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Mortgage Choice Determinants: The Role of Risk and Bank Regulation

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Abstract

This paper sheds new light on the role of borrower characteristics in mortgage product choice, and how these are impacted by regulatory capital requirements.Using rich loan-level data from the Australian market we analyse the way in which these risk effects impact the choice between adjustable rate mortgages and a range of complex mortgages which provide reduced initial payments. For the first time we find that all three of income, wealth and mobility risks play a role in product choice. We also investigate the role of regulatory capital requirements in an environment where banks hold mortgage risk on their balance sheet and find that the Basel capital discounts based on loan-to-valuation ratios divide otherwise similar borrowers between ARM and CM product choices.

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1. Introduction

The structure of mortgage markets varies substantially around the globe; Warnock and Warnock (2008), Scanlon et al (2008), Badarinza et al (2013). The benchmark US market is dominated by securitized long term fixed rate mortgages, while the prevalence of adjustable rate and short-term fixed rate products is generally higher in other countries; Lea (2010a,b). Currently, considerable attention is focused on the diversity of mortgage product choices, in part due to the importance of the US mortgage market in precipitating the global financial crisis, but also reflecting the key role that mortgages play in monetary policy transmission; Calza et al (2013) and Landier et al (2013). Mortgage product choice is additionally relevant in assessing market completeness and risk management, and hence has strong implications for optimal householder outcomes; Campbell and Cocco (2003), Miles (2005).

Unlike much of the existing literature, this paper considers mortgage choice in an economy where mortgage transactions are not influenced by institutional structures such as Fannie Mae and Freddie Mac in the US, government mortgage insurance (in the US, Netherlands and Canada) or government security guarantees (in US, Canada and Japan); see Campbell (2013), Lea (2010b), Green and Wachter (2005), and Frame and White (2005). Outside the US the structure of the mortgage market can be quite different. For example, in Australia securitization plays a minimal role in sourcing funds for banks, there is strong prudential regulation, but no public mortgage insurance scheme and no government deposit guarantee existed prior to the global financial crisis of 2008-09.

New products, which lie between the usually investigated adjustable rate mortgages (ARM) and fixed rate mortgages (FRM) are more common in markets like Australia than in the US benchmark. Recent work has begun to reflect interest in the popularity of these alternative mortgage products (AMPs) or complex mortgages (CMs). Amromin et al (2011) introduced the CM terminology to denote the increasing array of mortgage products ranging between ARMs and FRMs. They define CMs as products categorized by low introductory 'teaser' interest rates, short interest rate reset periods and deferred principal repayment. AMPs can be distinguished from CMs in that they mainly represent contracts with zero or neg-

ative amortization; see Brueckner et al (2013), Cocco (2013), LaCour-Little and Yang (2010), Scanlon et al (2008).

The paper has two main contributions. First, we empirically investigate household mortgage choice between CM and ARM products with the inclusion of a full range of mortgage cost variables, market conditions and borrower characteristics in the absence of the institutional structures previously mentioned.[1] Second, we find important differences in some of the mortgage choice effects when we control for the level of loan-to-value (LTV) ratio imposed by the Basel capital requirements, revealing the relationship between these prudential regulatory structures and the choices of individual households. Using a unique dataset from over half a million mortgage applications by owner-occupiers in Australia between 2003-2008 we establish the dominance of mortgage cost in determining the product chosen, consistent with the existing literature for other markets. However, we shed new light on the role of borrower characteristics due to the rich detail in our complete individual, bank-verified loan application data - unlike existing studies we do not rely on interpolated or survey based measures.

Borrower characteristics can be expected to play a role in mortgage product choice because they are indicators of borrowers exposure to, and attitudes towards, various kinds of risks. Theoretically, borrower characteristics relate directly to income risk, wealth risk, mobility risk and borrowing constraints as in Campbell and Cocco (2003). Theory predicts that consumers facing *income risks* will prefer to take a product which reduces the variability of their payments. Tests of this proposition have been attempted in the literature using a variety of proxies with little success in obtaining significant relationships.[2] The potential for future income growth, reducing the importance of mortgage payments in the household

[1] Amromin et al (2011) examine choice between ARM, CM and FRM in the US but have only income and geographical proxies available for borrower characteristics. Sa-Aadu and Sirmans (1995) investigate a range of different mortgage options which are distinguished only by frequency of interest rate adjustment and term.

