

Figure 18: Labour supply over the life-cycle: women and men, partnered and single (participation and weekly hours)



Source: Author calculations from HILDA panel data (2001–12)

Table 5 below summarises how housing debt and wealth varies over the life-course in three main age groups: 20–39 years, when we expect that households will be forming, families growing and households purchasing or upgrading their housing; 40–54 years, when the majority of households will likely be upgrading their housing and paying down mortgage debt; and lastly 55 years and older, when retirement decisions are likely to be a major influence on labour supply and housing decisions.

Each sub-panel of the table shows the share of households who are owner-occupiers (in the column labelled ‘Mean’). As expected, we observe that for both men and women the share of

owner-occupiers increases from 55 per cent to roughly 85 per cent. While the mean and median of the local area median house price remain roughly constant across these age ranges, we observe also the expected increase in self-reported housing value at the mean and median as respondents move from the early to middle life phase.

Housing value remains broadly stable between the middle phase and retirement phase, with outstanding mortgage balances declining as expected with increasing age at both the mean and the median. By the retirement phase, men and women have an average outstanding mortgage of $35 000 and $25 000, respectively, while the medians for both men and women are $0.

Table 5: Housing status, home value and mortgage outstanding by gender and age

	Men		Women	
	Mean	**Median**	**Mean**	**Median**
		Ages 20–39 years		
Home owner	0.54	1.00	0.55	1.00
Self-reported home value ($)	360,406	304,902	372,577	310,630
Local Area median house price ($)	312,632	286,971	312,889	285,531
Outstanding mortgage ($)	141,520	119,445	147,443	123,163
		Ages 40–54 years		
Home owner	0.77	1.00	0.78	1.00
Self-reported home value ($)	410,137	338,780	417,460	345,152
Local Area median house price ($)	311,294	281,958	318,757	287,194
Outstanding mortgage ($)	111,882	69,937	98,614	54,360
		Ages 55 years and older		
Home owner	0.85	1.00	0.83	1.00
Self-reported home value ($)	408,041	327,748	396,006	317,841
Local Area median house price ($)	310,551	278,239	315,442	282,169
Outstanding mortgage ($)	34,012	0	25,513	0

Source: Author calculations from HILDA panel data (2001–12)

Notes: Financial variables are reported in 2001 AUD

In response to differences identified in labour supply, housing wealth and mortgage balances for partnered and single men and women in the three key age categories outlined above, the empirical analysis of labour supply responses to housing wealth and debt will be undertaken separately for these sub-groups.

6 ECONOMETRIC ANALYSIS: EMPIRICAL METHODOLOGY AND PRELIMINARY RESULTS

This research study uses unconfidentialised unit record files from 12 waves of the HILDA panel dataset (2001–12), including wealth module data for waves 2, 6 and 10 (2002, 2006 and 2010), to address three key research questions:

1. What is the nature and magnitude of the relationship between housing prices and household debt and between its mortgage and non-mortgage components?
2. Does labour supply respond to changes in housing prices and mortgage debt? Is there a causal link?
3. If so, how large are these effects and are some types of households more responsive than others?

Cross-sectional and panel data models are utilised for the econometric analysis. Detailed information about the HILDA dataset is provided in Chapter 4.

This chapter provides a brief description of the empirical methodology underpinning each research question with results of our preliminary analysis of the relationship between house prices and indebtedness provided in Section 6.3. A more detailed discussion of the econometric methodologies is included in the Appendix. The Final Report will extend this analysis and examine the relationship between labour supply, house prices and housing debt.

6.1 House prices and indebtedness

In this section we present the methodology for our first research question: What is the nature and magnitude of the relationship between housing prices and household debt and between its mortgage and non-mortgage components? Two econometric models are employed. The first model is used to explore the cross-sectional variation in household debt in the HILDA data. We also extend this model to investigate the heterogeneity of the household responses to house price changes, hence partially addressing the third research question (how large are these effects and are some types of households more responsive than others?).

We then discuss the panel data method widely used in the literature to investigate the link between house prices and household debt for home owners. It is important to note that our interest will be not only in specifying the magnitude of the effect but also distinguishing between alternative transmission mechanisms that link house prices and household debt. The Final Report will extend our panel data model to better address this question.

6.1.1 Cross-sectional model

Our examination of the relationship between house prices and household debt starts with our first specification in which we investigate the impact of rising house prices on total indebtedness. This specification is similar to Dynan and Kohn (2007), Kartashova and Tomlin (2013):

$$TotalDebt_{ikt} = \beta_0 + \beta_p p_{kt} + \beta_r r_t + \beta_u u_{kt} + \sum_{i=2}^{4} \beta_y y_{it} + X'_{it}\beta_x + \sum_{t=2002}^{2011} \delta_t d_t + \epsilon_{ikt} \qquad (Equation\ 1)$$

where $TotalDebt_{ikt}$ is the logarithm of total debt for household *i* in region *k* at period *t*. Total debt includes housing, business, student, other personal and credit card debt. P_{kt} is the logarithm of LGA median house prices.

We have used two ways to construct this price variable. First, we use the self-reported values for home owners in HILDA, aggregate them across LGA, and take the median of this number for each year. Second, we use LGA median house prices from the RP house price data for each year. r_t is the real interest rate, which is obtained from World Bank data. X'_{it} is a vector of household characteristics, including age, age squared, age cubed, home ownership and education 'indicators' (completed a university or higher degree; completed a diploma; completed year 12), with high school dropouts as the education reference group. Household income groups are divided into less than $35 000 (reference group), between $35 000 and $49 999, between $50 000 and $99 999 and more than $100 000. For wave indicators, the first wealth wave (wave 2, 2002) is set to be the base group.

We estimate this specification using the wealth modules in 2002, 2006 and 2010. In this specification we treat each module as an independent cross-section and control general time effects by including time dummies. Our next model uses the data as a panel and investigates the changes in debt and house prices at the household level.

As a result of the log-log specification in Equation (1) β_p can be interpreted as elasticity measuring the effect of a 1 per cent increase in housing prices on household debt. It is also important to note that reference categories in multi-category variables are omitted in the regression. Thus the coefficients on the dummy variables for a specific group measure the difference in the intercepts between that group and the reference group.

