

## **National Housing Conference, October 2005**

### **“MEASURING THE IMPACT OF INTEREST RATE ON HOUSING DEMAND”**

Author / Presenter: Min Hua Zhao, Stephen Whelan  
Email: mzha0816@mail.usyd.edu.au

#### **Abstract:**

The housing sector is one of the most interest rate sensitive sectors of the economy. However, despite an extensive literature on the relationship between interest rate and housing demand, there is little empirical evidence for Australia. A key consideration is differences in the impact of interest rate changes on alternative segments of the housing market. In this paper, these segments are defined along two dimensions: between owner-occupier and rental investment housing demand, and; between households with different incomes. Comparison between these segments allows an examination of the impact of interest rate on housing demand for households with diverse socio-demographic and economic characteristics.

The paper utilizes the second wave of the HILDA survey in an attempt to address two research questions: what are the mechanism through which interest rate changes affect household level housing demand, and; the extent to which the magnitude of these influences differs between the defined segments. The first question is addressed through the modelling of interest rate sensitive factors in household's housing demand decision. The second question is addressed through the simulation of interest rate changes on these interest rate sensitive factors, and observing their impact on household level housing demand. This simulation exercise provides a proxy for the likely impact of interest rate changes on housing demand both at the household level, and between the defined housing market segments.

The empirical modelling framework builds upon existing studies, and attempts to extent the analysis through a systematic examination of the interest rate sensitive factors in housing demand. This includes borrowing constraints; the relative price of housing; and household debt repayment capacity. Other household information provided by the HILDA dataset, such as investment attitudes and the subjective evaluation of employment prospects, are also incorporated into the model.

Min Hua Zhao is a PhD candidate, and Stephen Whelan, lecturer, at the Department of Economics, University of Sydney. The authors have benefited greatly from the very helpful comments and suggestions provided by Prof Judith Yates, both on the direction of the research and on an earlier draft. However, any remaining errors rest with the authors. Min Hua Zhao would also like to acknowledge the financial assistance provided through the Australian Housing and Urban Research Institute top-up scholarship. A detailed appendix on variable specification and additional results are available on request.

## **1. Introduction**

The housing sector is one of the most interest rate sensitive sectors of the economy. Due to the expense; size; and illiquid nature of housing market transactions, there is as heavy reliance by households on debt instruments to finance their purchases. As a result, the rate of interest becomes a critical factor in household's housing demand decision as it affects both their ability to access adequate housing finance and meet on-going repayments (Lessard and Modigliani, 1975, Kearl et al., 1975, Kearl and Mishkin, 1977, Feldman, 2002). Thus, while monetary policy in Australia does not specifically target the housing sector, given its interest rate sensitivity and the social and economic benefits that it delivers at both the household and macroeconomy level, it is important to understand the effect that an adjustment in the rate of interest would have on housing demand.

This paper considers the impact of interest rate changes on both owner-occupier and rental investment housing demand, with housing demand defined as the decision to own the housing asset. The first research question looks at the role of interest rate in household level housing demand decisions. This is accomplished through the incorporation of interest rate sensitive factors in the empirical modelling of both types of housing demand, and examining both the direction and significance of their impact. The second research question utilizes the framework established in the first research question, and conducts a micro-simulation model to examine the impact that interest rate changes have on housing demand. Utilizing a household level dataset, potential differences in the impact of interest rate on housing demand can be examined between owner-occupiers and rental investors, as well as between households with different levels of economic resources.

The remainder of the paper is divided into 4 sections. Section 2 provides a brief overview of the existing literature on the relationship between housing demand and interest rates, and describes the dataset used in this study. Section 3 discusses the empirical framework. The results are discussed in Section 4, and Section 5 concludes.

## **2. Interest Rate and Housing Demand**

The rate of interest is not a direct determinant of either owner-occupier or rental investment housing demand. However, both are sensitive to movements in the rate of interest as it is an integral component of the debt instrument used to fund the housing purchase. Both home purchasers and rental investors require adequate housing finance to purchase their desired dwelling. This is influenced by the rate of interest as housing lenders typically required that loan repayments – calculated on the lending rate – be no more than 30 percent of household income (Bourassa, 1995, Feldman, 2002, Duca and Rosenthal, 1994). Thus, changes in the interest rate affects household's borrowing capacity through its influence on the maximum housing loan that lenders would agree to.

Similarly, both home purchasers and rental investors must commit to a long term repayment program over which the housing debt is progressively retired. This is again interest rate sensitive, as changes in the lending rate affects the level of loan repayments

that borrowers are required to meet, and hence affects both the financial viability and attractiveness of the housing purchase (Brueggeman and Peiser, 1979, Chinloy, 1991, Diamond, 1980, Hendershott and Slemrod, 1983). In addition, the interest rate also affects the required yield for rental investors, as increases in interest repayments increases the required return on rental property investments if it is to be comparable to the next best investment alternative (Wood et al., 2002a, Wood and Watson, 1999).

The interest rate sensitivity of both owner-occupier and rental investment housing demand has lead to the development of a substantial body of literature on the relationship between interest rate and housing demand. To the extent that homeownership is often viewed as important way for households to secure both social and economic benefits, much of this analysis has been confined to owner-occupier housing demand.

The theoretical impact of interest rate on owner-occupier housing demand has been extensively studied in existing research (Lessard and Modigliani, 1975, Kearl and Mishkin, 1977, Titman, 1982, Wheaton, 1985). There is substantial consensus that there should be an overall negative relationship, as a rise in the rate of interest reduces households demand for homeownership through both an increase in the repayment burden and more stringent borrowing requirements. However, existing empirical evidence are not very robust. At the aggregate level, existing studies have produced mixed results between aggregate homeownership rate and the interest rate in the economy, with many indicating a non-significant effect (Kearl and Mishkin, 1977, Meen, 1998, Painter and Redfearn, 2002, Green, 1996a).

At the household level, the effect of interest rate on owner-occupier housing demand has been modelled both directly and indirectly by existing research. However, while existing studies have examined the impact of interest rate on housing demand through its various channels of influence, it does not give any systematic analysis of how an interest rate change may impact on different segments of the market (Kearl, 1979, Van Order and Dougherty, 1991, Schwab, 1983, Schwab, 1982, Boehm and McKenzie, 1982). This is despite consistent theoretical recognition that the impact of interest on housing demand would vary across households, as households with different levels of economic resources vary in their ability to accommodate the impact that a change in interest rate impose on their borrowing and repayment capacities (Lessard and Modigliani, 1975, Kearl and Mishkin, 1977, Painter and Redfearn, 2002).

Existing studies on rental investment housing demand do not focus directly on the impact of interest rates. However, this existing literature offer important insights as to the effect that interest rate changes has on rental investment housing demand. The bulk of the existing research hinges the decision to invest on a portfolio allocation model where the return under rental investment is compared to that of the best alternative (Wood et al., 1998, Wood and Watson, 1999, MacNevin, 1997). In these models, the rate of interest is invariably a crucial component of the rental investment decision process.

In the first instance, when comparing prospective returns, investor households must take account of the costs of rental investment. Investment housing loan repayments is an

important component of the cost of holding the rental property, and it is interest rate sensitive. Secondly, the rate of interest also serves as a proxy for the alternative return that the household can earn by lending out their funds. Thus in this respect, the rate of interest becomes the rate of return on the alternative investment. In both cases, interest rate movements are inversely related to the rental investment decision, since an increase in interest rate leads to both an increase in debt repayment costs, as well as an increase in the return on the next best alternative. Both effects have a negative influence on the incentive to invest in rental housing.