[2] Proxies for income risk used have been the presence of children, non-durable expenditure, age, income levels and growth, education, occupation, self-employment or public employee, and income volatility estimated using a Mincer equation – see Brueckner and Follain (1988), Dhillon et al (1987), Sa-Aadu and Sirmans (1995), Paiella and Pozzolo (2007), Coulibaly and Li (2009), Cocco (2013).

budget may also induce household towards products where they bear more interest rate risk, but again the evidence is mixed.[3] *Wealth risk* enters both as borrowing constraints and the potential for capital gain/loss; Gabriel and Rosenthal (forthcoming) show how expected housing price growth encourages home ownership and Yamashita (2007) shows that low wealth-to-income homeowners are more sensitive to house price appreciation. When faced with expected housing price gains households may be willing to bear more interest rate risk; and while the majority of the literature explores the ARM/FRM choice, Amromin et al (2011) discover that when faced with the opportunity of a CM in these circumstances, borrowers prefer CM products. Borrowing constraints are expected to influence households away from ARM products - particularly for first home buyers. However, CM products are designed to reduce early period payments and may attract these households. Households facing *mobility risk* should choose products with the least penalty for change, as confirmed in the US literature; Dhillon et al (1987), Brueckner and Follain (1988), Sa-Aadu and Sirmans (1995), Coulibaly and Li (2009), Fortowsky et al (2011).

In addition to these risk factors, the existing literature also suggests that female borrowers may have more risk averse preferences; Barber and Odean (2001), Broghans et al (2009), Agnew et al (2008), Bernasek and Shwiff (2001), and Watson and McNaughton (2007).[4] Similarly, risk aversion has been shown to increase with age; see Morin and Fernandez Suarez (1983), Bellante and Saba (1986) and Riley and Chow (1992).[5]

Overall, the literature contains mixed evidence on the role of borrower characteristics in mortgage choice. The majority of the evidence concerns US households choosing between FRMs and ARMs where Dhillon et al (1987), Brueckner and Follain (1988) find borrower characteristics to be weak determinants of mortgage product choice, although they play a role in Sa-Aadu and Sirmans (1995),

[3] Age dummies in Brueckner and Follain (1988) and income in Paiella and Pozzolo (2007) show little evidence although income growth data in Sa-Aadu and Sirmans (1995) finds significant impact in the expected direction. Cocco (2013) shows that higher income growth increases the likelihood of choosing alternative mortgage contracts relative to principal repayment mortgages.

[4] See also Sapienza et al (2009). However, the experiments reported in Schubert et al (1999) do not find gender-specific risk attitudes after controlling for economic conditions.

[5] See also Deakin et al (2004).

Coulibaly and Li (2009) and Fortowsky et al (2011). International evidence is limited: Paiella and Pozzolo (2007) find little role for borrower characteristics in Italy; Cocco (2013) finds a role for income growth and income risk in Britain, and Ehrmann and Ziegelmeyer (forthcoming) find a role for income volatility in the Euro Area. The only existing work on CMs by Amromin et al (2011) is for the US, and finds some role for education, age and income in determining default and mortgage product.

This paper considers mortgage choice in a market with a completely different structure to the commonly investigated US mortgage market. As discussed in more detail below, there are three striking differences between the US and Australian markets. Firstly, unlike in the US, Australian banks hold almost all the mortgage risk on their balance sheet. Second, the predominant mortgage product in Australia is the standard ARM written for up to 30 years, where the interest rate is reset at the discretion of the bank, but generally follows market rates.[6] Lastly, FRMs as understood in the US market do not exist. CM products are far more common, and include contracts with discounted introductory interest rates, contracts with periodic reset and equity withdrawal. Owner-occupied interest rate expenses are not tax deductible, and mobility costs are increased by transaction taxes imposed by state governments.