This model is estimated by using the ordinary least squares technique, commonly known as classical linear regression method, and is thus useful for summarising the average relationship between dependent variable and the regressors. In addition, we are interested in the relationship between the dependent variable and the regressors at different points in the conditional distribution of dependent variable (in our case, the debt distribution). Quantile regression provides a statistical tool for estimating conditional quantiles (percentiles) of the dependent variable (see Appendix for the technical discussion).

For our purposes, comparing the marginal effects of house prices at different quantiles of the regression is informative for distinguishing between the alternative transmission mechanisms that link house prices to household debt. Specifically, larger responses at the upper and middle parts of the debt distribution are likely indicative of the collateral constraint channel. These households are more likely to be credit constrained given their large levels of debt. Moreover, increases in house prices relax binding borrowing constraints tied to their houses. In contrast, larger effects on households with low debt suggest that the wealth effect may dominate.

We extend our base specification by including additional explanatory variables and using different samples. These are discussed when presenting the preliminary results in Section 6.3.

An econometric issue arises in the estimation of Equation (1). Since we only observe debt for households with positive debt, we are faced with a selection problem. For example, if an individual owns a house with a mortgage, or if s/he is paying a HECS/HELP debt, we will observe a positive debt. But for some households, those who are renters or outright home owners, we may not observe any debt. The standard solution for this problem is using the Heckman sample selection correction model (Heckit method). This method is summarised in the Appendix.

6.1.2 Panel data model

Another way to investigate the impact of rising house values on household debt is to take advantage of the panel nature of HILDA and examine the changes in house prices and debt at

the household level. This empirical strategy is similar to that of Disney and Gathergood (2011) and Disney, Bridges and Gathergood (2010). Namely, we regress the change in household debt on the change in house prices and a set of financial, labour market and demographic controls:

$$\Delta TotalDebt_{i,t} = \beta_0 + \beta_1 \Delta Homevalue_{i,t} + \beta_2 \Delta Household\ Income_{i,t} + \quad (2)$$

$$\beta_3 \Delta Financial\ Assets_{i,t} + \beta_4 \Delta HECS\ Debt_{i,t} + X'_{it}\beta_5 + u_{i,t}$$

where $\Delta TotalDebt_{i,t}$ is the change in the total debt of household *i* in two consecutive wealth modules: for example, between 2002 and 2006. Δ represents the changes and, in Equation (2), we explicitly control for changes in household income, financial assets and HECS/HELP debt levels. We also control for the household's age, age squared, gender, household income squared and household assets squared, education dummies, number of children and the lagged values of household asset and HECS/HELP debt.

In this panel data model we restrict our attention to home owners, as our aim is to use the household level changes in home values and indebtedness. However, there are two empirical issues with this model.

1. Equation (2) imposes a relationship from changes in house value to changes in total debt. However, if, for example, households reduce consumption to purchase additional housing or invest in home renovations that will increase the value of their homes, this debt-financed home improvement can also cause a positive relationship between growth in house values and growth in total indebtedness. As a solution, we use the RP data to generate LGA median house price changes, rather than self-reported changes. We then instrument for self-reported house price changes in HILDA with the council level RP prices changes. These specifications are less likely to be influenced by measurement error (e.g. reporting errors in self-reported house prices) and endogeneity problems, and hence allow us to assess the robustness of our estimates.
2. Moving tends to be associated with changes in household mortgages. Because of the data limitations, we are not able to decompose the change in debt into non-housing consumption use and that used for housing purchases. Hence we limit our sample to the sub-sample of non-moving home owners. In addition, moving choices are not random. Specifically, across non-moving home owners, the likelihood of moving, and indeed the likelihood of extracting equity from their property when moving, varies considerably. To control for the non-random nature of non-movers, we again estimate the Heckman selection model on movers and non-movers. The selection model is discussed in the Appendix.

In our Final Report we will augment our baseline specification by introducing LTV thresholds in order to distinguish between the wealth and the collateral transmission mechanisms between house prices and household debt.

In summary, our empirical strategies test whether household responses to house price changes differ according to:

1. the household's relative position in the debt distribution
2. whether the household is a home owner or renter
3. the household's initial LTV ratio
4. whether there are any effects on the non-mortgage components of household debt.

This report focuses on the first two questions. The Final Report will address the last two questions.

6.2 Labour supply, house prices and housing debt

In line with the simple theoretical model presented in Section 2.3 we take two approaches to examine the relationship between housing debt, housing prices and labour supply. First, we

assess whether there is evidence to suggest that some households' labour supply is constrained by their mortgage debt. Second, we assess the impact of changes in housing wealth, captured by unexpected variation in local housing prices, on labour supply.

Given the descriptive statistics above, we consider the effect of debt and housing price shocks separately for men and women, partnered and single, and in three different stages of the life-cycle: namely, for those aged 20–39, 40–54, and 55–75 years.

Our study will begin by examining the relationship between debt and labour supply using a reduced form approach. This will allow us to explore the conditional correlations between labour supply and debt for our population sub-groups of interest: that is, separately for men and women, by phase of the life-cycle and by relationship status.

The next step of our analysis will be to refine these reduced form estimates to assess the causal effect of housing debt on labour supply for these same sub-groups. We do so in order to deal with the potential endogeneity of housing debt to labour supply decisions. Our approach will be to instrument for debt using LGA variation in housing prices.

Lastly, we will examine the impact of changes in housing wealth on labour supply. Here, we will follow both Disney and Gathergood (2014) and Milosch (2014) in examining the impact of unexpected, and thus exogenous, changes in housing wealth labour supply. These unexpected changes in housing wealth will be measured using variation in local area housing prices. We will discuss each of these approaches in more detail in the Final Report.

6.3 House prices and indebtedness: preliminary results

To estimate the impact of house prices on household debt, we initially exploit household-level changes in total indebtedness with respect to house prices. Our empirical strategy is detailed in Section 6.1 above. Throughout our empirical analysis of the relationship between debt and house prices, we use only the three wealth modules of HILDA (in waves 2, 6 and 10).

Table 6 below presents the raw correlation between house prices and different types of debt in HILDA. In panel A, we regress the log of household debt (or mortgage debt) on the log of LGA house prices. In panel B, we include time and state fixed effects. Unsurprisingly, we find a significant positive relationship both in specifications and for all types of debt. The existence of a mechanical link between house prices and mortgage debt is also apparent. After controlling for year and state effects, a 10 per cent increase in house prices is associated with a 4.65 per cent increase in the mortgage debt. The non-mortgage component of household debt is also highly and significantly positively correlated with house prices.