Given these existing studies, there remain 2 significant gaps to the understanding of interest rate and its effect on housing demand. First of all, the scope of the existing analysis has been restricted to either owner-occupier or rental investment housing demand, and does not give any consideration to the potential quantitative differences in the impact on owner-occupiers and rental investors. This is particularly relevant in the context of the recent Australian housing market upswing, where there has been a surge in demand for residential rental properties and a strong increase in the share of investment loans in total housing related debt (Reserve Bank of Australia, 2003b, Reserve Bank of Australia, March 2003). Household rental investors are shown to have greater financial capacity than owner-occupiers, and should thus be more able to accommodate any adverse change in their borrowing and repayment abilities as a result of interest rate increases (Reserve Bank of Australia, 2004).

Secondly, there is an absence of comparative analysis on the impact of interest rate on housing demand across different segments of the market. The effect of interest rate on housing demand is inherently a household level phenomenon. As indicated by existing household level studies, the effect of interest rate on the household's housing demand decision operates through its borrowing and repayment capacities. However, more stringent borrowing constraints and higher repayment burdens would only have a significant effect on households for whom these considerations play a dominate role in their housing demand choices. While for households whose borrowing and repayment commitments are well within their budget allowances, the increase in interest rate would not have a significant effect on their housing demand (Green, 1996b, Painter and Redfearn, 2002, Kearn and Mishkin, 1977, Lessard and Modigliani, 1975).

Both gaps highlight the fact that to draw any conclusions at the aggregate level would require proper distinction between sub-sets of households for whom the impact of interest rate on their housing demand differs significantly. The present study aims to address these shortcomings of the existing research by examine the potential differences in the impact of interest rate on housing demand on different segments of the market.

The dataset used in this study is wave 2 of the Household Income and Labour Dynamics in Australia (HILDA) survey, dated 2002. It is a cross sectional, household level dataset, with cross-country geographic representation. While this dataset was not specifically tailored to issues of housing and housing demand, it contains detailed information on both the family home and investment properties that facilitate analysis of both owner-occupier and rental investment housing demand.

The sample is composed of 5017 households. 61.67 percent of the sample is homeowners, with the remaining households in private rental tenure. 14.78 percent of the sample are rental investors, with the bulk of these households (18.31 percent) being existing homeowners. Tables 1 and 2 reports on key socio-demographic and economic characteristics of households in the sample, broken down by tenure and rental property ownership respectively. Homeowners are more likely to be mature aged households, engaged in marital / de factor relationship, and have dependent children present in the household. They are also more likely to have full time employment and have higher educational attainment than renter households. While these patterns are also present between rental investor and non rental investor households, the differences in household structure are less pronounced.

Table 1: Household Characteristics by Tenure

	Total	Homeowner	Renter
Homeownership	61.67	100.00	0.00
Age	43.37	46.53	38.28
Gender – male	59.59	63.44	53.39
Marital status	59.86	72.18	40.03
Presence of dependent children	42.51	48.26	33.25
Head born overseas	28.79	28.68	29.97
Location:			
Non-Sydney capitals	41.67	42.51	40.31
Regional areas	38.69	40.36	36.00
Education Attainment			
Postgraduate	8.60	10.48	5.57
Graduate	23.82	25.48	21.14
Certificate	29.63	30.25	28.62
Year 12	11.52	9.62	14.56
Year 10 or below	26.44	24.16	30.11
Employment status			
Full-time employed	58.73	63.36	51.27
Part-time employed	13.99	12.34	16.63
Partner in full / part time employment	60.11	62.22	54.93
Expected residential mobility	29.50	15.90	51.38
Relative cost of homeownership	1.62	1.59	1.66
Household Income			
Permanent	5114	57315	41227
Transitory	9013	12666	3136
Household attitudes			
Long planning horizon	42.98	46.88	36.69
Not risk taking	74.11	79.67	65.16
Feeling prosperous	64.64	71.43	53.72
Borrowing constraint			
Moderately wealth constrained	2.30	0.27	5.57
Highly wealth constrained	18.89	0.86	47.90

Borrowing constraint gap	-0.78	-1.17	-0.14
Excess debt repayment capacity	0.35	0.40	0.27
Rental property investment			
Ownership rate	14.78	18.31	9.09
Marginal effective tax rate	-0.19	-0.20	-0.18
Required yield	6.14	6.07	6.26
Actual yield	1.34	1.53	1.03

Table 2: Household Characteristics by Rental Investment Property Ownership

	Total	Investor	Non investor
Homeownership	61.67	76.42	59.12
Age	43.37	45.21	43.05
Gender – male	59.59	65.15	58.62
Marital status	59.86	75.76	57.10
Presence of dependent children	42.51	48.78	41.42
Head born overseas	28.79	29.47	28.67
Location:			
Non-Sydney capitals	41.67	40.87	41.8
Regional areas	38.69	39.58	38.53
Education Attainment			
Postgraduate	8.60	14.52	7.57
Graduate	23.82	31.56	22.48
Certificate	29.63	27.43	30.01
Year 12	11.52	8.73	12
Year 10 or below	26.44	17.75	27.95
Employment status			
Full-time employed	58.73	72.59	56.32
Part-time employed	13.99	13.72	14.03
Partner in full / part time employment	60.11	72.93	57.42
Relative cost of homeownership	1.62	1.57	1.62
Household Income			
Permanent	5114	69206	48019
Transitory	9013	20548	7014
Household attitudes			
Long planning horizon	42.98	57.07	40.53
Not risk taking	74.11	76.85	73.63
Feeling prosperous	64.64	82.17	61.60
Borrowing constraint			
Moderately wealth constrained	2.30	0.13	2.67
Highly wealth constrained	18.89	1.63	21.88
Borrowing constraint gap	-0.78	-1.61	-0.63
Excess debt repayment capacity	0.35	0.48	0.32
Rental property investment			
Ownership rate	14.78	100.00	0.00
Marginal effective tax rate	-0.19	0.13	-0.24
Required yield	6.14	5.81	6.19

Actual yield	1.34	3.04	1.05
--------------	------	------	------

An examination of the economic characteristics of households in Tables 1 reveals that homeowners are more financially affluent than renters. The permanent and transitory incomes of homeowner households are significantly higher than that of the sample mean and the mean for renter households, and are also significantly less likely to experience wealth borrowing constraints. The most significant difference is between the incomes of homeowners and renters are that of transitory income. Mean transitory income for homeowners (12383) is almost 6 times that of renter households (2893). Table 2 shows that rental investors are also more financially affluent when compared with non rental investors.

#### 4. Empirical Framework

The empirical model is in 2 parts. Section 4.1 addresses research question 1. It models household level housing demand with specific emphasis on the mechanisms through which interest rate change affects this decision. Section 4.2 addresses research question 2. It presents a micro-simulation model that measures the impact of interest rate changes on household level housing demand, and the extent to which these impacts differ between different segments of the housing market.

##### 4.1 Models of Household Level Housing Demand

Housing demand is modelled for both owner-occupiers and rental property investors. Owner-occupier housing demand is estimated using a multivariate logit model. This involves the use of different independent variables to reflect the impact of both economic and non-economic determinants on the household's probability of homeownership. The use of non-economic factors proxy for unobservable household preferences towards homeownership and reflects the joint consumption-investment nature of the decision, as in additions to acquiring the housing asset the household also resides within the dwelling and consumes its flow of housing services. The use of economic factors reflect the financial ability of households in meeting the costs associated with homeownership.