CM products are more appealing to households seeking less up-front risk. Households which are wealth or income constrained, but anticipate future improvements in their income, or indeed capital gains from house price inflation are attracted to these products. Amromin et al (2011) find that in the US market, where 70 percent of loans are FRM, CM products are favoured by high income, financially sophisticated households and importantly by households where the loan value exceeds that level which can be securitized by the GSEs. In contrast, in the UK and Australia, similar customers are largely served by the ARM market, and the CM products offer short-term income and wealth risk reduction for constrained households; see Miles (2004, 2005) for UK evidence. In our study, CM products

[6]These are not the same as 'tracker' rate loans which follow a pre-agreed interest rate. In the standard Australian ARM the bank has the right to reset the interest rate on the contract at any time.

are shown to fill a niche of facilitating housing purchase for wealth constrained and consumers averse to income risk.

Finally, we find that the prudential capital requirements associated with on-balance-sheet mortgages interact with borrower characteristics to influence mortgage product choice. Fully documented mortgage loans with loan-to-value ratio (LTV) of up to 80 percent or low document loans with LTV of up to 60 percent attract a 50 percent capital weighting under Basel II rules. An LTV of over 80 percent requires purchase of loan insurance by the borrower (this product pays out to the lender, so acts as an additional cost to the borrower). Low doc loans with LTV of greater than 60 percent weighting attract no discount to capital requirements. Australian loans cluster around LTV of 60 and 80 percent consistent with these institutional requirements. The role of borrower characteristics is influenced by LTV; we show that some constrained borrowers show a greater preference for CM products when faced with high LTV, while others choose a greater propensity to hold both default and interest rate risk, particularly those with higher discretionary expenditure to reallocate, and those with expectations of higher income and wealth. Although borrowers are probably unaware of these effects, capital requirements for lenders influence mortgage choice via their interaction with borrower characteristics. In this sense, this paper emphasizes the fact that the chosen products reflect the intersection of supply-side effects with borrower characteristics, an aspect not included in the framework of Campbell and Cocco (2003) and Miles (2004) who do not model bank behaviour.

Section 2 provides some background on the Australian mortgage market. The empirical methodology is given in Section 3, and Section 4 presents the data set. The results are discussed in Section 5 and the specific issues surrounding the effects of LTV ratios in Section 6. Section 7 concludes.

2. Background

The Australian banking industry is highly concentrated, with the four largest banks having more than 60 percent of owner-occupied loan approvals. Smaller banks have around 20 percent market share, credit unions and building societies less than 10 percent, and wholesale mortgage originators less than 10 percent; Davies (2009). The share of total housing credit funded by securitization rose

from 10 percent in 2000 to more than 20 percent in 2007, at which point issuance of residential mortgage backed securities (RMBS) fell sharply with the onset of the global financial crisis. Almost all this increase reflected the use of securitization as a funding vehicle for mortgage originators, credit unions and smaller banks to access competitive funding; Debelle (2008, 2009). Major banks fund their mortgage debt predominantly through deposits and long- and short-term wholesale debt.

Australian mortgages are predominantly an ARM product – a credit foncier loan written for terms of up to 30 years, with the interest rate adjustable periodically at the discretion of the bank. A FRM such as commonly described in the international literature with a rate fixed for a very long term is not available; instead a loan with an interest rate fixed for an initial period (usually between 3 to 5 years) is offered, after which terms are renegotiated. Under renegotiation the options include conversion to an ARM or to a second FRM. In this paper we denote this product as a short FRM or SFRM. Full cost recovery fees apply to customers wishing to exit SFRM contracts prior to the expiration of the fixed rate period if market interest rates fall below the agreed rate.

The SFRM is one example of the growing category of CM products. An increasing market share in many economies has been captured by products which reduce the initial payment burden for the consumer, but retain the longer term mortgage risks with the consumer, not with the financial institution. Such products include honeymoon or teaser mortgages (HM), which offer a discounted introductory interest rate, contracts with periodically reset fixed interest rates, and equity withdrawal mortgages. More recently CMs have extended to include reverse mortgages, interest-only loans, shared-equity loans, low-doc loans for borrowers who self-report their financial position and forms of non-conforming loans for borrowers not meeting standard lending criteria. However, Debelle (2010), reported that low-doc loans never comprised more than 10 percent of housing loan approvals in Australia, and non-conforming loans never exceeded 2 percent of the total in data up to 2009.