Table 6: Correlation between house prices and household debt

A – Raw correlation between house prices and household debt			
	Total debt	**Mortgage debt**	**Non-mortgage debt**
ln(house price)	0.637***	0.601***	0.328***
	(0.032)	(0.023)	(0.031)
Year dummies	*N*	*N*	*N*
State dummies	*N*	*N*	*N*
R^2	0.028	0.079	0.010
Observation	13,616	8,183	10,880
B – Correlation after controlling for year and state effects			
	Total debt	**Mortgage debt**	**Non-mortgage debt**
ln(house price)	0.600***	0.465***	0.343***
	(0.037)	(0.026)	(0.035)
Year dummies	Y	Y	Y
State dummies	Y	Y	Y
R^2	0.030	0.095	0.014
Observation	13,616	8,183	10,880

Source: Author calculations from HILDA panel data (2002, 2006, 2010)

Notes: 1. Standard errors are in parentheses. 2. *** p<0.01, ** p<0.5, * p<0.10

Next we use Equation (1) described in Section 6.1.1 which regresses log of household debt on log house prices as well as controls for household characteristics and variables for macroeconomic conditions. That is:

$$TDebt_{ikt} = \beta_0 + \beta_p p_{kt} + \beta_r r_t + \beta_u u_{kt} + X'_{it}\beta_x + \sum_{t=2002}^{2010} \delta_t d_t + \epsilon_{ikt}$$

In Table 7 below, the first column presents the estimates from our ordinary least square regression for the sample of individuals who report positive household debt. Given that Equation (1) is only estimated for households with positive debts, results from Ordinary Least Squares (OLS) procedure should be interpreted carefully. The second column controls for selection bias using the Heckman sample selection model via maximum likelihood (see Appendix). In column 3, we replace the LGA level median house price variable from the RP data with HILDA's self-reported house values, which we aggregate to LGA level.

The OLS coefficient estimate on house prices indicates that a 1 per cent increase in house prices is associated with a 0.198 per cent increase in total debt, *ceteris paribus*. This number is roughly one-third of the estimated correlations in Table 6. As expected, home owners, high-income households and educated households hold significantly more debt. The real interest rate and unemployment rate variables have the expected signs but are not significantly different from zero. The age coefficients also highlight the hump shape identified in the descriptive statistics. Comparing columns 1 and 2, we observe a small but insignificant difference between the estimated house price coefficients.

In the third column, we use an alternative house price measure; it is clear that self-reported house prices give very similar results. Comparing columns 2 and 3 we see that self-reported house values are good proxies for the historical prices used in the baseline model. Results confirm that a 1 per cent increase in house prices is associated with a 0.18 per cent increase in

the total household debt. At the mean of the data in 2006, this translates as follows: households who observe an AUD$1000 increase in house values increase their total household debt by approximately $95.

We next use the same specification as in column 2, but run a quantile regression at the 10th, 25th, 50th, 75th and 90th percentiles.[3] Results are very similar when we do not control for selection. In Table 8 our quantile regression estimates show that, except for at 10th percentile of the total debt distribution, the coefficient on the house price variable is positive and significantly different than zero. The positive effects get larger as we move up the conditional total debt distribution. A 10 per cent increase in house prices is associated with a 1.38 per cent increase at the 25th percentile of the debt distribution and a 2.98 per cent increase at the 75th percentile. This differential impact implies that house price increases also cause dispersion in household debt. Our finding of a statistically and economically significant impact for the lower end of the distribution indicates that the relationship between house prices not only impacts households via their mortgage borrowing. In the Final Report, we will explore whether there is also a significant effect on non-mortgage debt.

[3] In order to control for selection, we include the Inverse Mills ratio and its square in our base regression (Buchinsky & Hahn 1998).

Table 7: Total debt regression results

	(1)	(2)	(3)
House price (Log—Council level)	0.198***	0.181***	0.187***
	[0.035]	[0.033]	[0.026]
Home owner	1.955***	1.955***	1.938***
	[0.032]	[0.033]	[0.034]
Real interest rate	0.291	0.187	0.287
	[1.464]	[1.464]	[1.465]
Unemployment rate	-0.006	-0.047***	-0.067***
	[0.021]	[0.018]	[0.016]
Household income			
$35,000 to $49,999	0.534***	0.542***	0.543***
	[0.044]	[0.046]	[0.046]
$50,000 to $99,999	1.011***	1.023***	1.014***
	[0.038]	[0.040]	[0.041]
More than $100,000	1.504***	1.517***	1.505***
	[0.045]	[0.048]	[0.048]
Household head's age	0.102***	0.102***	0.103***
	[0.036]	[0.036]	[0.037]
Age Square	-0.002**	-0.002**	-0.002**
	[0.001]	[0.001]	[0.001]
Age Cube	0	0	0
	[0.000]	[0.000]	[0.000]
Household head's education			
Bachelor Degree or higher	0.497***	0.474***	0.476***
	[0.039]	[0.039]	[0.039]
Diploma	0.259***	0.252***	0.243***
	[0.035]	[0.035]	[0.035]
Completed year 12	0.291***	0.290***	0.292***
	[0.046]	[0.046]	[0.046]
Observations	18,063	18,063	17,849
Year—Quarter controls	Y	Y	Y
State controls	Y	Y	Y
Heckman selection method	N	Y	Y

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Notes: 1. Standard errors are in brackets. 2. *** p<0.01, ** p<0.5, * p<0.10