The model for owner-occupier housing demand is set out in equation (1).

$$(1) \text{ own} = f[\psi, inc_{PER}, inc_{TRAN}, \Gamma, rc, bc, v]$$

Variable	Description
<i>own</i>	Probability of homeownership.
$\psi$	Household demographic characteristics. This includes age, gender, marital status, number of dependent children, geographic region, and expected residential mobility.
<i>inc<sub>PER</sub></i>	Household permanent income. This is estimated using household human capital and labour market characteristics.
<i>inc<sub>TRAN</sub></i>	Household transitory income. Defined as the deviation of household

---

	permeant income from its current income.
$\Gamma$	Household subjective / attitudinal characteristics relevant to the homeownership decision. This includes financial planning horizon, risk taking attitudes, and self assessment of financial prosperity.
$rc$	Relative price of homeownership.
$bc$	Wealth borrowing constraint.
$v$	Household's excess debt repayment capacity.

---

For owner-occupier housing demand, the model identifies 2 channels through which changes in the rate of interest affects the household's tenure choice decision. First, changes in the interest rate affect housing loan repayments and hence the cost of homeownership compared to renting ( $rc$ ). Given that other factors stays constant, changes in interest rates have a negative association with owner-occupier housing demand as an increase in interest rate would increase the relative cost of owning, and hence reduce both the financial viability and attractiveness of homeownership (Brueggeman and Peiser, 1979, Chinloy, 1991, Diamond, 1980, Hendershott and Slemrod, 1983). While change in the nominal interest rate also carries implications for the rate of house price inflation in the economy, existing evidence shows that even as the rate of inflation increases, there is a net negative impact on housing demand, as more stringent borrowing and repayment conditions reduce housing demand despite the positive effect on housing price capital gain (Schwab, 1982, Titman, 1982, Van Order and Dougherty, 1991, Kearl, 1979).

Second, changes in the rate of interest affect household's excess debt repayment capacity. This is defined as that portion of the household's disposable income that can be used to meet any adverse changes in its debt repayment obligations after non-housing expenditures have been accounted for. This measure has not been used in previous studies, and is measured using the household's existing disposable income, loan repayments on its optimal home purchase, and the minimum level of non-housing expenditure that it must meet in order to stay above the poverty line.

Through its inclusion, the model aims to examine whether the household's housing demand decision is affected by its expected ability to weather future adverse changes in income or repayment obligations. The use of household permanent income reflects, to some extent, the ability of the household to accommodate unexpected (adverse) changes in the future. However, it is an absolute measure. Households that are highly geared, and that have high income, may be just as constrained to as households with lower income and correspondingly lower levels of debt. The degree of unused debt repayment capacity depends not on absolute measures, but on the relative measure of household debt repayment to income ratio.

Further, previous studies have shown that households take uncertainties into account (Rosen et al., 1984, Robst et al., 1999, Robst and Deitz, 1999). Similar conclusions can be drawn in the case of the expectation regarding future repayment capacities, since households are most likely to be concerned with their expected ability to meet housing costs when critical factors – such as the mortgage interest rates – changes through time.



This is particularly relevant in the Australian context, as the majority of housing loans are variable rate loans. Households with greater excess debt repayment capacity are more likely to enter homeownership, as they face less uncertainty regarding both their current and future financial abilities to meet housing costs.

The model for rental investment housing demand relies heavily on Wood and Watson, 1999. It follows a discounted cash flow model where rental property ownership is predicted if the actual gross rental yield is no less than the required gross rental yield. This model is set out in equation (2), with the required gross rental yield formula set out in equation (3).

$$(2) \frac{rent}{rval} = \frac{(1-t_{INV}) * r - \mu + depr + ((1-t_{INV}) * \eta)}{(1-t_{INV}) * r - \mu + depr} * \frac{(1-t_{INV}) * r - \mu + depr}{(1-t_{INV}) * (1-\kappa)}$$

$$(3) yield_{INV} = \frac{r}{(1-\kappa)} + \frac{depr - \mu}{(1-t_{INV}) * (1-\kappa)} + \frac{\eta}{(1-\kappa)}$$

Variable	Description
$t_{INV}$	Investor's marginal effective tax rate.
$\mu$	Annual rate of increase for rental income, this is assumed to be equal to the rate of general price inflation.
$depr$	Rate of depreciation for the housing stock. This is set at 1.4 percent per annum.
$r$	Loan interest rate.
$\kappa$	Property management costs at 12 percent of annual gross rent
$\eta$	Property taxes and maintenance costs.

The discounted cash flow model takes into account both the investor's existing equity in the property, and the on-going cost in holding the property. The premise for the model is that the investor would continue to hold the property if the net present value of the cash flows from the investment is just sufficient to maintain the owner's existing equity in the property, with a discount rate equal to the yield on the next best alternative.

It is important to note that, unlike the model for owner-occupier housing demand, the discounted cash flow mode presented in equations (2) and (3) considers only the financial aspect of the rental property ownership decision. This reflects the fact that rental investment housing demand is a pure investment decision. Households compare the prospective returns from rental housing to other alternative investment options. The decision is made to invest if the return from rental housing exceeds that of the alternative investment options.

#### 4.2 Micro-simulation Model and Decomposition Analysis

The micro-simulation model seeks to examine the change in housing demand as a result of changes in interest rates. 8 interest rate changes are implemented:

1. A 25 basis point change in each direction,
2. A 50 basis point change in each direction,
3. A 75 basis point change in each direction, and
4. A 125 basis point change in each direction.

For each interest rate change, the micro-simulation is conducted by following the 3 steps outlined below. Simulation framework relies heavily on (Wood et al., 2002b).

Firstly, using the tenure choice specification outlined in equation (1), the probability of homeownership is estimated for each household. Each household is assigned to either homeownership or rental tenure using a probability threshold of 0.5. There are 2 interest rate sensitive factors in the model: the relative cost of homeownership and household's excess debt repayment capacity. These interest rate sensitive factors are calculated using a lending rate of 6.36 percent. Rental investment housing demand is also evaluated using this baseline lending rate. These results are used as the benchmark scenario.

Secondly, for each interest rate change, the interest rate sensitive factors for owner-occupier housing demand are re-evaluated for each household. Since interest rates are the only change in the model, all other explanatory variables are assumed to stay constant. For rental investment housing demand, the required rental yield is also evaluated at each interest rate change.

As the third step, the probability of homeownership is evaluated for each interest rate change using the estimated parameters from the first step and the vector of explanatory variables post rate change. Tenure is again assigned using the 0.5 rule. For rental investment housing demand, the outcome of the rental property ownership decision for each interest rate change is obtained by comparing the actual rental yield with the required rental yield post rate change. These assignments represent the simulated change in household's housing demand as a result of the change in interest rates. The simulated results can then be used to examine the impact of interest rate change on housing demand at either the aggregate level, or across different segments of the housing market.

This simulation method utilizes 1 set of estimated parameters for all households in the sample, and hence assumes that the propensity to own – as reflected in the coefficients and the constant term of the model – does not vary across market segments. Thus, any variations in the impact of interest rate on housing demand across these segments would be driven purely by differences in their socio-demographic and economic endowments, and the extent to which these endowments allows the households in each segment to accommodate changes in lending rates. To test for whether there are differences in the propensity effects – in addition to the endowments – across different segments of the housing market, a decomposition analysis is also conducted for owner-occupier housing demand using 2 groups of households – households with above median income, and households with median and below median income.