As in many countries, taxation incentives exist in the housing market. The consumption services provided by owner-occupied homes are not taxable, and neither are capital gains on the sale of these properties. While mortgage interest

payable by owner-occupiers is not tax deductible,[7] owners of dwellings purchased for investment purposes receive a deduction against wage and salary income for all associated expenses. Tax losses made in this way are not capped. Loans for owner-occupied housing comprise two thirds of banks' outstanding housing loans, and this proportion has shown very little variation in the last decade which includes our sample period. To further encourage home ownership, and in partial compensation for the introduction of the goods and service tax in 2000, there is a variety of grants and tax concessions offered to owner-occupiers by all levels of government to first home buyers, see Dungey et al (2011).[8]

3. Empirical Specification

We consider the following index model.

$$y_i^* = \alpha + \beta X_i + \delta W_i + \gamma Z_i + \varepsilon_i, \tag{1}$$

where at time of application, household i makes a decision to choose the mortgage product, y_i^* which best matches its risk profile given mortgage costs, the economic and credit market conditions prevailing, and household characteristics. X_i represents the mortgage cost variables faced by individual i at time of application, W_i are the macroeconomic and credit market conditions prevailing at time of application, and Z_i are individual household characteristics. The residual ε_i is assumed $i.i.d$ normal. Note that estimation proceeds as a pooled regression, taking into account the time dimension by matching the time of application with market conditions at that time – this is not a panel estimation problem with repeated observations on the same individual, but rather has a time element in addition to cross-section dimension to the estimation problem.

However, there is not a continuum of mortgage products available, so that the observed behavior is the choice of either an ARM or CM product. Consequently,

[7] Bourassa (1995) argues that the user cost of owner-occupied housing has a significant impact on tenure choice. In particular, he points out that the housing user cost depends on the loan-to-value ratio (LTV) because mortgage interest is not deductible in Australia.

[8] Outside of our sample period short-term variation in these concessions has also been used as an instrument of macroeconomic stabilization during the 2008-2009 global financial crisis.

define the dichotomous variable y_i as

$$y_i = \begin{cases} 1 \quad if \quad y_i^* \geq 0; \quad \text{i.e., borrower } i \text{ chooses an ARM} \\ 0 \quad if \quad y_i^* < 0; \quad \text{i.e., borrower } i \text{ chooses a CM} \end{cases}$$

We are then interested in the probability of choosing an ARM which can be expressed as a Probit:

$$P(y_i = 1|X, W, Z) = \Phi(\alpha + \beta X_i + \delta W_i + \gamma Z_i) \tag{2}$$

where $\Phi(.)$ is the cumulative distribution of the standard normal ε_i.

Our maintained hypothesis is that choice of mortgage type is independent of the decision to apply for a mortgage. This assumption is dictated by our data which refer to mortgage applications. Longitudinal surveys such as the Household, Income and Labour Dynamics in Australia (HILDA) Survey offer the potential to examine this issues, but questions on the type of mortgage were first asked in Wave 10 of the survey, conducted in late 2010, which is after the global financial crisis, and outside our sample period. Wave 2 of the survey, conducted in 2002, was used by Kohler and Rossiter (2005, p.28) to investigate how family characteristics impacted leverage ratios for home-buyers. They found that when estimating a Heckman selection model, there was no selection effect. Paiella and Pozzolo (2007) employ Italian household survey data to test the role of household characteristics on the choice between FRM and ARM; they are able to test for sample-selection bias, and also reject it. Ehrmann and Ziegelmeyer (forthcoming) arrive at a similar conclusion for the Euro Area.

An important explanatory variable in the existing literature is the interest rate differential between alternative mortgages available to the householder at the time of application. This is an unobservable variable, as only the interest rate of the chosen contract is recorded, and the comparable alternative is not. This can be addressed in a number of ways.