Table 8: Total debt quantile regression

	Quantile				
	0.1	**0.25**	**0.5**	**0.75**	**0.9**
House price (Log—Council level)	-0.087	0.138***	0.275***	0.298***	0.296***
	[0.078]	[0.046]	[0.027]	[0.024]	[0.037]
Home owner	3.619***	2.633***	2.139***	1.713***	1.084***
	[0.241]	[0.149]	[0.115]	[0.106]	[0.153]
Real interest rate	2.402***	0.589***	-0.234*	-0.685***	-1.048***
	[0.336]	[0.196]	[0.130]	[0.113]	[0.161]
Unemployment rate	-0.063	-0.067	-0.043***	-0.036***	-0.060***
	[0.041]	[0.022]	[0.013]	[0.012]	[0.018]
Household income					
$35,000 to $49,999	1.884***	0.894***	0.405***	0.292***	0.283**
	[0.240]	[0.170]	[0.109]	[0.097]	[0.139]
$50,000 to $99,999	3.340***	1.375***	0.704***	0.575***	0.641***
	[0.374]	[0.256]	[0.172]	[0.153]	[0.220]
More than $100,000	3.963***	1.824***	1.102***	1.001***	1.118***
	[0.422]	[0.285]	[0.194]	[0.175]	[0.250]
Household head's age	0.119	-0.042	0.016	0.091***	0.207***
	[0.092]	[0.056]	[0.038]	[0.032]	[0.043]
Age Square	-0.001	0.002	-0.000	-0.002**	-0.004***
	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]
Age Cube	-0.000	-0.000	-0.000	0.000*	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Household Head's education					
Bachelor Degree or higher	0.685***	0.451***	0.344***	0.340***	0.343***
	[0.096]	[0.062]	[0.034]	[0.032]	[0.046]
Diploma	0.318***	0.282***	0.194***	0.185***	0.186***
	[0.089]	[0.054]	[0.031]	[0.024]	[0.039]
Completed year 12	0.575***	0.287***	0.222***	0.235***	0.209***
	[0.123]	[0.069]	[0.042]	[0.035]	[0.052]
Observations	13,608	13,608	13,608	13,608	13,608
Year—Quarter controls	Y	Y	Y	Y	Y
State controls	Y	Y	Y	Y	Y
Inverse of Mill's ratio	Y	Y	Y	Y	Y

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Notes: 1. Standard errors are in brackets. 2. *** p<0.01, ** p<0.5, * p<0.10

In Table 9 below, we separate our sample into three age groups: 20–34 years, 35–49 years and 49 years and older. The effect of house prices is highly significant for middle and older age groups but not for young households. OLS estimates of the coefficient on house prices suggest that a 1 per cent increase in house prices is associated with a 0.315 per cent increase for the middle age group and a 0.274 per cent increase for the older age group. Finding the biggest impact on the middle-age group supports the importance of collateral transmission mechanism between house prices and household indebtedness.

As Figure 14 showed, the middle-age group holds relatively large amounts of debt compared to the other age groups. This is supported by the summary statistics showing high LTV ratios for middle-aged households. Additional evidence is also provided by the literature. Atalay et al. (2014) show that the consumption of middle-aged Australian home owners is most responsive to increases in house prices. Their paper argues that such a pattern is consistent with higher house prices relaxing credit constraints, and thereby financing higher consumption (housing collateral). Schwartz et al. (2008) present evidence that middle-aged households in Australia are more likely to withdraw equity from their housing wealth by increasing mortgage debt. In recent AHURI reports, Ong et al. (2013) and Judd et al. (2014) present evidence of increases in home equity withdrawals, especially for older Australians during the 2000s.

Thus far in this section we have tried to isolate the relationship between house prices and household debt by controlling for variables that may confound the relationship if omitted. Our results suggest that, after controlling for macro factors and household characteristics, regional house prices are positively and significantly associated with the total debt of home owners. This effect is larger at the upper part of the conditional debt distribution and also for middle-aged and older households. We also find significant effects for the lower end of the total debt distribution, suggesting that the relationship between house prices and debt is not only driven by home purchases. This finding motivates us to examine the link between house prices and non-mortgage debt. We will investigate this relationship in the Final Report.

Before moving to the panel data model, we note one important caveat. The above results should not be interpreted as indicating a causal link between house prices and household debt. As discussed in the literature review, a key challenge to empirically investigating this link is finding a substantial and plausibly exogenous source of variation in house prices to ensure that simultaneity (omitted variable) bias does not confound the relationship. A substantial part of the empirical studies on house price literature is faced with this simultaneity problem. Similarly, we do not claim to have identified the casual impact. Rather, we offer refined estimates of house price effects in Australia using a unique period where we observe spatial and time variations in house prices.

Table 9: Total debt regression results for different age groups

	(1)	(2)	(3)
House price (Log—Council level)	0.04	0.315***	0.274***
	[0.055]	[0.053]	[0.078]
Home owner	2.251***	1.750***	1.129***
	[0.054]	[0.052]	[0.087]
Real interest rate	0.21	-0.123	-0.3
	[0.147]	[1.441]	[0.294]
Unemployment rate	-0.035	-0.046	-0.009
	[0.029]	[0.028]	[0.044]
Household income			
$35,000 to $49,999	0.440***	0.111	0.363***
	[0.066]	[0.077]	[0.108]
$50,000 to $99,999	0.942***	0.485***	0.430***
	[0.063]	[0.064]	[0.092]
More than $100,000	1.258***	0.975***	0.844***
	[0.082]	[0.075]	[0.108]
Household head's age	1.243	0.95	-0.896
	[0.782]	[1.830]	[2.120]
Age Square	-0.045	-0.022	0.015
	[0.029]	[0.044]	[0.036]
Age Cube	0.001	0	0
	[0.000]	[0.000]	[0.000]
Household head's education			
Bachelor Degree or higher	0.814***	0.387***	0.357***
	[0.069]	[0.063]	[0.094]
Diploma	0.438***	0.204***	0.195**
	[0.064]	[0.056]	[0.081]
Completed year 12	0.510***	0.12	0.220*
	[0.068]	[0.079]	[0.124]
Observations	4,553	6,604	6,906
Censored observation	724	987	2,744
Joint significant test	2,795	2,106	443
Selectivity test	0.77	112.60	145.90
Year—Quarter controls	Y	Y	Y
State controls	Y	Y	Y
Heckman selection method	Y	Y	Y

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Notes: 1. Standard errors are in brackets. 2. *** p<0.01, ** p<0.5, * p<0.10

Next we present the preliminary results from the panel data model (Equation 2), discussed in Section 6.1.2. Our empirical strategy is to regress the change in household debt against the change in house prices and a set of financial, labour market and demographic controls (Equation 2).

In this panel data model, we restrict our attention to home owners. The sample is further limited to those who appear in at least two of the three waves. As mentioned in Section 6.1.2, there are two main econometric issues with this model. The first is the endogeneity of self-reported house values; the second is restricting our sample to non-movers (sample selection problem).