The decomposition analysis aims to achieve 2 objectives. First, changes in lending rates affect housing demand principally through its economic considerations – such as relative homeownership costs, and the ability to repay housing loans. The extent to which these

considerations affect each household depends on their individual financial capacity. Thus, this gives rise to a potential for differences in the propensity for homeownership across housing market segments that is not captured through the differences in income endowments already incorporated in the estimation. Secondly, given that low income households are less able to accommodate rate increases, there is the potential for agents in both the housing and mortgage market to hold unfavourable perceptions against low income households with regards to their borrowing and repayment (and hence the home purchasing) capacities. For instance, housing lenders are more likely to grant loans to households who are more financially affluent as they are viewed to be more capable of meeting current and any future changes in loan repayments. Differences in the propensity effects can also indicate whether such discriminations against low income households are a significant factor in their housing demand decisions.

The decomposition analysis closely follows previous applications of this technique in exiting housing demand research (Wachter and Megbolugbe, 1992, Yates, 2000). Let households with above median income be denoted by  $g_1$ , and those with median or below median income be denoted  $g_2$ . The homeownership probability for households in  $g_1$  and  $g_2$  is estimated separately using the specification outlined in equation (1). The mean homeownership probability for households in  $g_1$  and  $g_2$  can then be found using the product of the estimated coefficients from these 2 logit regressions and the corresponding vector of mean explanatory variables.

Let  $P(g_1)$  and  $P(g_2)$  denote the (estimated) mean homeownership probability for  $g_1$  and  $g_2$  respectively. Taking  $g_2$  as the benchmark scenario, the difference between  $P(g_1)$  and  $P(g_2)$  can be found through equation (1).  $E_1$  and  $E_2$  denote the endowments of an average household in  $g_1$  and  $g_2$  respectively,  $c_1$  and  $c_2$  are vector of coefficients for  $g_1$  and  $g_2$  respectively.

$$(1) P(g_1) - P(g_2) = [c_1 * (E_1 - E_2)] + [E_2 * (c_1 - c_2)]$$

The first term to the right of equation (1) measures the endowment effect. It measures the difference in the homeownership probability of an average household in  $g_1$ , compared to  $g_2$ , if the only difference between these segments is their respective endowments. Note the use of the common vector of coefficients ( $c_1$ ), this is to control for propensity effects between  $g_1$  and  $g_2$ . Thus, the endowment effect measures the difference between homeownership probabilities of an average household in  $g_1$ , and an average household in  $g_1$  if they had  $g_2$  endowments.

The second term to the right of equation (1) measures the propensity effect. It measures the difference in  $P(g_1)$  and  $P(g_2)$  due to variations in the coefficients. The coefficients in an equation reflect the behavioural response of households to the explanatory variables and hence their propensity for homeownership. The propensity effect is measured by using a constant set of endowment ( $E_2$ ), and allowing the vector of coefficients to vary. Thus, the propensity effect in equation (1) measures the difference between homeownership probabilities of an average household in  $g_2$ , and an average household in  $g_2$  if they had the homeownership propensities of a  $g_1$  household.

A test for the significance of the propensity effect is a chi-squared test for the equivalence of the coefficients between households in  $g_1$  and  $g_2$ . The null hypothesis is that the coefficients are equal between the two groups. The test statistic is set out in equation (2).  $L_R$  is value of the log-likelihood function for the (restricted) model estimated using the pooled sample, and  $L_U$  the sum of the log-likelihood function for the (unrestricted) model the estimated for  $g_1$  and  $g_2$ . It follows a chi-squared distribution with degrees of freedom equalling to the number of explanatory variables including the constant. Rejection of the null hypothesis indicates the significance of the propensity effect.

$$(2) \chi^2 = -2*(L_R - L_U)$$

## 4. Results

### 4.1 Modelling Owner-occupier and Rental Investment Housing Demand

Estimation results for owner-occupier housing demand are presented in Table 1. Household head age, marital status, and the presence of dependent children are highly significant and are positively associated with the probability of homeownership. This is consistent with previous findings that shown household demographic characteristics to exert a significant influence on homeownership, as they serve to reflect housing preferences at different stages of the household's life cycle (Gyourko and Linneman, 1996, Elder and Zumpano, 1991, Jones, 1995). Mature age households with martial commitments and dependents have greater demand on housing qualities more commonly associated with owner-occupier housing, this includes tenure security, living spaces and the ability to control housing arrangements. Households with expectations of residential mobility are also less likely to enter homeownership due to future housing adjustment costs.

Household permanent income is also statistically significant and has a positive effect on the probability of homeownership. This indicates that households with higher incomes have a greater financial capacity in meeting the costs associated with homeownership, and are hence more likely to own. In addition to permanent income, the model also incorporates the household's excess debt repayment capacity as a more direct measure of their ability to meet the main component of homeownership costs – housing loan repayments. The estimation results show that household's excess debt repayment capacity is highly significant, and of the expected positive sign. This confirms that households with greater debt repayment capacity are more likely to enter homeownership as they face less uncertainty regarding both their current and future ability to meet loan repayments.

Both wealth constraint variables are highly significant in the model. Their negative sign indicate that households who can not meet the wealth test are significantly less likely to attain homeownership. Variables reflecting the income test were also tested, but are not statistically significant. This reflects the importance of wealth test as a binding constraint on potential home buyers. Coupled with the fact that the majority of the wealth

constrained households in the sample are renters, shows that the ability of the household in meeting the deposit requirement is an important determinant of their ability in attaining homeownership (Bourassa, 1995). While the relative cost of homeownership is of the expected negative sign, it is not statistically significant.

Household subjective characteristics are also shown to be significant determinants of owner-occupier housing demand. Households that assess themselves to be financially prosperous are more likely to enter homeownership than those who do not, as they are more confident in their ability to meet costs associated with homeownership. This reinforces the importance of financial considerations in the homeownership decision. As while household permanent income and excess debt repayment capacity reflects the household's objective ability to pay, subjective confidence reflects the households willingness to pay (Bram and Ludvigson, 1998, Roberts and Simon, 2001, Loundes and Scutella, 2000). Households who are less risky taking in terms of their investment attitudes are more likely to be in homeownership. This is consistent with the traditional view of housing as a stable and less risky option for household investments.

Results in Table 1 are next compared to the results obtained if an auxiliary model of owner-occupier housing demand is estimated on the same dataset. This auxiliary model uses the same variable specifications, but excludes the wealth constraint variables, and household's excess debt repayment capacity. Results for this auxiliary model shows that permanent income and relative homeownership costs exhibit a marked increase in both statistical significance and the magnitude of coefficient. Further, transitory income becomes positive and highly significant. This has 2 important implications. First, it reflects the fact that transitory income act as a proxy for the household's ability to satisfy borrowing constraints. Secondly, it show the significance of the excess debt repayment capacity can be interpreted as a more direct reflection of the household's ability to meeting the cost of homeownership, and hence explains the reduction in significance of household permanent income as a predictor of homeownership. Since the relative cost variable is also a measure of the costs associated with homeownership, the addition of excess debt repayment capacity can also explain its reduction in significance.

Table 1b: Logit Regression Results for Owner-Occupier Housing Demand

	Coefficient	z – stat <sup>1</sup>	dY / dX <sup>2</sup>
Constant	0.210	0.36	
Head age:			
<25	-0.182	-0.96	-0.044
35 – 44	0.572	4.86***	0.133
45 – 54	0.739	5.52***	0.166
55 +	1.304	8.78***	0.277
Head gender (male)	-0.036	-0.39	-0.009
Married / De facto	0.670	6.61***	0.161
Dependent children:			
1 – 2	0.614	5.12***	0.143
3 +	0.462	2.61***	0.106

Location:			
Non-Sydney capitals	0.149	1.09	0.036
Regional areas	0.136	0.85	0.033
Expected residential mobility	-1.612	-17.8***	-0.382
Relative cost of homeownership	-0.329	-1.15	-0.079
Household income:			
Permanent	0.004	1.74*	0.001
Transitory	-4.7E-05	-0.02	-1.1E-05
Household attitudes			
Long planning horizon	-0.053	-0.58	-0.013
Not risk taking	0.241	2.33***	0.058
Feeling prosperous	0.263	2.59***	0.064
Borrowing constraints			
Moderately wealth constrained	-3.542	-9.04***	-0.572
Highly wealth constrained	-4.399	-20.59***	-0.735
Excess debt repayment capacity	0.739	2.24***	0.178
Log-likelihood			-1811.38
$\chi^2$			1113.92
Probability > $\chi^2$			0.00
Prediction error rate <sup>3</sup>			0.15
Sample size			5017

Source: Estimation using wave 2 of the Household Income and Labour Dynamics in Australia (HILDA) survey.