First, we calculate the monthly average interest rate for each mortgage contract type and use those averages to compute the interest rate differentials.[9] This simple

[9]To date Dhillon et al (1987), Brueckner and Follain (1988) and Paiella and Pozzolo (2007)

approach will be valid if the lender offers similar contracts to all customers during a period of time. Given that we have data provided by a single lender this may be a reasonable assumption.

Given the richness in our loan-level data we prefer a second approach, following Brueckner and Follain (1988), who estimate interest rate differentials using the differential between fitted values of:

$$RATE_i^{CM} = B^C V_t^C + u_{i,t}^C \quad (3)$$

$$RATE_i^{ARM} = B^A V_t^A + u_{i,t}^A \quad (4)$$

where V^C, V^A are vectors containing the determinants of the interest rates on CM and ARM products respectively, and contain variables belonging to the set $\{X, W, Z\}$ (in our estimations the common variables in $\{V^C, V^A\}$ and $\{X, W, Z\}$ are regional dummies), B^C and B^A are corresponding loading vectors, and the residuals u^C and u^A are i.i.d normal. We do this for ARMs and both types of CM products: HM and SFRM.

The predicted interest rate differential is then formed as the difference between the fitted values, where two interest rate spreads are built based on the two CM products

$$RATEDIFF_i = \widehat{B}^{SFRM} V_t^{SFRM} - \widehat{B}^{ARM} V_t^{ARM}. \quad (5)$$

$$Discount_i = \widehat{B}^{ARM} V_t^{ARM} - \widehat{B}^{HM} V_t^{HM}. \quad (6)$$

Our choice of terms recognises the convention from the existing literature by denoting the spread between the SFRM and ARM as 'RATEDIFF' and the difference between the ARM and HM as the 'Discount'. The second stage estimates equation (2) inserting the newly built fitted interest rate differentials (RATEDIFF and Discount) in X.

It is possible, however, that in equations (3) and (4), $E(u_{i,t}^C | y_i^* < 0) \neq 0$ or $E(u_{i,t}^A | y_i^* \geq 0) \neq 0$ simply because borrowers chose the mortgage product with the

support a positive effect for ARM choice over FRM when ARM interest rates are relatively lower. Other studies such as Amromin et al (2011), Cocco (2013), and Sa-Aadu and Sirmans (1995) do not include these cost variables.

lowest interest rate, or because the decision on the type of mortgage product offered and the interest rate charged is simultaneous (possibly together with loan amount, loan term and loan-to-value ratio), or because of other factors not captured in the model. Therefore, we estimate the two-stage procedure following Brueckner and Follain (1988) and Lee and Trost (1978) to correct for selectivity bias using inverse Mills ratios.

The estimation results are presented in Table 2. The first column of Table 2 presents the explanatory variables in $V^A$and V^C, which include measures of interest rates at varying maturities, the credit score of the borrower and dummies for the state of loan origination. Columns 2-4 show interest rate estimations with selectivity bias correction for each mortgage type interest rate. The coefficient on the inverse Mills ratio (the selectivity bias) is positive and significant in all cases, supporting the importance of this correction.[10]

4. Loan-level Data

The underlying data in this study refer to bank-originated mortgages issued to applicants for owner-occupied housing, including applications for the refinancing of existing home loans. The initial data set comprises 617,868 home loan applications for the January 2003 to August 2008 – thus avoiding the Global Financial Crisis – for seven States or Territories of Australia.[11] Of these, 41.7 percent are CM contracts, and the remainder are ARMs – there are no long-term FRM loans as defined in most of the literature.

Variable definitions are provided in the Appendix, while Table 1 shows descriptive statistics for the mortgage cost and borrower characteristics variables in the database – all monetary variables are reported in real 2006Q1 Australian dollar

[10]Brueckner and Follain (1988) control for regional variations and national average interest rates. Paiella and Pozzolo (2007) control for age, education, occupation and short-term and long-term (province level) interest rates on bank loans. Rosenthal and Zorn (1993) includes mobility into the interest rate determination.