In order to deal with the endogenity problem, we use LGA level prices collected by RP as an instrument for self-reported house values. The validity of this instrument relies on the fact that LGA level prices (collected by RP) are exogenous to the home improvement activity of individual households in the council area. There is a high correlation between changes in the self-reported values and council-level prices, and thus the instrument passes the relevancy test.

To address the second problem (sample selection), due to the non-random nature of moving choices, we estimate the Heckman selection model on movers and non-movers. Details of the methodology and problem are discussed in the Appendix.

Table 10 below summarises the preliminary findings of our panel data model. For brevity we have only reported selected estimates in the table. The OLS estimates in column 1 of Table 10 establish a strong relationship between house price movements and household indebtedness. The coefficient of 0.171 is significant at the 1 per cent level. The magnitude of the effect is sizeable: an AUD$1000 increase in house values is associated with an AUD$171 increase in household debt (at the mean of the data). We also observe a significant positive relationship with household income and household debt, and a negative significant relationship between financial asset holdings and household indebtedness.

The second column presents the results of the model with instrumented house prices (to correct the bias associated with the endogeneity of self-reported house values). The pattern of results is similar with the magnitude of the coefficient on the change in house value a little larger. This indicates a potential measurement error problem with the self-reported house values. In cases of classical measurement error, the OLS estimator is biased toward zero (attenuation bias). Instrumenting for self-reported house values with regional house prices at least partially solves this problem. The coefficient on house value then becomes 0.191, so the estimated impact of house price movements on household indebtedness increases by approximately 10 per cent. Although the standard errors are larger, the estimates are still significant at the 1 per cent level.

The last two columns in Table 10 report the Heckman selection model results. In this specification we used both self-reported and instrumented house prices. The former is reported in column 3 and the latter in column 4. The estimates from the Heckman selection models are similar to OLS and Instrumental Variable estimates presented in columns 1 and 2. Most of the covariates (including the change in household income and in financial assets) have the same signs and magnitudes but their standard errors are larger such that they become insignificant in the Heckman selection corrected estimates. The coefficients on the house value changes are positive and still significant at the 1 per cent level. They imply that households who experience a $1000 increase in their house value on average increase their consumer debt by between $169 and $192. This is an economically significant effect. This effect is also larger than the effects measured in US and UK studies.

Table 10: Changes in house prices and household indebtedness: panel data model

	(1)	(2)	(3)	(4)
Change in house value	0.171***	0.191***	0.169***	0.192***
	[0.008]	[0.008]	(0.036)	(0.044)
Change in financial assets	-0.023**	-0.019**	-0.027	-0.023
	[0.009]	[0.009]	(0.032)	(0.036)
Change in household income	0.294***	0.331***	0.191	0.234
	[0.205]	[0.064]	(0.258)	(0.243)
Age/1,000	1.823	1.444	16.706***	16.272***
	[2.272]	[2.266]	(8.359)	(7.942)
(Age square)/1,000	-0.024	-0.021	-0.131**	-0.127**
	[0.022]	[0.022]	(0.006)	(0.058)
Observations	3,614	3,613	7,327	7,318
Censored observations			3,713	3,705
Joint significant test			63,56	57.28
Selectivity test			526.1	525.1
House prices	Self-Reported	Instrumented House Price	Self-Reported	Instrumented House Price
Heckman selection model	No	No	Yes	Yes

Source: Author calculations from HILDA panel data (2002, 2006 and 2010)

Notes: 1. Standard errors are obtained from 99 bootstraps. They are reported in brackets. 2. *** p<0.01, ** p<0.5, * p<0.10. 3. Additional covariates include changes in HECS/HELP debt, household head gender, household income squared, household assets squared, education dummies, number of children and lagged values of HECS/HELP debt and household assets.

7 CONCLUSION, POLICY CONTEXT AND NEXT STEPS

This Positioning Paper provides preliminary evidence on the nature and magnitude of the relationship between housing prices, household debt and the labour market decisions of Australian households.

We have provided a review of the existing literature along with a discussion of the methodologies to be applied to address our research questions.

In Section 6.3 we estimated the impact of house price movements on household indebtedness using the HILDA dataset. Our preliminary analyses show a strong relationship between house prices and household debt in the cross-sectional data. Our panel data model exploits the effect of house price changes on home owners, while controlling for permanent unobserved and time-varying observed individual heterogeneity. Results from this specification confirm the cross-sectional findings and suggest that endogeneity and measurement error problems associated with the self-reported house values, as well as sample selection problems, do not appear to affect our baseline estimates.

Our cross-sectional results also indicate clear heterogeneity in the relationship between house price and overall household indebtedness across high and low debt households. Further analysis is needed to confirm this pattern in the panel data, specifically examining whether home owners with higher levels of mortgage debt relative to house values actually exhibit a stronger positive association between subsequent movements in house prices and household debt. This investigation will help us to distinguish the exact transmission mechanism that links house prices and household debt.

As discussed in Chapter 2, the collateral mechanism implies differential responses to house price changes depending on whether the home owner is constrained in the previous period or not. In the Final Report we will extend our panel data model to distinguish between the wealth and collateral transmission mechanisms that link house prices to household debt using initial LTV ratios.

Some implications of the preliminary results for policy can nonetheless be described here. The suggestion that house price increases lead also to an increase in dispersion in debt levels is important. Our results show that the house price effect is larger at the upper part of the conditional debt distribution (households with higher debt levels) and also for middle-aged households. These households are arguably most vulnerable to income shocks (e.g. unemployment, disability). These results are in contrast to the general belief in Australia that debt has been held by those most able to service it: namely, higher income and higher wealth households. Hence, macroeconomic policy-makers should interpret high levels of debt and rising household income to debt ratios in Australia carefully. In a number of countries with similar situations, macro-prudential regulations have been implemented to limit the growth of household indebtedness (RBA 2014).

Our current analyses also identify an effect of house prices on outright home owners' borrowing behaviours: we find an impact on households located further down the debt distribution. This suggests that there is a potential wealth effect associated with house price increases. The GFC highlighted important links between housing markets and the broader economy that are in part due to house-price-related wealth effects. Hence our results underline the importance of house prices for monetary policy in Australia.

In addition, the finding that debt held by older outright home owners responds to increases in housing prices suggests a role for housing as an insurance mechanism for the elderly. This, in turn, signifies the role of housing in supporting the consumption and wellbeing of the elderly and its potential to substitute for public provision.

