

# HOUSING WEALTH EFFECTS ON LABOUR SUPPLY: EVIDENCE FROM AUSTRALIA\*

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## **Abstract**

In this study we analyse the effect of housing wealth on labour supply using Australian panel data. Wealth effects are identified from exogenous variation in local area housing prices, while controlling for variation in local labour demand conditions. The most quantitatively important responses were in labour force participation and weekly hours of work by women (both single and married), with clear life-cycle patterns. The effect for the older cohort of women is associated with early retirement for those experiencing above-average housing wealth gains. For younger women there was a reduction in hours of work in response to unexpected gains in housing wealth. The estimated wealth effects are consistent with leisure being a normal good.

**JEL classifications:** D12, E21, J22.

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# 1 INTRODUCTION

Australia has experienced a prolonged increase in house prices and household debt during the last quarter century. However, since the GFC the rate of growth in housing prices has slowed. Indeed, both household and housing wealth declined as a share of annual household disposable income between 2007 and 2011. Household and housing debt, on the other hand, have continued to rise in relation to household disposable income, albeit at a considerably slower pace than in the pre-crisis period. In the mid-1990s, household debt was approximately 50 per cent of household disposable income. It rose to over 150 per cent of income by 2007 and has since remained at this level.

Globally, concerns have been expressed about rising household indebtedness and the potential threat this poses for macroeconomic stability. Households are seen as being more vulnerable to asset price shocks and as being more likely to reduce consumption when house prices fall but debt remains unchanged (Jansson, 2013). Concerns about economic and financial stability raise questions about the ongoing impact of housing wealth on household indebtedness and other economic behaviour of individuals, particularly labour supply. In light of these concerns, a number of recent studies have examined the relationship between housing prices, household debt and family labour supply.

The objective of this study is to examine the empirical relationship between housing prices, mortgage debt and labour supply in Australia. It is well established that there is a positive correlation among these in Australia, and has been widely reported for other economies in the international literature. However, the direction of causality, and the strength of any causal relationship, remains uncertain. This study examines 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.

To help fix ideas, consider a simple two-period life-cycle model such as that presented in Milosch (2014). The agent lives for 2 periods and gains utility from consumption and leisure. The agent maximises lifetime utility subject to a lifetime wealth constraint:

$$\begin{aligned} & \text{Max}_{\{c_1, l_1, c_2, l_2\}} U(c_1, l_1) + \frac{1}{1+r} U(c_2, l_2) \\ \text{s.t.} \quad & (1-l_1)w_1 + \frac{(1-l_2)w_2}{1+r} + A_1 + \frac{\mathbf{E}(A_2)}{1+r} = c_1 + \frac{c_2}{1+r} \end{aligned}$$

where  $c_1$  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  $(1 - l_t)$ , total time minus leisure in each period) and the expected present value of net assets. 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 will lead to  $A_2 \neq E(A_2)$ . As a result, after realising  $A_2$ , the agent may either adjust optimal consumption or labour supply in period 2. As Milosch (2014) notes, agents' responses to a given shock to housing prices may vary.

Consider the effects of a positive housing price - or wealth - shock. In response to such a shock, the straightforward predictions of the model are:

1. An owner-occupier household that is neither planning to move nor 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 a young couple 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 the now more expensive larger house.
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. 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 also lead to an increase in consumption or a decrease in labour supply.

We can also consider an explicit per-period borrowing constraint as in Fortin (1995). This constraint reflects the borrowing restriction imposed by lending institutions in terms of a maximum gross debt service ratio. That is, the constraint may be of the form  $k[w_t(1 -$

$l_t)] - M_t \geq 0$ , where the mortgage payment in period  $t$ ,  $M_t$ , must not be greater than some predetermined share  $k$  of labour income.

The model 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. The discussion also raises the issue of potential endogeneity - does an agent increase their labour supply to save for a future housing purchase, or is the change in labour supply a response to a past change in housing wealth? The discussion points us towards a potential solution to this endogeneity issue. By identifying and isolating unexpected changes, which are true shocks to housing wealth, these will be exogenous to labour supply. We will return to this point in detail below.

## 2 Literature Review

Australian evidence on the relationship among housing prices, household debt and labour supply is limited to descriptive studies (cross-sectional) and aggregate analyses (macroeconomic data). The macroeconomic analyses—see, for example, Connolly (1996) and Connolly and Kirk (1996)—use a high level of aggregation, and, as a consequence, are unable to examine the distribution of responses by income or across demographic groups. On the other hand, cross-sectional analyses—see, for example, Kidd and Ferko (2001)—are also problematic because of “unobserved heterogeneity”. That is, an unobserved characteristic (such as taste or the discount rate of an individual) 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 alternative is to utilise panel (longitudinal) data. Because 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 the panel data contain time series as well as cross-sectional variation, one can study life-cycle transitions in labour, housing and debt decisions.