[11]These are Australian Capital Territory (ACT), New South Wales (NSW), Queensland (QLD), South Australia (SA), Tasmania (TAS), Victoria (VIC) and Western Australia (WA). The Northern Territory (NT) is excluded as the bank which provided our data has no branches there, although there are some applications from NT residents or for property in the NT. The majority of applications are recorded for NSW, QLD and VIC consistent with the population distribution in Australia.

values. The mean size of the ARM contract is just under $227,000 and the CM is just under $176,000. However, some very large contracts skew this picture, with the median ARM contract over $204,000 and the median CM over $160,000. For this reason we concentrate on reporting the median results in the tables. The median term for each mortgage type is the same at 30 years, noting that we have no information on the term of any honeymoon arrangements or how long an initial fixed rate period may be in the dataset. Initial median repayments for ARMs exceed those for CMs, reflecting the higher value of the ARM mortgages. The ratio of median ARM mortgage size to CM mortgage size is 1.28, but the ratio of initial monthly repayment on the ARM to initial monthly repayment on CM is 1.13 - indicating the extent of extra security CM borrowers are achieving in the early part of their loans. Bank fees are similar for both products.

The median CM rate is below that of the ARM, a feature that is not uncommon during our sample period for mortgage markets outside the US, see Badarinza et al (2013). The median LTV in the dataset for both contracts is similar to the average of 67 percent recorded for the Australian market in September 2006 by the Australian Prudential Regulatory Authority (APRA).[12] The median house valuation for ARM borrowers was $340,032, while CM median house valuations were around $60,000 lower at $281,417.

In terms of household characteristics, the median borrower for a CM is 38 years old, with no dependents (where dependents are present the average age of the youngest child is 5 years), has median gross monthly income of $5,311 ($63,732 per annum), net wealth at time of application (H'hold surplus) of $246,635 and liquid assets of $13,906. The median ARM applicant is only 1 year older, but has higher monthly income at $6,707 ($80,484 per annum), net wealth that is almost one third higher and liquid assets over 50 percent higher. The ARM applicants have been clients of the bank for 2 years longer than CM applicants, and have slightly higher credit scores.

As shown in equation 2 the explanatory variables are divided into three groups: mortgage costs X, market conditions W, and borrower characteristics Z. For convenience we present and discuss results distinguishing these three categories -

[12] APRA (2007), 'ADI housing lending', APRA Insight, Issue 1.

although estimation proceeds including the full set of variables. Exact definitions of all variables are given in the Appendix.

The mortgage costs variables, shown in Table 3, include the monthly ARM interest rate, the interest differential between SFRM and ARM mortgages, and the discount on the HM discussed above, bank fees, a dummy to represent large loans (over $500,000), the loan-to-value ratio (LTV) and the payment-to-income ratio (PTIR). We also include an interaction variable between the interest rate differential and the borrower's income.

Market conditions variables are also shown in Table 3. These include unemployment, inflation and housing inflation rates, the net assistance provided by Federal and State governments to first home buyers obtained from Dungey et al (2011). Consumer sentiment on housing market conditions is captured through changes in the dwelling index collected by Westpac-Melbourne Institute. To control for competition between lenders, given that we only have one bank provider, we include a dummy indicating whether the Bank was offering the lowest market interest rate for SFRM at time of application.

The borrower characteristics in our data set are particularly rich; see Tables 4-5. One group of variables concerns household structure and demographics and includes borrower age, gender, marital status, number of dependent children, and the presence of very young children. Loan servicing capacity is captured by income, expenditure, occupation and employment status, with additional information on their financial position provided by variables on net wealth, liquid assets and short term liabilities. Evidence of any ongoing relationship with the bank is captured by the number of years as a client and the number of current accounts and credit facilities. As a proxy for mobility we use a binary dummy to indicate whether the applicant will change post-code (suburb) from their address at time of mortgage application and the address of the new property.

5. Empirical Results

The baseline applicant is a 40-year-old single salary-earning male without a co-applicant, with no dependents, who is not a first-time homebuyer, with a loan under $500,000.