Dependent variable used is observed tenure status of households. It is a binary variable. It is 0 if household rent, 1 if household is homeowner.

<sup>1</sup> \*\*\* Significance at the 1% level, \* Significance at the 10% level

<sup>2</sup> For binary explanatory variables, marginal effect is for discrete change from 0 to 1.

<sup>3</sup> Error prediction rate is defined as the ratio of incorrectly predicted tenure outcomes to the total number of predictions made.

Results for rental investment housing demand are reported in Table 3. Using the discounted cash flow model, only 0.26 percent of the sample is predicted to be rental property investors. This is compared with 14.78 percent of the sample that are actual rental property investors. Thus, while the model correctly predicts 85.49 percent of rental property ownership outcomes, the predicted rate of rental property ownership is significantly lower than the observed rate.

Table 3: Estimation Results for Rental Investment Housing Demand		
	Observed	Predicted
Rental investment ownership	14.78	0.26
Error in prediction <sup>1</sup>		
Correctly predicted		85.49
Investor → non-investor		14.51
Non-investor → investor		0.00

Source: Estimation using wave 2 of the Household Income and Labour Dynamics in Australia (HILDA) survey.

<sup>1</sup> Breaks down the error in the prediction. Investor → non-investor means the percentage of investors incorrectly predicted as non-investors.

<sup>2</sup> Error prediction rate is defined as the percentage of incorrectly predicted rental investment ownership outcomes in the total sample.

The significant discrepancy between the predicted and the observed rate of rental property ownership in the sample can be explained by 2 factors. First, for all households across the sample, the actual gross rental yield is significantly less than the required gross rental yield. In other words, the actual return that existing investors are earning fall short of the return on the next best alternative. For existing rental investors, actual gross rental yield is at 3.04 percent, where as the required rental yield is 5.81 percent. For non rental investors, the discrepancy is even greater, with the actual gross rental yield falls short of the required yield by over 5 percent. This explains why the bulk of existing rental investors are predicted not own, whereas no existing non-rental investors are predicted to own.

Secondly, the relative large discrepancy between the actual and the required rental yield can be explained by the condition of the housing market in which many of the rental investment properties may have been purchased. Wave 2 of the HILDA dataset was collected in 2002. Thus, it is likely (as HILDA does not provide the purchase year) that many of the rental investment properties were purchased during the housing market upswing which began in early 1996. During this upswing, median housing prices for capital cities around Australia have exhibited high rates of growth, accompanied by accelerated increases in household debt for both owner-occupation and rental investment purposes (Productivity Commission, 2003, Reserve Bank of Australia, 2003a, Reserve Bank of Australia, 2003b, Reserve Bank of Australia, May, 2002). Investors purchasing during such an upswing are likely to pay less emphasis to the rental yield, and more to the potential speculative return to be made on the sale of the property.

#### *4.2 Simulation and Decomposition Results*

Micro-simulation is conducted for both owner-occupier and rental investment housing demand for 8 different changes in lending rates. Table 4 presents overview of the aggregate level simulation results for both homeownership rate and rental investment ownership rate and for the change in interest sensitive factors under each interest rate change.

Table 4: Change in Interest Rate Sensitive Factors and Predicted Ownership Rate

	Base	<u>- Interest Rate Change</u>			
		0.25%	0.50%	0.75%	1.25%
Owner-occupier housing demand					
Rel. cost of homeownership	1.626	1.557	1.498	1.439	1.321

Excess debt repayment capacity	0.349	0.353	0.357	0.361	0.368
Rental investment housing demand					
Marginal effective tax rate	-0.190	-0.194	-0.195	-0.196	-0.198
Required rental yield	0.061	0.059	0.056	0.053	0.047
Housing demand					
Homeownership rate	69.55	69.79	70.06	70.29	70.69
Rental property ownership rate	0.26	0.31	0.41	0.49	0.61
		<u>+ Interest Rate Change</u>			
	Base	0.25%	0.50%	0.75%	1.25%
Owner-occupier housing demand					
Rel. cost of homeownership	1.616	1.675	1.734	1.793	1.911
Excess debt repayment capacity	0.349	0.345	0.341	0.338	0.330
Rental investment housing demand					
Marginal effective tax rate	-0.190	-0.192	-0.191	-0.190	-0.188
Required rental yield	0.61	0.064	0.067	0.070	0.076
Housing demand					
Homeownership rate	69.55	69.28	69.14	68.84	68.33
Rental property ownership rate	0.26	0.26	0.26	0.26	0.23

For both homeownership and rental property ownership rate, changes are as expected for both increases and decreases in lending rates. However, for both owner-occupier and rental investment housing demand, it is clear that the simulated changes are more responsive to reductions in interest rates than to increases in interest rates, as the changes in ownership rates are more pronounced when interest rate decreases than when it increases.

Rental investment ownership rate does not change for increases in lending rates up to 75 basis points, but decreased by 11.54 percent when interest rate increased by 125 basis points. When interest rate decreases, rental investment ownership rate increased by 19.23, 57.69, 88.46, and 134.62 percent respectively for each successive interest rate reductions. The change in homeownership rate is comparatively more subdued. Increase of 25, 75 and 125 basis points produced a reduction in homeownership rate of 0.39, 1.02, and 1.75 percent respectively, while reductions in lending rates of the same magnitude produced increases in homeownership rate of 0.36, 1.06 and 1.64 percent respectively.

Thus, on the aggregate level, the impact of interest rate on housing demand is more pronounced for reductions in lending rates than increases. Further, the impact on rental investment housing demand is more pronounced than for owner-occupier housing demand. The first observation can be explained by the fact that once property ownership is entered into, households are unlikely to adjust their housing demand due to the high level of transaction costs involved. While this is true for owner-occupier housing demand, similar entry and exist costs from the market are also true for rental investors. Further, studies have also shown that housing debt, in particular, home loan debts are the last debt that the household would default on even under financial distress (Whitley et al., 2004). Both factors contributed to the subdued reduction in ownership rates as interest



rates increase – that while new entrants might be deterred, existing ownership are less likely to exist the market.