Our current analyses use the change in total household debt as the dependent variable. If the changes in house values causes households to refinance their debt portfolio, the net effect will depend upon the change in both mortgage and non- mortgage debt. Hence, examining the relationship between house prices and non-mortgage debt is also relevant for policy-making. Finding a significant substitution effect in debt portfolios, in accordance with wealth effects, signifies another potential role for housing in influencing the financial wellbeing of Australians. The Final Report will look also at this issue in depth.

Consistent with international findings, our initial analysis of the micro data on labour supply, housing debt and house prices suggests that there are important differences in the patterns of labour supply and housing debt and wealth over the life-course and between partnered and single Australians. These preliminary descriptive statistics suggest that it will be important to consider the links between labour supply, housing debt and house prices separately for these demographic sub-groups.

As noted above, our Final Report will extend the preliminary analyses of house prices and household indebtedness and undertake the econometric analysis of the relationship between labour supply, house prices and housing debt as described in Section 6.2. We will employ the HILDA data in tandem with historical series of median house prices at LGA level sourced from RP data. We will use both panel data and instrumental variable econometric techniques in order to provide robust estimates of the links between house prices and household debt and between labour supply, housing debt and house prices. Our proposed methodologies will address issues of sample selection, unobserved heterogeneity and endogeneity or simultaneity bias.

Our analysis in the Final Report will shed light on the role of the collateral and wealth effects on the labour supply decisions of Australians. It may be that an increase in indebtedness, particularly mortgage debt, prompts households to supply more labour, with labour supply reacting to housing market constraints (especially collateral constraint). Alternatively, older home owners may choose to retire early or reduce work hours when their housing wealth increases. These two channels have different implications for a number of policy issues (employment and labour force productivity, housing policies and the level of long run economic growth). Hence understanding their relative importance is important for macroeconomic and social policy formulation in Australia.

REFERENCES

Aladangady, A 2014, *Household balance sheets and monetary policy*, Finance and Economics Discussion Series 2014–98, Board of Governors of the Federal Reserve System (US).

Aldershof, T, Alessie, R J M & Kapteyn, A 1999, *Female labor supply and the demand for housing*, Dutch Ministry of Economic Affairs, Discussion Paper no. 04B07.

André, C 2010, *A bird's eye view of OECD housing markets*, OECD Economics Department Working Papers, no. 746, OECD, Paris.

Aoki, K., Proudman, J & Vlieghe, J 2001, 'House prices, consumption and monetary olicy: a financial accelerator approach', *Journal of Financial Intermediation*, vol.13, no.4, pp.414–435.

Aron, J & Muellbauer, J 2006, *Housing wealth, credit conditions and consumption*, CSAE WPS/2006–08, the Centre for the Study of African Economies, Department of Economics, Oxford University.

Aron, J, Duca, J, Muellbauer, J, Murphy, A & Murata, K 2012, 'Credit, housing collateral and consumption, evidence from the UK, Japan and the US', *Review of Income and Wealth*, vol.58, no.3, pp.397–423.

Atalay K, Whelan, S & Yates, J 2014,' House prices, wealth and consumption: new evidence from Australia and Canada', *Review of Income and Wealth*, forthcoming.

Attanasio, O, Leicester, A & Wakefield, M 2011, 'Do house prices drive consumption growth? The coincident cycles of house prices and consumption in the UK', *Journal of the European Economic Association*, vol.9, no.3, pp.399–435.

Attanasio, O & Weber, G 1994, 'The UK consumption boom of the late 1980s: aggregate implications of microeconomic evidence', *Economic Journal*, vol.104, no.427, pp.1269–1302.

Australian Bureau of Statistics (ABS) 2013, *Australian national accounts: financial accounts*, December quarter 2013, cat. no. 5232.0, Australian Bureau of Statistics, Canberra.

—— 2014, *Australian social trends*, 2014, cat. no. 54102.0, Australian Bureau of Statistics, Canberra.

Belkar, R, Cockerell, L & Edwards, R 2007, *Labour force participation and household debt*, Reserve Bank of Australia, Economic Research Department, Research Discussion Paper (RDP) 2007–05.

Bottazzi, R 2004, *Labour market participation and mortgage-related borrowing constraints*, Institute for Fiscal Studies, Working Paper WP04/09, London.

Bradbury B & Chalmers J 2003, *Housing, location and employment*, AHURI Final Report no. 44, Australian Housing and Urban Research Institute, Melbourne.

Browning, M, Gørtz, M & Leth-Petersen, S 2013, 'Housing wealth and consumption: a micro panel study', *Economic Journal*, vol.12, no.568, pp.401–428.

Buchinsky, M & Hahn, J 1998, 'An alternative estimator for the censored quantile regression model', *Econometrica*, vol.66, pp.653–671.

Cameron, A C, Trivedi, P K 2005, *Microeconometrics: methods and applications*, Cambridge University Press, Cambridge.

Campbell, J & Cocco, J 2007, 'How do house prices affect consumption? Evidence from micro data', *Journal of Monetary Economics*, vol.54, no.3, pp.591–621.

Carroll, C 1997, 'Buffer-stock saving and the life-cycle/permanent income hypothesis', *Quarterly Journal of Economics*, vol.112, no.1, pp.1–55.

Commonwealth Bank 2013, 'Household debt trends', *Global Market Research*, viewed on June 2014 https://www.commbank.com.au/content/dam/commbank/corporate/research/publications/economics/economic-issues/australia/2013/250713-HouseHold_Debt.pdf.

Connolly G 1996, 'Causality between consumer loan affordability and the female full-time participation rate in the Australian labour force', *Australian Bulletin of Labour*, vol.22, no.3, pp.183–193.

Connolly, G & Kirk, B 1996, 'Determinants of the full-time participation rate for males aged 45–54 years', in Department of Social Security (ed.), *Early retirement seminar: papers from the seminar held by the Department of Social Security*, 14 December 1995, pp.97–109, AGPS, Canberra..

Cooper, D 2010, *Did easy credit lead to overspending? Home equity borrowing and household behavior in the early 2000s*, Federal Reserve Bank of Boston Public Policy Discussion Paper no. 09–7.

—— 2013, 'House price fluctuations: the role of housing wealth as borrowing collateral', *Review of Economics and Statistics*, vol.95, no.4, pp.1183–1197.