Tables 3 to 5 present the average marginal effects of the probit estimation. Column (1) presents results where the interest rate differential variables are the simple monthly averages of the interest rates reported by the bank. It is apparent that the spread between the SFRM and ARM (RATEDIFF) has a negative and significant coefficient, suggesting a preference for ARMs as they become relatively more expensive in the short term. This is clearly at odds with the existing literature. However, column (2) reports the results using interest rate differentials (RATEDIFF and Discount) built from the fitted rates from equations (3)-(4) and selectivity bias correction, which reverses this abnormal finding. For this reason, we concentrate our analysis on the results in column (2), but note that the marginal effects for most other variables are relatively unaffected by this change.

We proceed in the following sections to discuss the effect of mortgage cost variables and market conditions and separately, borrower characteristics. We emphasise that all estimations were conducted including all categories of variables simultaneously. Additionally, to test the relevance of the three different categories, we report specifications which include only mortgage cost variables, in column (3) of the tables, and only borrower characteristics in column (4) of the tables. (A specification including only market conditions has no explanatory power and is not reported separately.) It is apparent from these last two columns that each of these sets of variables plays a role – and that together they enrich the modeling specification. The $pseudo - R^2$ statistics reported at the bottom of Table 5, show the contribution of each group of variables is non-negligible. Thus, one would not wish to exclude borrower characteristics from empirical specifications of mortgage product choice.

5.1. Mortgage Cost and Market Condition Variables

In line with the existing literature, the results in Table 3 support the importance of the interest rate in mortgage choice. Here, a 100 basis point increase in the ARM interest rate decreases the probability of taking an ARM by 9.3 percent. For example, the predicted probability of taking an ARM when the prevailing ARM rate is 6.9 percent (as in June 2005) is 61 percent; while when the prevailing rate is 9 percent (as in August 2008) the predicted probability is 41 percent.

A widening range between the SFRM and the ARM (RATEDIFF) is expected

to increase the probability of ARM choice as this becomes the relatively cheaper product. This is reflected in our results, where an increase in the margin of the SFRM over the ARM of 100 basis points leads to a 52.9 percent increase in the probability of the household choosing an ARM product. Clearly households are very sensitive to relative interest rates in choosing their financing product. However, when we control for a potential non-linearity in the spread between SFRM and ARM related to income (RATEDIFF $\times$ Income), our results suggest that borrowers with higher income are a little less sensitive to a widening spread between the rates of these two contracts. The discount offered on a HM contract (Discount) is less important in magnitude, however it is statistically significant and has the expected sign. For a 100 basis point rise in the discount between an ARM and a HM there is a 4.1 percent fall in the probability of observing an ARM product choice.

Mortgage applicants are also sensitive to higher bank fees; higher bank fees are associated with greater probability of ARM choice. To contextualise this result, an increase of \$100 over the observed average bank fee of \$630 would result in the predicted probability of ARM to only rise from 57 percent to 60 percent. However, if the fee increases by \$1,000, the probability of observing an ARM increases from 57 percent to 86.5 percent.

Loans of greater than \$500,000 attract a further marginal increased probability of selecting an ARM of about 20 percent. To put this in Australian context, it is useful to know that the median (2006) house price in Sydney was \$470,000.[13]

Loan servicing ratios also affect mortgage choice. As repayment risk increases through higher loan-to-value ratios (LTV) and higher payment-to-income ratios (PTIR), households are less likely to choose an ARM over a CM. A LTV ratio below 80 percent attracts a 50 percent discount on Basel capital requirements on lenders. At very high LTV, say 100 percent, the probability of observing an ARM is 51 percent, but at 80 percent LTV the probability of observing an ARM is 55 percent. We return to the issue of LTVs in Section 6.

Table 3 also presents the coefficient estimates for the market conditions, W. Macroeconomic conditions are often included as controls in mortgage choice stud-

[13]ABS House Price Indexes: Eight Capital Cities, June 2013: Catalogue 6416.02.

ies, as they are presumed to provide information to both borrowers and lenders about expectations of future states of the economy. Commonly chosen indicators include the unemployment rate, house price inflation and the yield curve or inflation expectations; see for example Dhillon et al (1987), Piaella and Pazzola (2007), Amromin et al (2011), Erhmann and Ziegelmeyer (forthcoming).

Our results support the statistical significance of market conditions, although the effects are sometimes not large. For instance, although a one percentage point rise in the unemployment rate - representing increased income risk - decreases the probability of an ARM by over 6 percent, a one percentage point increase in the inflation rate - representing future interest rate risk - decreases the likelihood of ARM choice by only 1.1 percent.