There are two existing studies that use Australian panel data to investigate the relationship between housing debt and labour supply. Drago, Wooden and Black (2009) find that the total household debt-to-income ratio has a positive effect on the propensity to work long

hours. Belkar et al. (2007) examine the importance of household indebtedness to LFP for both married males and females, finding a small but positive effect of debt on LFP. Both studies have several shortcomings. In addition to being somewhat dated, the analyses cover only the short period from 2001 to 2005. As a result, the time series variation is limited, yet this variation is crucial in addressing econometrics issues and identifying the 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).

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

More recent work by Disney and Gathergood (2014) and Milosch (2014) is motivated by the declines in housing prices experienced in 2008/9 in the UK and the US, respectively. The authors study the impact of housing wealth shocks on labour supply for both men and women, married and single, using panel data along with local house price variation. In both studies, married young to middle-aged women and men close to retirement respond to housing wealth shocks. Milosch (2014) separately considers the effect of positive and negative shocks to housing wealth and finds 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.

## **3 DATA AND EMPIRICAL METHODS**

### **3.1 Data and Descriptive Statistics**

#### *HILDA Survey Panel Data*

The analysis in this paper uses the Household Income and Labour Dynamics in Australia (HILDA) Survey data. The HILDA Survey is funded by the Department of Social Services (DSS). HILDA is a general population survey that follows individuals and households over time. This panel feature of HILDA is unique among the general population surveys in

Australia. The analysis will use waves one to twelve of the HILDA Survey, collected between 2001 and 2012. The first wave of the HILDA dataset collected in 2001 contains information on approximately 7,500 households and over 13,000 responding individuals. Subsequent waves contain similar numbers of observations. Each annual wave of HILDA includes a rich set of topics that are repeated every year, along with a set of special topics, or “modules”, that are one-off or repeated over longer intervals. Each year includes detailed questions on household income, economic wellbeing, measures of labour market activity and a broad array of socio-demographic characteristics. Housing related information such as tenure, the value of residential properties and mortgage debt held, is also collected in every wave.

In addition, at longer intervals, the survey collects data on a set of special topics, or “modules”. The wealth modules are the most pertinent for this paper. These wealth modules ask respondents detailed questions about their holdings of assets and liabilities; the wealth module was included in the survey in 2002 (Wave 2), 2006 (Wave 6) and 2010 (Wave 10). The repeated nature of the wealth modules will enable us to look at the dynamics of household debt and the borrowing behaviour of Australian households. Analysing two wealth modules before the 2008 GFC and one after it will also enable us to investigate the resulting changes in the housing and total wealth of households.

#### *RP House Price Data*

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

#### *ABS Local Labour Demand Data*

We will also use data on local labour demand sourced from the National Regional Profiles of the ABS (Catalogue Number 1379.0.55.001). This data will comprise unemployment rates and average wage and salary earnings at the annual frequency by local government area. These series are merged into the HILDA Survey data using the local government area (or council area) identifiers.

Our estimation sample is composed of individuals between 20 and 75 years of age. Sample

summary statistics are shown in Table 1. Across all 12 waves, we have 138,500 observations in an unbalanced panel of 15,978 individuals.

Across the sample, respondents have an average age of 48 years. Just over 50 per cent are female, and 57 per cent have more than a high school education. Some 76 per cent are married or cohabiting, with an average of 0.19 children 4 years of age or younger and 0.77 children over the age of 5 years in the household. The average annual household income is \$104,000 (in 2001 Australian dollars), 76 per cent of respondents are in the labour force and respondents work an average of 25 hours per week, or 38 hours per week when excluding those who do not work.

Turning to their housing tenure status, across all ages, some 75 per cent of the respondents are owner-occupiers with an average outstanding mortgage of almost \$123,000. Their self-reported home value is close to \$466,000 on average, somewhat higher than the average of the local area median house price of approximately \$314,000.