Deaton, A 1991, 'Saving and liquidity constraints', *Econometrica*, vol.59, no.5, pp.1221–1248.

Debelle, G 2004, *Macroeconomic implications of rising household debt*, Bank for International Settlements: Monetary and Economic Department, BIS Working Paper no. 153 (June), Switzerland.

Del Boca, D & Lusardi, A 2003, 'Credit market constraints and labor market decisions', *Labour Economics*, vol.10, pp.681–703.

Disney, S Bridges, J Gathergood 2010, 'House price shocks and household indebtedness in the United Kingdom', *Economica*, vol.77, pp.472–496

Disney, R J & Gathergood, J 2011, 'House price growth, collateral constraints and the accumulation of homeowner debt in the United States', B.E. *Journal of Macroeconomics*, vol.11, no.1.

——. 2014, *House prices, wealth effects and labor supply*, The Institute for Fiscal Studies, IFS Working Paper WP201425, London.

Disney, R J, Gathergood, J & Henley, A 2010, 'House price shocks, negative equity and household consumption in the United Kingdom', *Journal of the European Economic Association*, vol.8, no.6, pp.1179–1207.

Drago R, Wooden M and Black D 2009, 'Long work hours: volunteers and conscripts', *British Journal of Industrial Relations*, vol.47, no.3, pp.571–600.

Dynan, K E & Kohn, D L 2007, *The rise in U.S. household indebtedness: causes and consequences*, Board of Governors of the Federal Reserve System, FEDS Working Paper 2007–37, US.

Fortin, N M 1995, 'Allocation inflexibilities, female labor supply, and housing assets accumulations: Are women working to pay the mortgage?', *Journal of Labor Economics*, vol.13, pp.524–557.

Friedman, M 1957, *A theory of consumption function*, Princeton University Press, New Jersey USA.

Greene, W H 2003, *Econometric analysis*, Prentice Hall, Upper Saddle River, NJ.

Greenspan, A & Kennedy, J 2005, *Estimates of home mortgage originations, repayments, and debt on one-to-four-family residences*, FEDS Working Paper 2005–41 Board of Governors of the Federal Reserve System, United States.

—— 2008, 'Sources and uses of equity extracted from homes', *Oxford Review of Economic Policy*, vol.24, no.1, pp.120–144.

Hiebert, P 2006, *Household saving and asset valuations in selected industrialised countries*, Reserve Bank of Australia, Research Discussion Paper (RDP) 2006–07.

Hurst, E & Stafford, F 2004, 'Home is where the equity is: mortgage refinancing and household consumption', *Journal of Money*, Credit, and Banking, vol.36, no.6, pp.985–1014.

Iacoviello, M 2004, 'Consumption, house prices and collateral constraints: a structural econometric analysis', *Journal of Housing Economics*, vol.13, no.4, pp.304–320.

Jappelli, T 1990, 'Who is credit constrained in the U.S. Economy?', *Quarterly Journal of Economics*, no.105(February), pp.219–234.

Judd, B, Liu, E, Easthope, H, Davy, L & Bridge, C 2014, *Downsizing amongst older Australians*, AHURI Final Report no.132, Australian Housing and Urban Research Institute, Melbourne.

Kartashova, K & Tomlin, B 2013, *House prices, consumption and the role of nonmortgage debt*, Bank of Canada Working Paper 2013–2.

Kidd, M P & Ferko, I 2001, 'The employment effects of gender discrimination in Australia 1994–95', *The Economic Record*, vol.77, no.236, pp.71–88.

King, M 1990, 'Discussion', *Economic Policy*, vol.5, no.2, pp.383–387.

Koenker, R & Bassett, G Jr 1978, 'Regression quantiles', *Econometrica*, vol.46, pp.33–50.

Lustig, H N & van Nieuwerburgh, S G 2005, 'Housing collateral, consumption insurance, and risk premia: an empirical perspective', *Journal of Finance*, vol.60, no.3, pp.1167–1219.

Mack, A & Martínez-García, E 2011, *A cross-country quarterly database of real house prices: a methodological note*, Globalization and Monetary Policy Institute Working Paper no. 99, Federal Reserve Bank of Dallas, US.

McGrath, P 2014, Household debt the big threat to Australian Economy, ABC, viewed 8 May 2014, http://www.abc.net.au/news/2014-05-07/household-debt-the-big-threat-to-australian-economy/5435844

Melbourne Institute 2014, *Families, incomes and jobs, volume 9: a statistical report on waves 1 to 11 of the Household, Income and Labour Dynamics in Australia Survey*, Melbourne Institute of Applied Economic and Social Research, the University of Melbourne, Melbourne.

Mian, A & Sufi, A 2011, 'House prices, home equity-based borrowing, and the US household leverage crisis', *American Economic Review*, vol.101, no.5, pp.2132–2156.

Miles, D 1992, 'Housing markets, consumption and financial liberalisation in the major economies', *European Economic Review*, vol.36, no.5, pp.1093–1127.

Milosch, J L 2014, *House price shocks and labor supply choices*, unpublished manuscript.

Modigliani, F 1976, 'Life-cycle, individual thrift, and the wealth of nations', *American Economic Review*, vol.76, no.3, pp.297–313.

Modigliani, F & Brumberg, H 1954, 'Utility analysis and the consumption function: an interpretation of cross-section data', in Kenneth K Kurihara (ed.), *Post-Keynesian economics*, pp.388–436, Rutgers University Press, New Brunswick, NJ.

Muellbauer, J & Murphy, A 1990, 'Is the UK balance of payments sustainable?', *Economic Policy*, vol.5, no.2, pp.347–395.

Ong, R, Haffner, M, Wood, G, Jefferson, T M & Austen, S E 2013, *Assets, debt and the drawdown of housing equity by an ageing population*, AHURI Final Report no. 153, Australian Housing and Urban Research Institute, Melbourne.

Ong, R, G A, Wood, S E, Austen, T, Jefferson M & Haffner, M.2013, *Housing equity withdrawal in Australia: prevalence, patterns and motivations in mid-to-late life*, AHURI Final Report no. 217, Australian Housing and Urban Research Institute, Melbourne..

Organisation for Economic Co-operation and Development (OECD) 2012, *OECD economic surveys: Australia 2012*, Organisation for Economic Co-operation and Development, Paris.