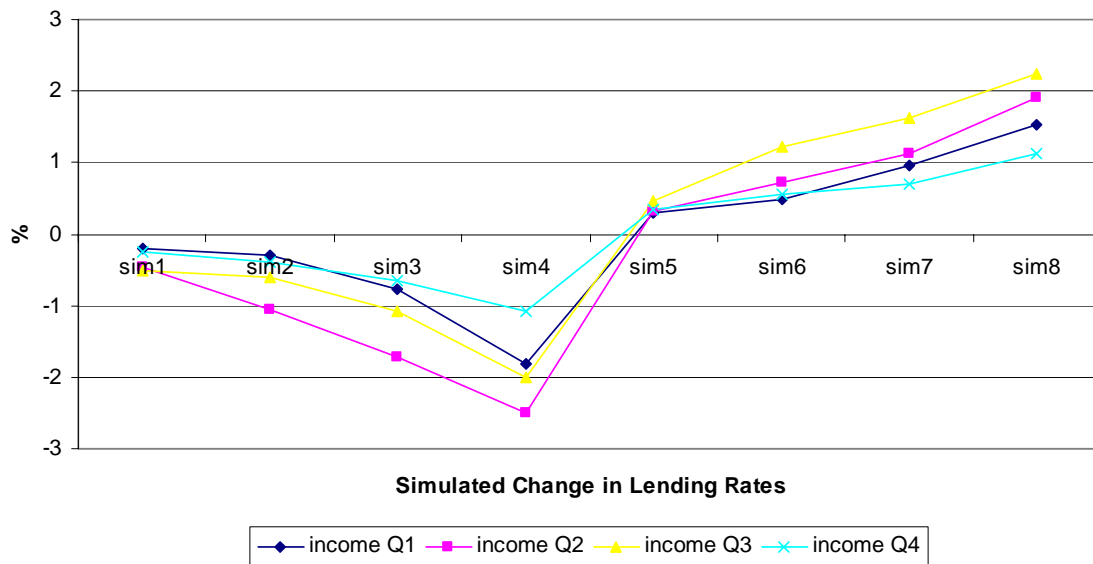
Secondly, rental investment housing demands is determined by primarily financial considerations, and hence is more likely to be influenced by changes in lending rates. On the other hand owner-occupier housing demand is also heavily influenced by non-economic factors. Thus, given the comparatively greater weight that interest rates play in rental investment housing demand, it is consistent with expectations that changes in lending rates would have a proportionately greater impact on housing investment decisions than homeownership decisions.

Graphs 1 to 3 examine the effect of lending rate changes on owner-occupier housing demand for different segments of the market. If households are segmented by income quartiles, as expected, the highest 2 quartiles have a less pronounced effect than households in the lower 2 quartiles. However, what is of interest is that it is households in the second lowest income quartile – as opposed to the lowest quartile – that are most responsive to changes in lending rates. This reflects the fact that households in the lowest income quartile are likely to be highly constrained households that are not able to meet homeownership costs irrespective of the lending rate. Whereas households in the upper 2 quartiles – particularly those households in the highest quartile – have sufficient economic capacity and are thus less likely to be affected by interest rate changes. For these households, the driving determinant in housing demand is their housing preferences rather than economic considerations.

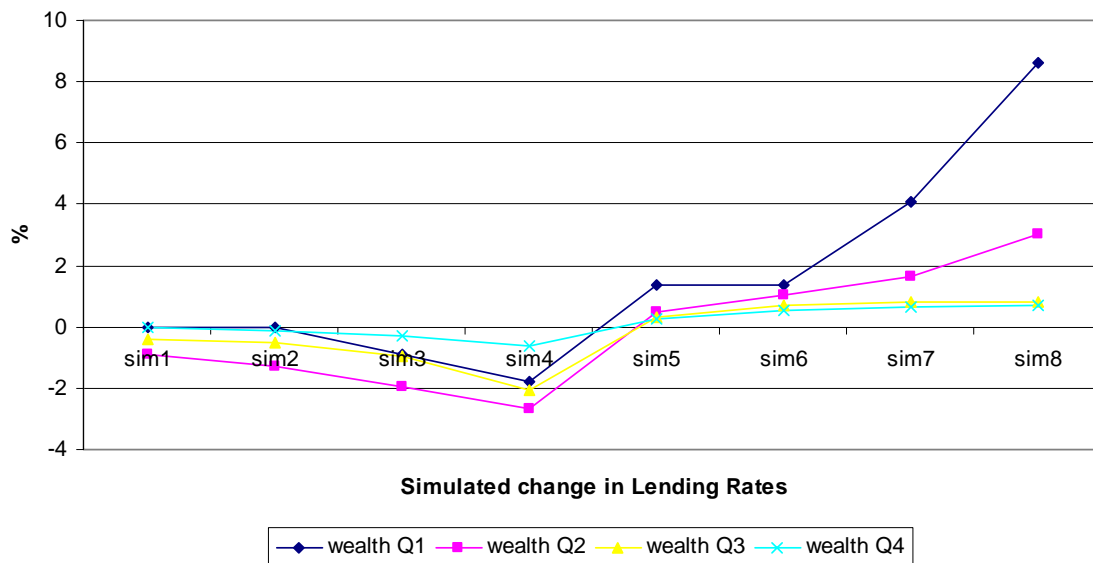
Changes in lending rates have the most pronounced effects on households in the second income quartile. This result is expected. It has long been recognised that the impact of interest rate on housing demand is not uniform across households with different levels of financial ability. It is on the marginal households for whom economic considerations play a critical role in their homeownership decision that the interest rate change would have its most pronounced effect.

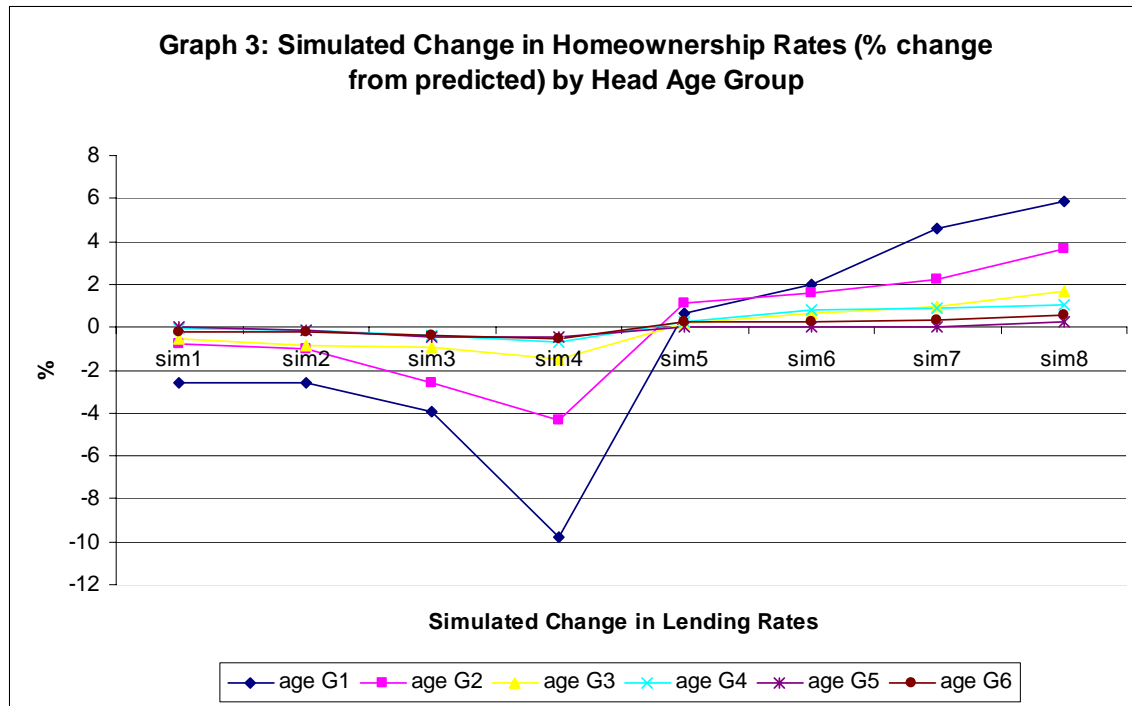
Examination of household segments by wealth quartile and head age groups produces similar results. When one views the simulated change in homeownership rates by wealth quartiles, it can be seen that it is households in the lowest wealth quartile that experience the most significant increase in homeownership rates as a result of the decrease in lending rates. This can be attributed to the greater significance that economic considerations play in their housing demand decisions when compared with other households in the sample. This is also the case for households in the youngest head age group, whereas households in higher wealth quartiles and older head age groups have a less marked response.