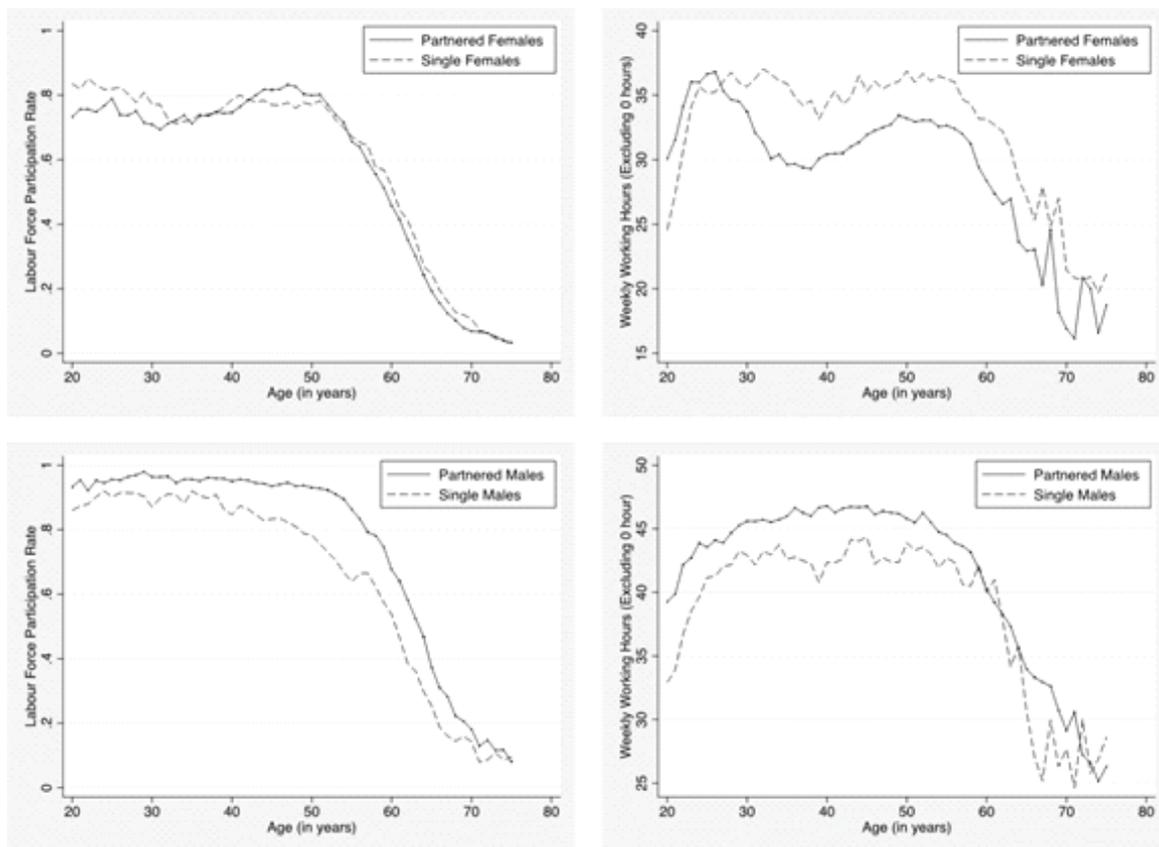
As Table 1 indicates, our estimation sample is a sub-sample of the available HILDA survey data. Columns 3 and 4 provide the summary statistics for the broader full sample available in the HILDA survey. We have selected our estimation sample to exclude observations for respondents in years in which there were fewer than 30 home sales in their postcode recorded in the RP house price data. We do so to ensure that the median house prices recorded in the RP house price database 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 full samples. None of the P-values are close to indicating a statistically significant difference in means between the complete or full sample and the estimation samples. Therefore, the estimation sample retains the representativeness of the HILDA survey.

[Table 1 here]

Figure 1 explores the labour supply of men and women over the life-cycle by marital status. The sub-figures in the left 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-cycle, although this feature is stronger in hours worked than in participation, especially among partnered women. Partnered women tend to work approximately 3-4 fewer hours per week than single women during their prime childbearing years, while the gap in hours remains but narrows to approximately 1.5 hours later in the life-cycle. Turning to the labour supply of men, we observe that partnered men both participate in greater numbers and work longer hours than single men. Male participation rates start to decline for partnered men when they are in their mid-50s and earlier still for single males, while average hours for those working positive hours average approximately 44 hours until they reach approximately 60 years of age.



**Figure 1.**

*Labour Supply (Participation and Weekly Hours) over the Life-Cycle:  
Women and Men, Partnered and Single*

The sequence of Tables 2-4 describe in more detail how housing wealth and debt vary by population groups defined over gender, partnership status and stage of the life-cycle. Table 2 presents summary statistics for the sample grouped by gender. It is apparent that the

male subsample, on average, has higher levels of educational attainment and labour supply (in terms of both participation and weekly hours of work). The final column of table 2 indicates that the differences in means across the male and female subsamples are mostly highly statistically significant.

Table 3 presents summary statistics for the estimation sample by partnership status. Not surprisingly, there are substantial average differences among the subsamples of single and partnered adults, household annual income, tenure status mean housing wealth and mortgage debt. Again, the differences in mean values by partnership status are highly statistically significant.

An illuminating sample breakdown is by age, as presented in Table 4. Age is grouped into three segments corresponding to different stages of the life-cycle. The summary statistics are consistent with the 20-39-year group forming families, with the family growing and purchasing or upgrading their housing. In the 40-54-year group, the majority of households are more likely to be upgrading their housing and paying down mortgage debt, while for the age 55+ year group, decisions around retirement are likely to be a major influence on labour supply, tenure and mortgage debt. The average values by age segment in Table 4 confirm these life-cycle trajectories. For instance, the share of households that are owner-occupiers increases from 60 per cent to 84 per cent for the older group, and the corresponding average mortgage debt declines.

[Tables 2-4 here]

The above differences in labour supply, housing wealth and mortgage balances over the life-cycle, as well as by gender and marital status, prompt our decision to conduct our empirical analysis of labour supply responses to housing wealth and debt separately for these sub-groups.

## **3.2 Empirical Methodology**

In line with the simple theoretical model presented above, we take two approaches to examine the relationship among housing prices, housing debt and labour supply. First, we assess the impact of changes in housing wealth, captured by unexpected variation in local housing prices, on labour supply. Second, we assess whether there is evidence to suggest that some

households' labour supply is constrained by their mortgage debt.

Given the descriptive statistics above, we consider the effect of housing price shocks and mortgage debt 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.