Ortalo-Magné, F & Rady, S 2006, 'Housing market dynamics: on the contribution of income shocks and credit constraints', *Review of Economic Studies*, vol.73, no.2, pp.459–485.

Poterba, J 2000, 'Stock market wealth and consumption', *Journal of Economic Perspectives*, vol.14, no.1, pp.99–118.

Reserve Bank of Australia (RBA) 2014, *Financial stability review*, March 2014, viewed on June 2014 http://www.rba.gov.au/publications/fsr/2014/sep/pdf/0914.pdf.

Schwartz, C, Lewis, C, Norman, D & Hampton, T 2008, 'Factors influencing housing equity withdrawal: evidence from a microeconomic survey', *Economic Record*, vol.84, no.267, pp.421–433.

Windsor, C, Jääskelä, J & Finlay, R 2013, *Home prices and household spending*, Research Discussion Paper (RDP) 2013–04, Reserve Bank of Australia, Sydney.

Wood, G & Nygaard, C 2010, 'Housing equity withdrawal and retirement: evidence from the Household, Income and Labour Dynamics in Australia Survey (HILDA)', in S Smith & B Searle (eds), *The Blackwell companion to the economics of housing: the housing wealth of nations*, Blackwell, Oxford.

Worswick, C 1999, 'Credit constraints and the labour supply of immigrant families in Canada', *Canadian Journal of Economics*, vol.32, no1, pp.152–170.

Yamashita, T 2007, 'House price appreciation, liquidity constraints, and second mortgages', *Journal of Urban Economics*, vol.62, no.3, pp.424–440.

Yates, J & Whelan, S 2009, *Housing wealth and consumer spending*, AHURI Final Report No. 132, pp.1–69, Australian Housing and Urban Research Institute, Melbourne.

APPENDIX

Econometric issues

1.1 Quantile regression

Quantile regression provides a statistical tool for estimating conditional quantiles (percentiles) of dependent variables. For the purposes of this study, we are interested in the relationship between the dependent variable (debt distribution) and the regressors at different points in the conditional distribution of the dependent variable.

As defined in Koenker and Bassett (1978) and Cameron and Trivedi (2005), quantile regression can be defined as:

$$y_i = x'_i\beta_q + u \quad with \quad Q_q(y_i|x_i) = x'_i\beta_q$$

where y_i is the dependent variable, x'_i is the vector of the regressor and β_q is the vector of population parameters to be estimated. The qth 'quantile regression' estimator $\widehat{\beta_q}$ minimises over β_q objective function:

$$Q(\beta_q) = \sum_{i:y_i \geq x'_i\beta}^{N} q|\, y_i - x'_i\beta_q| + \sum_{i:y_i < x'_i\beta}^{N} (1-q)|\, y_i - x'_i\beta_q|$$

where $0 < q < 1$ and β_q is used to highlight that for different quantile choices, we estimate different values of β. For example, if q=0.5, this gives the median estimator (also known as the least absolute deviation estimator), and from above it minimises:

$$\sum_i |\, y_i - x'_i\beta_{0.5}|$$

This objective function is not differentiable so the minimisation problem is then solved by linear programming methods. The quantile regression coefficients can be interpreted as the partial derivative of the conditional quantile of the dependent variable 'y' with respect to a particular regressor. In other words, the coefficients represent the marginal change in y at the '*q*'th conditional quantile due to a marginal change in the independent variable.

In addition to providing richer understanding of the data, quantile regression has several advantages. First, median (quantile) regression is more robust to outliers than mean regression. This is important when dealing with self-reported financial variables, since it is common to have some outliers in the data due to misreporting. Second, since quantile regression avoids assumptions about the parametric distribution of regression errors, it is more suitable when we may be concerned about heteroskedasticity.

1.2 Cross-sectional model: Heckman selection method

An econometric issue arises in the estimation of Equation (1) (see Section 6.1.1). Since we only observe debt for households with positive debt, we are faced with a selection problem. The selection bias problem we face arises due to an incidental truncation of the sample (Greene 2003, p.780). For example, if an individual owns a house with a mortgage or is paying a HECS/HELP debt, we will observe a positive debt. But for households who are renters or outright home owners we may not observe any debt. Therefore, the truncation of debt is incidental because it depends on other variables.

The standard solution for this problem is to use the Heckman sample selection correction model (Heckit method). This method can be summarised in two steps. In the first step we use all observations to estimate a probit model of selection and calculate the Inverse Mills ratio for

each observation. In the second step we use the selected sample and run the original equation incorporating the Inverse Mills ratio as an additional regressor. For our model, the selection equation takes an indicator variable for having a positive debt as the dependent variable with the same explanatory variables as our original equation. We use this standard Heckman selection method for our mean regression model. For the quantile regressions, we follow a similar procedure described in Buchinsky and Hahn (1998) and include the Inverse Mills ratio and its squared value in the quantile regression.

1.3 Panel data selection model

The selection equation we utilise is:

$$NotMoved_{i,t} = \alpha_0 + \alpha_1 Intention\ to\ \ Move_{i,t-1} + \alpha_2 Like\ Neig_{i,t-1} + \alpha'_3 X_{i,t} + e_{i,t}$$

where $NotMoved_{i,t}$ is an indicator variable taking the value 1 if the household has not moved in the consecutive waves and 0 otherwise. '*Intention to move'* is an indicator variable derived from the HILDA question which asks each respondent whether they intend to move in the next 12 months.[4] '*LikeNeig*' indicate the respondent's satisfaction with the neighbourhood on a scale from 0 to 10 and $X_{i,t}$ is the same vector of regressors as in Equation (2) (see Section 6.1.2). These questions are asked in every wave. Lagged responses of '*Intention to move*' and '*LikeNeig*' are used as exclusion restrictions in the first stage of the Heckman selection model for whether the household moved between the periods. When we are discussing the results, we present the estimates with and without the selectivity corrected models.

The results for the first stage, the Heckman selection equation, show that the likelihood of the household being a non-mover decreases with its intention to move in the next year and increases (although insignificantly) with the household liking its neighbourhood. The coefficients on the exclusion restrictions are jointly significant at the 1 per cent level, confirming the validity of the exclusion restriction. There are 3700 observations of households moving in the four-year wave period.

[4] The exact wording of the question is: 'How likely is it that you will move in the next 12 months?'

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