**Graph 1: Simulated Change in Homeownership Rates (% change from predicted) by Income Quartile**



**Graph 2: Simulated Change in Homeownership Rates (% change from predicted) by Wealth Quartiles**





Estimation results for the decomposition analysis are reported in Tables 5a and 5b. Table 5a contains estimation results using households with above median income, and Table 5b for households with median and below median incomes.

Table 5a: Logit Regression Results for Owner-Occupier Housing Demand (Above Median Income Households)

	Coefficient	z – stat <sup>1</sup>	dY / dX <sup>2</sup>
Constant	-0.829	-0.98	
Head age:			
<25	0.041	0.15	0.006
35 – 44	0.677	4.40***	0.095
45 – 54	0.844	4.52***	0.109
55 +	1.161	4.61***	0.127
Head gender (male)	0.027	0.20	0.004
Married / De facto	0.798	5.14***	0.135
Dependent children:			
1 – 2	0.822	4.50***	0.116
3 +	0.784	2.65***	0.097
Location:			
Non-Sydney capitals	0.374	1.94**	0.055
Regional areas	0.102	0.45	0.015
Expected residential mobility	-1.880	-14.88***	-0.351
Relative cost of homeownership	-0.136	-0.35	-0.020
Household income:			
Permanent	0.002	0.65	3.19E-04

Transitory	-3.4E-04	-0.12	-5.1E-05
Household attitudes			
Long planning horizon	-0.099	-0.77	-0.015
Not risk taking	0.281	1.89*	0.044
Feeling prosperous	0.612	4.00***	0.101
Borrowing constraints			
Moderately wealth constrained	-3.316	-4.64***	-0.679
Highly wealth constrained	-3.530	-10.66***	-0.708
Excess debt repayment capacity	1.282	1.52	0.191
Log-likelihood			-886.73
$\chi^2$			482.34
Probability > $\chi^2$			0.00
Prediction error rate <sup>3</sup>			0.15
Sample size			2450

Source: Estimation using wave 2 of the Household Income and Labour Dynamics in Australia (HILDA) survey.

Dependent variable used is observed tenure status of households. It is a binary variable. It is 0 if household rent, 1 if household is homeowner.

<sup>1</sup> \*\*\* Significance at the 1% level, \* Significance at the 10% level

<sup>2</sup> For binary explanatory variables, marginal effect is for discrete change from 0 to 1.

<sup>3</sup> Error prediction rate is defined as the ratio of incorrectly predicted tenure outcomes to the total number of predictions made.

Table 5b: Logit Regression Results for Owner-Occupier Housing Demand (Median and Below Median Income Households)

	Coefficient	z – stat <sup>1</sup>	dY / dX <sup>2</sup>
Constant	0.523	0.57	
Head age:			
<25	-0.384	-1.44	-0.082
35 – 44	0.417	2.26***	0.096
45 – 54	0.659	3.22***	0.156
55 +	1.309	6.35***	0.302
Head gender (male)	-0.103	-0.82	-0.023
Married / De facto	0.603	4.08***	0.137
Dependent children:			
1 – 2	0.339	1.62	0.078
3 +	-0.066	-0.21	-0.015
Location:			
Non-Sydney capitals	-0.105	-0.51	-0.023
Regional areas	0.119	0.48	0.027
Expected residential mobility	-1.363	-10.39***	-0.272
Relative cost of homeownership	-0.478	-1.07	-0.107

Household income:			
Permanent	0.020	2.09***	0.004
Transitory	0.013	1.21	0.003
Household attitudes			
Long planning horizon	0.004	0.03	0.001
Not risk taking	0.184	1.25	0.041
Feeling prosperous	0.040	0.30	0.009
Borrowing constraints			
Moderately wealth constrained	-3.660	-7.74***	-0.350
Highly wealth constrained	-4.758	-16.83***	-0.674
Excess debt repayment capacity	0.281	0.39	0.063
Log-likelihood			-900.25
$\chi^2$			567.76
Probability > $\chi^2$			0.00
Prediction error rate <sup>3</sup>			0.14
Sample size			2567

Source: Estimation using wave 2 of the Household Income and Labour Dynamics in Australia (HILDA) survey.

Dependent variable used is observed tenure status of households. It is a binary variable. It is 0 if household rent, 1 if household is homeowner.

<sup>1</sup> \*\*\* Significance at the 1% level, \* Significance at the 10% level

<sup>2</sup> For binary explanatory variables, marginal effect is for discrete change from 0 to 1.

<sup>3</sup> Error prediction rate is defined as the ratio of incorrectly predicted tenure outcomes to the total number of predictions made.

The estimation results – when viewed from the view point of comparison between samples – are consistent with expectations. In Table 5a, the coefficient for permanent income is highly significant for below median income households, where as it is not significant for the above median income sub-sample. This indicate that household income plays a much important role for less financially affluent households for whom economic consideration is an crucial part of their homeownership decision. Similarly, the significance of wealth borrowing constraints is also greater for households with below median income. It is also worthwhile in noting that the effect of subjective characteristics is significant in above median income households, but not on below median income households. This can again be attributed to the greater role that non-economic considerations play in the homeownership decisions of households with above median income.

The results of the decomposition analysis are reported in Table 6. It can be seen that when households are broken down via final income, households with above median income have significantly higher probabilities for homeownership (on average) than households with median or below median income. Using the decomposition results of the differences in mean probabilities, it is clear that the bulk of the difference can be attributed to endowment effects (0.482), with an offsetting propensity effect (-0.002). In

other words, the highest mean homeownership probability of higher income households is attributable to their endowments.

However, it is important to note that while the propensity effect is statistically significant. This negative sign on the propensity effect is of the wrong sign to indicate the presence of any market perceptions unfavourable to the ability of low income households in accessing homeownership.

Table 6: Decomposition Analysis Results

Pr (above median income)	0.818
Pr (median or below median income)	0.339
Pr (pooled sample)	0.598
Scenario 1: Above median compared to median and below median income <sup>1</sup>	
P(g1) – P(g2)	0.479
Endowment effect <sup>2</sup>	0.482
Propensity effect <sup>2</sup>	-0.002
$\chi^2$ test statistic <sup>3</sup> – null rejected	48.76

## 5. Conclusion

This paper examined the role of interest rate in both owner-occupier and rental investment housing demand, and conducted a micro-simulation model in which the impact of interest rate change on different segments of the household market are analysed. The results confirm that the effects of interest rate on housing demand are not uniform across different segments of the household. This is particularly the case when household segments are defined with respect to their level of economic resources. Those households that are most affected by interest rate changes are found to be average income households for whom financial considerations play a critical role in their housing demand decisions. Further, the results of the decomposition analysis does not support there being unfavourable perceptions against lower income households in both the housing and mortgage markets. However, The magnitude of coefficients for economic variables between households with above median and median and below median income are noticeably different, with these economic variables playing a more significant role in the household's homeownership decision.