The main focus of the analysis in this section is the impact of changes in housing wealth on labour supply. For this, we will follow the approach of 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 are measured using variation in local area housing prices. We briefly describe each of these approaches in more detail.

Next, we examine the relationship between labour supply and debt 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 marital status.

The final part of our analysis in this section refines the reduced form estimates to assess the causal effect of housing debt on labour supply for these same sub-groups. We do so to address the potential endogeneity of housing debt to labour supply decisions. Our approach will be to instrument for debt using local area variation in housing prices.

### **3.2.1 Estimating the causal effect of changes in housing wealth on labour supply**

The main methodological approach will follow that of Disney and Gathergood (2014) and Milosch (2014). The empirical specification can be represented by:

$$\begin{aligned} ls_{ict} &= \beta X_{ict} + \gamma HP_{ict} + \delta \hat{W}_{ict} + ld_{ict} + \alpha_i + \eta_c + \varphi_t + u_{ict} \\ \hat{W}_{ict} &= \theta Z_{ict} + e_{ict} \end{aligned} \tag{1}$$

This approach uses a fixed effects panel model to examine the effect of housing prices on labour supply  $ls_{ict}$  for person  $i$  in year  $t$  residing in local area  $c$ . Labour supply will be examined at both the extensive margin (labour force participation) and the intensive margin (hours of work). We control for individual time-varying characteristics  $X_{ict}$  such as number of children, health status, marital status, spousal employment status and non-labour income.

An instrumental variable approach will be used to control for the individual’s wage because self-reported hourly wages may be endogenous to labour supply. The instruments,  $Z_{it}$ , will include age its square and indicator variables for the highest level of education achieved. This approach and the choice of instrumental variables for potentially endogenous wages is standard in the literature, as elaborated in Disney and Gathergood (2014). We also control for local labour demand at the local council area level (LGA) using the unemployment rate and average earnings. Time  $\varphi_t$ , local area  $\eta_c$  and individual-specific  $a_i$  fixed effects are included to control for aggregate time trends and time-constant unobserved heterogeneity.

In this specification, housing prices are measured using the log of the local area median house price,  $HP_{ict}$  at an annual frequency. After controlling for local area fixed effects and year fixed effects, our identifying variation is the local variation in housing prices relative to national trends. We are controlling for permanent local council area amenities through the local council area fixed effects. Furthermore, we are assuming that an individual’s labour supply will only respond to a change in housing prices, that is, housing wealth, if the change is different from the national trend. For example, a 5 per cent increase in your house price is assumed to not affect your labour supply if the prices of all other houses in the nation also increase by 5 per cent.

In the model specifications, we examine whether responses differ by housing tenure status, that is, by owner-occupier or renter status. To do so, we will expand the estimation sample to incorporate renters. Using the interaction of a housing tenure status indicator variable and the measures of housing price, we analyse differences in the estimated effect of housing price shocks to the labour supply of owner-occupiers and renters.

### 3.2.2 Housing debt and labour supply

The empirical analysis will then be extended by examining the correlations between housing debt and labour supply. The analysis is based on the following empirical specification:

$$\begin{aligned} ls_{it} &= \beta X_{ict} + \gamma D_{it} + \delta \hat{W}_{it} + ld_{it} + \alpha_i + \varphi_t + u_{ict} \\ \hat{W}_{it} &= \theta Z_{it} + e_{ict} \end{aligned} \tag{2}$$

This model is analogous to specification (1), with the house price measure (proxying wealth shocks) replaced by a measure of housing debt. This specification is a fixed effects

panel regression model with which we assess the correlations between changes in labour supply  $ls_{it}$  for person  $i$  in year  $t$  and housing debt  $D_{it}$ . Housing debt is measured using the natural log of the outstanding loan value. Controls  $X_{it}$  will include time-varying individual-level demographic and socio-economic characteristics, as used in the analysis of housing wealth and labour supply. Individual  $\alpha_i$  and time  $\varphi_t$  fixed effects are included to control for individual-specific time-constant unobserved heterogeneity and time trends.

## 4 RESULTS

### 4.1 Labour Supply and Housing Wealth

#### 4.1.1 Labour Force Participation

The panel fixed effects regression models were estimated to examine the effect of house prices on labour force participation. The models were estimated separately for men and women by age group, corresponding to major segments of the life-cycle (ages 20-39 years, 40-54 years and 55-75 years). Each model specification included controls for the socio-economic characteristics weekly wage, tenure status, local area unemployment rate, number of dependent children who are infants (aged 0-4 years) or older (aged 5+ years), health status, spousal labour force status, and log of household non-labour income, as well as year and location (state and capital city) fixed effects. Because the weekly wage is potentially endogenous, a quadratic in age and indicator variables for educational attainment are used as instrumental variables for the wage.

Table 5 presents the results for partnered men and women. Column (1) presents the estimates for key variables for the subsample of married men aged 20-39 years. The coefficient on the log-house price (taken from the RP database for the LGA) interacted with the homeowner indicator variable is -0.0415, indicating that within this subsample, higher prices are associated with a lower probability of labour force participation, other things equal, among homeowners. The direction of this effect is consistent with the negative wealth effect of higher house prices, as predicted by the canonical life-cycle model. The magnitude implies that 10% higher house prices, other things equal, reduces LFP by approximately 0.42. At the mean level of LFP for this age group (0.50), this implies an elasticity of labour force participation with respect to house prices of almost 0.1. While statistically significant, this

elasticity is a practically small response, which is unsurprising given that the wealth effect is not expected to have a large impact on labour force withdrawal at the earlier stages of the life-cycle.

The estimates presented in column (1) of Table 5 show that changes in house prices have no effect on the labour force participation of partnered young men who are renters. This is consistent with the basic economic model, as there is no impact on household wealth from housing price changes for renters. The small magnitude and statistical insignificance of the coefficient on the house price–renter interaction term provides support for the house price variable measure as a component of household wealth and not something reflecting general local area or labour market demand factors.

Comparing across the panel regression model estimates in Table 5 reveals no response at the extensive margin of labour supply for middle-age and elderly male homeowners to changes in house prices. For female homeowners, there is a significant decline in labour force participation due to house price growth among the elderly age group. This response is consistent with a move towards earlier retirement among homeowners following abnormally strong increases in local house prices. The implied elasticity is  $-0.81$  ( $=-0.029/0.36$ ), which is economically significant.

Interestingly, the results in column (5), for partnered women aged 40-54 years, indicate a significant increase in participation among renters in response to house price growth. As explained above, this positive response in participation is not a pure wealth effect by virtue of being renters. However, it may reflect a response of renters seeking to move into the local housing market as owners, and hence, it may reflect a response by families to accumulate savings in order to satisfy deposit and servicing requirements by mortgage institutions. This is consistent with the analysis and findings of Fortin (1995), where partnered women in this age segment increased their labour force participation in order to meet lending requirements and to “help pay-off the mortgage” in strong housing markets.

[Table 5 here]

The responses in labour force participation to house price variation were then examined for the sample of single men and women. The panel regression results for the key variables of interest are presented in Table 6. Reading across the columns, there is no change in labour

force participation by homeowners (or renters) in response to the above trend in house price growth among most groups. The important exception is the group of single women aged 55-75, for whom a 10% increase in house prices is associated with a 0.54 percentage point decline in labour force participation, other things equal. The implied elasticity of participation with respect to house prices is -1.6, approximately double the magnitude of that found for partnered women in the same age cohort. This response is consistent with housing forming a larger share of the asset portfolio of single women homeowners compared to partnered women homeowners. Thus, the wealth effect of the house price growth is stronger, and the resulting labour supply response is consequently greater. Overall, the panel regression estimates indicate that there is an economically important response in labour force participation among female homeowners in the older age cohort due to the wealth effect of the above trend increases in house prices.

[Table 6 here]

#### 4.1.2 Hours of Work

The panel regression models were then estimated using hours of work, conditional on participating in the labour force, as the dependent variable. This part of the empirical analysis is focused on the intensive margin of labour supply. Table 7 presents the model estimates for partnered males and females by age group.

[Table 7 here]

The model estimates show a statistically significant reduction in hours of work by homeowners in response to house price growth only among the younger cohort, aged 20-39. In this younger age cohort, partnered men, on average, reduce their hours of work by 0.39%, and partnered women by 0.26%, due to a 1% increase in house prices. These are economically significant effects and are consistent with either partner in the family devoting additional time to non-market activities (such as in caring roles). This age cohort has the highest incidence of dependent children and infants present in the household, and this represents a formative stage of the life-cycle for these families. Among partnered homeowners in this age cohort, unexpectedly high house price growth and the resulting gain in household wealth effectively funds time away from work to undertake significant non-market activities.

The pattern of reduced hours of work in response to house price growth is not observed among homeowners in later stages of the life-cycle. The prima-facie evidence is that the unexpected wealth gains provide a form of finance for further home caring activities. A fruitful line of inquiry is to use the HILDA survey data to further explore this possibility.

The models were also estimated for the sample of single men and women, with the panel regression estimates presented in Table 8. As is evident from the table, the only statistically and economically significant responses are among single female homeowners in the 40-54 and 55-75 age cohorts. Both groups exhibit quantitatively large responses, with implied work elasticities of 0.42 and 1.1, respectively. The comparatively large response among the older group of female homeowners is consistent with a large, positive wealth shock used to fund earlier transitions from the labour market into retirement. Interestingly, because this is for the sample of single adults, these labour supply responses are not attributable to a ‘secondary earner’ role within the family, as studied by Fortin (1995) for Canada. Rather, given the sample, these significant responses are for sole and, hence, primary earners. Housing represents a key part of the wealth portfolio held by many Australian families, more so for single women homeowners. Consequently, unexpected increases in house prices for this group represents a significant wealth shock that is found to have important impacts on their labour market participation and hours of work conditional on participation.

Importantly, from a methodological viewpoint, the estimates for the hours of work models indicate no systematic response among renters to house price gains. This provides evidence that the house price variable does not reflect potentially confounding influences from the local labour market or the regional economic environment. The estimates for renters provide corroborating evidence that the estimated responses among homeowners is reflective of pure wealth effects transmitted from the housing market.