## Bibliography

- BOEHM, T. P. & MCKENZIE, J. A. (1982) Inflation, Taxes, and the Demand for Housing. *AREUEA Journal*, 10, 25-38.
- BOURASSA, S. C. (1995) The Impacts of Borrowing Constraints on Homeownership in Australia. *Urban Studies*, 32, 1163-1174.
- BRAM, J. & LUDVIGSON, S. (1998) Does Consumer Confidence Forecast Household Expenditure? A Sentiment Index Horse Race. *Federal Reserve Bank of New York Economic Policy Review*, June, 59-78.
- BRUEGGEMAN, W. B. & PEISER, R. B. (1979) Housing Choice and Relative Tenure Prices. *Journal of Financial and Quantitative Analysis*, 14, 735-751.
- CHINLOY, P. (1991) Risk and the User Cost of Housing Services. *AREUEA Journal*, 19, 516-531.
- DIAMOND, D. B. J. (1980) Taxes, Inflation, Specuation and the Cost of Homeownership. *Journal of the American Real Estate and Urban Economics Association*, 8, 281-298.
- DUCA, J. V. & ROSENTHAL, S. S. (1994) Borrowing Constraints and Access to Owner-occupied Housing. *Regional Science & Urban Economics*, 24, 301-321.
- ELDER, H. W. & ZUMPANO, L. V. (1991) Tenure Choice, Housing Demand and Residential Location. *Journal of Real Estate Research*, 6, 341-376.
- FELDMAN, R. J. (2002) Mortgage Rates, Homeownership Rates, and Government-Sponsored Enterprises. *Region (Federal Reserve Bank of Minneapolis)*, 16, 3-22.
- GREEN, R. K. (1996a) Should the stagnant homeownership rate be a source of concern? *Regional Science and Urban Economics*, 26, 337-368.
- GREEN, R. K. (1996b) Should the Stagnant Homeownership Rate be a Source of Concern? *Regional Science & Urban Economics*, 26, 337-368.
- GYOURKO, J. & LINNEMAN, P. (1996) Analysis of the Changing Influences on Traditional Household's Ownership Patterns. *Journal of Urban Economics*, 39, 318-331.
- HENDERSHOTT, P. H. & SLEMROD, J. (1983) Taxes and the User Cost of Capital for Owner-Occupied Housing. *AREUEA Journal*, 10, 375-393.
- JONES, L. D. (1995) Testing the Central Prediction of Housing Tenure Transition Models. *Journal of Urban Economics*, 38, 50-73.
- KEARL, J., ROSEN, K. & SWAN, C. (1975) Relationships Between the Mortgage Instruments, the Demand for Housing and Mortgage Credit: A Review of Empirical Studies. IN LESSARD, D. R. (Ed.) *New Mortgage Designs for Stable Housing in an Inflationary Environment*. Cambridge, Massachusetts, Federal Reserve Bank of Boston.
- KEARL, J. R. (1979) Inflation, Mortgages, and Housing. *Journal of Political Economy*, 87, 1115-1138.
- KEARL, J. R. & MISHKIN, F. S. (1977) Illiquidity, the Demand for Residential Housing, and Monetary Policy. *The Journal of Finance*, 32, 1571-1586.
- LESSARD, D. R. & MODIGLIANI, F. (1975) Inflation and the Housing Market: Problems and Potential Solutions. IN MODIGLIANI, F. (Ed.) *New Mortgage Designs for Stable Housing in an Inflationary Environment*. Cambridge, Massachusetts, Federal Reserve Bank of Boston.

- LOUNDES, J. & SCUTELLA, R. (2000) Consumer Sentiment and Australian Consumer Spending. *Melbourne Institute Working Paper Series*, No.21/00.
- MACNEVIN, A. S. (1997) Marginal Effective Tax Rates on Canadian Rental Housing Investment: An Asset Pricing Model Approach. *Public Finance Review*, 25, 306-326.
- MEEN, G. (1998) Modelling Sustainable Home-ownership: Demographic or Economic? *Urban Studies*, 35, 1919-1934.
- PAINTER, G. & REDFEARN, C. L. (2002) The Role of Interest Rates in Influencing Long-Run Homeownership Rates. *Journal of Real Estate Finance and Economics*, 25, 243-267.
- PRODUCTIVITY COMMISSION (2003) First Home Ownership. *Productivity Commission Discussion Draft*. Melbourne, December.
- RESERVE BANK OF AUSTRALIA (2003a) Household debt: what the data show. *Reserve Bank of Australia Bulletin*, March, 1-11.
- RESERVE BANK OF AUSTRALIA (2003b) *Submission to the Productivity Commission Inquiry on First Home Ownership*.
- RESERVE BANK OF AUSTRALIA (2004) Residential Property Investors in Australia. *Reserve Bank of Australia Bulletin*, May, 52-56.
- RESERVE BANK OF AUSTRALIA (March 2003) Household Debt: What the Data Show. *Reserve Bank of Australia Bulletin*, 1-11.
- RESERVE BANK OF AUSTRALIA (May, 2002) Statement on Monetary Policy. *Reserve Bank of Australia Bulletin*, 30-32.
- ROBERTS, I. & SIMON, J. (2001) What do Sentiment Surveys Measure? *Reserve Bank of Australia Research Discussion Paper Series*, No. 2001-09.
- ROBST, J. & DEITZ, R. (1999) Income Variability, Uncertainty and Housing Tenure Choice. *Regional Science & Urban Economics*, 29, 219-229.
- ROBST, J., DEITZ, R. & MCGOLDRICK, K. (1999) Income variability, uncertainty and housing tenure choice. *Regional Science and Urban Economics*, 29, 219-229.
- ROSEN, H. S., ROSEN, K. T. & HOLTZ-EAKIN, D. (1984) Housing Tenure, Uncertainty, and Taxation. *Review of Economics and Statistics*, 66, 405-416.
- SCHWAB, R. M. (1982) Inflation Expectations and the Demand for Housing. *American Economic Review*, 72, 143-153.
- SCHWAB, R. M. (1983) Real and Nominal Interest Rates and the Demand for Housing. *Journal of Urban Economics*, 13, 181-195.
- TITMAN, S. (1982) The Effects of Anticipated Inflation on Housing Market Equilibrium. *The Journal of Finance*, 37, 827-842.
- VAN ORDER, R. & DOUGHERTY, A. (1991) Housing Demand and Real Interest Rates. *Journal of Urban Economics*, 29, 191-201.
- WACHTER, S. & MEGBOLUGBE, I. (1992) Racial and Ethnic Disparities in Homeownership. *Housing Policy Debate*, 3, 333-370.
- WHEATON, W. C. (1985) Life-Cycle Theory, Inflation, and the Demand for Housing. *Journal of Urban Economics*, 18, 161-179.
- WHITLEY, J., WINDRAM, R. & COX, P. (2004) An Empirical Model of Household Arrears. Bank of England Working Paper Series No. 214.



- WOOD, G. A. & WATSON, R. (1999) The User Cost-of-Capital, Taxation and the Marginal Supply of Rental Housing: Evidence from Microdata. *Murdoch University, Department of Economics Working Paper Series No. 176*.
- WOOD, G. A., WATSON, R. & FLATAU, P. (2002a) The Incentive to Invest in Residential Rental Housing: The Role of Alternative Supply-side Policies. Murdoch University, School of Economics Working Paper No. 185.
- WOOD, G. A., WATSON, R. & FLATAU, P. (2002b) A Microsimulation Model of Tenure Choice in the Australian Housing Market. *Murdoch University Economics Working Paper Series no. 188*.
- WOOD, G. A., WATSON, R. & YATES, J. (1998) Transaction Costs, Taxation and Gross Rental Yields in Private Rental Housing. *Murdoch University, Department of Economics Working Paper Series No. 172*.
- YATES, J. (2000) Is Australia's Home-ownership Rate Really Stable? An Examination of Change between 1975 and 1994. *Urban Studies*, 37, 319-342.