[Table 8 here]

## 4.2 Labour Supply and Mortgage Debt

The empirical analysis of labour supply effects was extended to consider alternative measures of housing wealth and debt obligations. As discussed above, the panel regression models were re-estimated with local house price variable replaced with the alternative measure of

debt holdings and obligations.

Table 9 presents the estimates for model specification (2). For this subsection, the panel regression models are estimated using the sample of homeowners only (renters are excluded from the sample). The first row presents the results using the log of outstanding mortgage debt as an independent variable instead of house prices. The second row of estimates uses the debt servicing ratio, defined as yearly repayments on mortgages as a fraction of household income, as the key explanatory variable. For brevity, only the coefficient on the explanatory variable of interest is reported (each coefficient estimate is from a separate panel regression); the full set of results is available from the authors upon request.

[Table 9 here]

The estimates presented in Table 9 reveal a further dimension of how housing market developments impact labour market activity. The estimated coefficients for the mortgage debt variable show that middle-aged and older men, and younger and older women, work more intensively the greater their outstanding debt. Likewise, older women homeowners who have a greater part of their unearned income devoted to mortgage debt servicing also have work more hours on average (as well as having higher participation). This interaction between mortgage debt and labour market activity may reflect a causal response to these housing finance factors (due house price variation and, hence, debt obligations over time and geographic region). Alternatively, this pattern may, in part, reflect ‘preference heterogeneity’, whereby men and women with a stronger commitment to the labour market plan for longer work careers and, hence, take on greater mortgage obligations. An interesting area for future research is to separate these competing explanations for this important pattern of economic behaviour.

## 5 CONCLUSION

The analysis of the impact of house price movements on labour market activities identified important differences according to partnership / family status, gender and stage of the life cycle. In light of this, panel regression models analysing labour force participation and hours of work were estimated separately for each of these demographic groups. Careful attention was devoted to using appropriate measures of house prices (relying on RP House

Price sales data by LGA) and ‘exogenous’ measures of an individual’s market wages (using instrumental variable measures based on the human capital model). The models of labour supply behaviour identified economically significant responses to above-average changes in house prices among homeowners. The most quantitatively important responses were in labour participation and hours of work by women (both partnered and single). The effect was apparent with the older cohort of women and is associated with early retirement for those experiencing above-average housing wealth gains. Another important response was observed among younger partnered men and women who exhibited a reduction in hours of work in response to the gain in housing wealth. The evidence suggests that for this demographic group, at a formative stage of the family lifecycle, the housing wealth gains effectively subsidized non-market caring activities. The analysis also considered the role of mortgage debt obligations, and there is consistent evidence that greater mortgage debt obligations are associated with higher hours of market work. Overall, the analysis in this section provided consistent evidence that house price movements have clear and consistent impacts on individual and family wealth and, consequently, on their labour market activities. The magnitude of that effect clearly varies by gender and life-cycle stage.

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**Table 1: Sample Summary Statistics HILDA: 2001-2012**

	Estimation Sample Waves 1-12		Full Sample Waves 1-12		Test of differences in means
	Mean	Std. Dev.	Mean	Std. Dev.	p-value
Age (in years)	48.28	13.16	48.28	13.17	1.00
Gender (female=1)	0.53	0.50	0.53	0.50	0.91
Education, University	0.26	0.44	0.26	0.44	0.65
Education, Diploma	0.31	0.46	0.31	0.46	0.98
Education, Yr 12	0.12	0.32	0.11	0.32	0.96
Education, Less than Yr 12	0.32	0.46	0.32	0.47	0.62
Annual household income (\$)	104,178	90,988	103,927	91,206	0.55
Partnered	0.76	0.43	0.76	0.43	0.64
Divorced	0.08	0.26	0.08	0.26	0.91
In the labour force	0.68	0.47	0.68	0.47	0.75
Weekly work hours	24.97	21.64	24.93	21.65	0.71
Spouse in the labour force	0.70	0.46	0.70	0.46	0.80
No. of children 0-4yrs of age	0.19	0.51	0.19	0.51	0.94
No. of children 5yrs and older	0.77	1.10	0.77	1.10	0.76
Home owners	0.75	0.43	0.75	0.43	0.45
Renters	0.25	0.43	0.25	0.43	0.45
Self-reported home value (\$)	465,712	358,285	464,750	359,015	0.61
Local Area Median House Price (\$)	313,649	171,743	312,859	171,703	0.23
Outstanding Mortgage (\$)	122898	192868	122499	192693	0.70
Number of observations. ( $i \times T$ )	138,500		139,638		
Number of individuals ( $i$ )	15,978		16,044		

Notes: The estimation sample comprises males and females from Waves 1-12 of HILDA between the ages of 20-75 years. The estimation sample is a subset of the full HILDA Survey sample in which we exclude observations for respondents in years in which there were fewer than 30 home sales in their postcode 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, 10, where we use the Melbourne Institute's imputed home loan values.

**Table 2: Summary Statistics by Gender: 2001-2012**

	<b>Males Waves 1-12</b>		<b>Females Waves 1-12</b>		<b>Test of differences in means</b>
	Mean	Std. Dev.	Mean	Std. Dev.	p-value
Age (in years)	48.81	13.16	47.83	13.17	<0.00
Education, University	0.25	0.43	0.26	0.44	<0.00
Education, Diploma	0.40	0.49	0.23	0.42	<0.00
Education, Yr 12	0.10	0.30	0.13	0.34	<0.00
Education, Less than Yr 12	0.25	0.43	0.37	0.48	<0.00
Annual household income (\$)	107,455	93,563	100,841	88,980	<0.00
Partnered	0.79	0.41	0.74	0.44	<0.00
Divorced	0.06	0.24	0.09	0.29	<0.00
In the labour force	0.75	0.43	0.61	0.49	<0.00
Weekly work hours	31.71	22.50	19.00	18.99	<0.00
Spouse in the labour force	0.63	0.48	0.77	0.42	<0.00
No. of children 0-4yrs of age	0.19	0.51	0.19	0.51	0.15
No. of children 5yrs and older	0.70	1.07	0.82	1.11	<0.00
Home owners	0.75	0.43	0.74	0.43	0.06
Renters	0.25	0.43	0.24	0.43	0.06
Self-reported home value (\$)	466,086	370,284	463,573	348,789	0.35
LGA Median House Price (\$)	311,636	177,495	315,450	167,191	<0.00
Outstanding Mortgage (\$)	122,898	192,868	122,499	192,693	<0.00
Number of individuals ( <i>i</i> )	7,492		8,486		

**Table 1: Summary Statistics by Partnership Status: 2001-2012**

	Single Waves 1-12		Partnered Waves 1-12		Test of differences in means
	Mean	Std. Dev.	Mean	Std. Dev.	p-value
Age (in years)	49.40	14.11	47.93	12.84	<0.00
Gender (female=1)	0.58	0.49	0.52	0.50	<0.00
Education, University	0.22	0.41	0.27	0.44	<0.00
Education, Diploma	0.30	0.46	0.31	0.46	<0.00
Education, Yr 12	0.12	0.32	0.11	0.32	<0.00
Education, Less than Yr 12	0.37	0.48	0.30	0.46	<0.00
Annual household income (\$)	57,578	53,638	118,322	95,627	<0.00
In the labour force	0.62	0.48	0.69	0.46	<0.00
Weekly work hours	22.32	21.64	25.75	21.63	<0.00
Spouse in the labour force			0.70	0.46	<0.00
No. of children 0-4yrs of age	0.04	0.23	0.24	0.56	<0.00
No. of children 5yrs and older	0.38	0.81	0.89	1.14	<0.00
Home owners	0.55	0.50	0.81	0.39	<0.00
Renters	0.45	0.50	0.19	0.39	<0.00
Self-reported home value (\$)	366,776	271,099	485,544	371,727	<0.00
LGA Median House Price (\$)	250,068	127,417	327,157	174,712	<0.00
Outstanding Mortgage (\$)	70,233	147,514	133,606	199,232	<0.00
Number of individuals ( <i>i</i> )	2,794		13,184		

**Table 2: Summary Statistics by Age Group: 2001- 2012**

	Age 20-39 Years Waves 1-12		Age 40-54 Years Waves 1-12		Age 55-75 Years Waves 1-12	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (in years)	32.68	4.71	46.78	4.26	63.68	5.90
Gender (female=1)	0.56	0.50	0.53	0.50	0.52	0.50
Education, University	0.31	0.46	0.28	0.45	0.18	0.39
Education, Diploma	0.31	0.46	0.33	0.47	0.29	0.46
Education, Yr 12	0.17	0.37	0.11	0.31	0.08	0.27
Education, Less than Yr 12	0.22	0.41	0.29	0.45	0.44	0.50
Annual household income (\$)	106,449	70,360	123,243	92,063	79,127	100,110
Partnered	0.78	0.41	0.78	0.42	0.73	0.45
Divorced	0.03	0.16	0.09	0.28	0.11	0.31
In the labour force	0.82	0.39	0.84	0.37	0.36	0.48
Weekly work hours	30.16	20.36	31.69	19.71	12.45	19.43
Spouse in the labour force	0.84	0.36	0.84	0.36	0.39	0.49
No. of children 0-4yrs of age	0.53	0.75	0.09	0.35	0.00	0.07
No. of children 5yrs and older	0.72	1.06	1.25	1.22	0.24	0.63
Home owners	0.60	0.49	0.79	0.41	0.84	0.37
Renters	0.40	0.49	0.21	0.41	0.16	0.37
Self-reported home value (\$)	400,654	275,487	492,336	370,572	474,217	386,144
LGAMedian House Price (\$)	312,766	129,479	315,249	177,875	313,094	185,349
Outstanding Mortgage (\$)	210,348	197,827	149,105	207,901	39,345	129,647
Number of individuals ( <i>i</i> )	3,873		6,496		5,609	

**Table 5: Panel Regression Results for Labour Force Participation, Partnered Men and Women**

	Age 20-39 (1)	Males Age 40-54 (2)	Age 55+ (3)	Age 20-39 (4)	Females Age 40-54 (5)	Age 55+ (6)
Ln(house price)*Owner	-0.0415* (0.022)	0.003 (0.012)	-0.0123 (0.018)	-0.003 (0.020)	-0.014 (0.019)	-0.029* (0.016)
Ln(house price)* Renter	-0.005 (0.017)	-0.008 (0.016)	-0.001 (0.103)	0.018 (0.019)	0.058** (0.023)	0.001 (0.033)
Unemployment rate	0.001 (0.098)	0.005* (0.003)	0.008* (0.004)	0.001 (0.021)	0.003 (0.004)	-0.003 (0.005)
Socio-economic Controls	Y	Y	Y	Y	Y	Y
Year Controls	Y	Y	Y	Y	Y	Y
State Controls	Y	Y	Y	Y	Y	Y
Observations	9159	13862	12119	12232	14856	10813
Individuals	2116	2816	2254	2777	3034	2060

**Table 6: Panel Regression Results for Labour Force Participation, Single Men and Women**

	Males			Females		
	Age 20-39 (1)	Age 40-54 (2)	Age 55+ (3)	Age 20-39 (4)	Age 40-54 (5)	Age 55+ (6)
Ln(house price)*Owner	0.029 (0.030)	0.015 (0.033)	-0.011 (0.043)	-0.019 (0.040)	-0.017 (0.040)	-0.054** (0.021)
Ln(house price)* Renter	-0.008 (0.027)	0.030 (0.029)	-0.032 (0.031)	0.022 (0.031)	-0.009 (0.038)	0.028 (0.024)
Unemployment rate	-0.003 (0.008)	-0.001 (0.008)	0.014* (0.008)	0.001 (0.011)	-0.013 (0.009)	0.022*** (0.005)
Socio-economic Controls	Y	Y	Y	Y	Y	Y
Year Controls	Y	Y	Y	Y	Y	Y
State Controls	Y	Y	Y	Y	Y	Y
Observations	2985	3545	3067	3099	4670	5501
Individuals	830	800	582	832	915	982

**Table 3: Panel Regression Results for Hours of Work, Partnered Men and Women.**

	Males			Females		
	Age 20-39	Age 40-54	Age 55+	Age 20-39	Age 40-54	Age 55+
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(house price)*Owner	-0.118** (0.046)	0.017 (0.015)	0.038 (0.044)	-0.055* (0.031)	-0.012 (0.032)	0.085 (0.063)
Ln(house price)* Renter	0.003 (0.033)	0.001 (0.025)	0.030 (0.068)	0.031 (0.030)	0.020 (0.041)	0.073 (0.090)
Unemployment rate	0.003 (0.010)	0.001 (0.005)	-0.009 (0.011)	0.008 (0.009)	-0.012* (0.007)	0.001 (0.099)
Socio-economic Controls	Y	Y	Y	Y	Y	Y
Year Controls	Y	Y	Y	Y	Y	Y
State Controls	Y	Y	Y	Y	Y	Y
Observations	8482	12559	5124	8251	11307	3280
Individuals	1998	2606	1300	2171	2484	885

**Table 8: Panel Regression Results for Hours of Work, Single Men and Women.**

	Males			Females		
	Age 20-39	Age 40-54	Age 55+	Age 20-39	Age 40-54	Age 55+
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(house price)*Owner	-0.059 (0.074)	0.053 (0.066)	-0.092 (0.157)	-0.0455 (0.071)	-0.134** (0.059)	-0.142** (0.068)
Ln(house price)* Renter	-0.090 (0.063)	0.011 (0.051)	-0.042 (0.108)	0.067 (0.055)	-0.0457 (0.089)	0.003 (0.089)
Unemployment rate	0.004 (0.021)	0.002 (0.014)	0.0220 (0.029)	0.013 (0.019)	-0.009 (0.015)	0.017 (0.016)
Socio-economic Controls	Y	Y	Y	Y	Y	Y
Year Controls	Y	Y	Y	Y	Y	Y
State Controls	Y	Y	Y	Y	Y	Y
Observations	2557	2646	855	2129	3418	1778
Individuals	755	658	237	674	743	404

**Table 9: Panel Regression Results for Hours of Work with Debt Measures – Only Homeowners**

<i>Model with Independent Variable</i>	Males			Females		
	<b>Age 20-39</b> (1)	<b>Age 40-54</b> (2)	<b>Age 55+</b> (3)	<b>Age 20-39</b> (4)	<b>Age 40-54</b> (5)	<b>Age 55+</b> (6)
<b>Mortgage Debt</b>	0.002 (0.002)	0.001* (0.001)	0.004** (0.002)	0.004* (0.002)	0.0004 (0.001)	0.006*** (0.002)
<b>Debt Servicing Ratio</b>	0.062 (0.039)	0.001 (0.002)	0.002 (0.009)	0.019 (0.038)	-0.002 (0.005)	0.104** (0.049)
Socio-economic Controls	Y	Y	Y	Y	Y	Y
Year Controls	Y	Y	Y	Y	Y	Y
State Controls	Y	Y	Y	Y	Y	Y