Borrowers' response to potential home equity gains is strongly reflected in the increased probability of observing an ARM as consumer sentiment around a dwelling purchase derived from the Westpac-Melbourne Institute survey improves. An increase in this buying sentiment index increases the probability of taking an ARM by 21 percent; the incentive provided by potential capital gains may outweigh the savings from delayed repayments in a CM. This result dominates the effect of observed house price inflation.

Over the sample period the Australian government has provided a number of programs to boost home ownership for first home buyers (FHBs). Using the measure of net assistance from Dungey et al (2011) we find that increased support to FHBs leads to a small decrease in the probability of these borrowers taking an ARM in favour of a CM. This evidence is consistent with the hypothesis that this scheme attracts applicants with low deposits into the market.

Given that our data are provided by one major bank, albeit with national representation, we also control for whether this bank is offering the lowest SFRM interest rate in the market on the month of application. When the bank is offering the lowest interest rate on a SFRM contract relative to the other banks, borrowers are more likely to take a CM contract (we contend this is most likely a SFRM).

Our study excludes a number of interest rate control variables included in previous literature; in particular the spread between the long-term government

bond rate and short-term bill rate, and the central bank official target rate.[14] The ARM rate is closely related to the official short rate and the SFRM rate closely follows the market rate on the 3-year Australian Government bond.[15] As these rates have been used to construct the yield curve in Table 8, they are omitted from the probit specification.

5.2. Borrower Characteristics and Risk Categories

In our uniquely detailed and bank-verified data, we can identify significant effects of most borrower characteristics, which when classified into income, wealth and mobility risk groupings, provide evidence consistent with the existing theoretical literature. For example, studies such as Brueckner and Follain (1988) find evidence of mobility risk only, while Cocco (2013) and Ehrmann and Ziegehmeyer (forthcoming) find evidence of income risk only. Here, we find all risk categories are statistically relevant.[16] Tables 4 and 5 present our results for borrower characteristics.

Income risk is captured by 7 variables: real gross income level, the unemployment rate, self-employment status, marriage, presence of a co-borrower, occupational categories and age. The marginal effects of income, marriage, co-borrower and occupational category are individually quite small, as reported in column (2) of Table 4. The uncertainty associated with higher unemployment provides the largest effect –a 6.4 percent decrease in the probability of an ARM associated

[14]Dhillon et al (1987), Sa-Aadu and Sirmans (1995), Coulibaly and Li (2009) include the yield spread as an explanatory variable together with the interest rate spread. Koijen et al (2009) find that the yield spread is weakly related to the share of ARMs; note that the definition of ARM in Koijen et al (2009) for the US is equivalent to our definition of CM in Australia.

[15]We thank market participants and regulators for feedback on this point.

[16]Dhillon et al (1987) find some evidence of the negative effect of marital status and presence of a co-borrower on the probability of taking an ARM, contradictory to the expectation that a spouse or a co-borrower represents an additional income earner to spread the income risk in favour of an ARM. Brueckner and Follain (1988) find that higher income borrowers are more likely to take an ARM than lower income borrowers. Coulibaly and Li (2009) find that income volatility decreases the likelihood of taking an ARM while a college degree and mobility increases it. Paiella and Pozzolo (2007) find that only age, the presence of children and living expenditure can explain mortgage product choice from a set of fourteen variables representing borrower characteristics in Italy. Amromin et al (2011) find that income, college and youth are good determinants of mortgage choice. Cocco (2013) finds evidence for education, income growth and income risk for UK survey panel data.

with a one percentage point increase in the unemployment rate. Younger borrowers, who are at the beginning of their income life-cycle have a lower probability of choosing an ARM, despite potential (unmeasured) future income growth. Although the individual income risk variables have relatively small significant effects, combining them suggests that a higher income (2%) borrower, who has a professional occupation category (2.9%), is married (0.6%) and has a co-borrower (0.9%), and faces low unemployment risk (6.1%) will be 12.5 percent more likely to choose an ARM than the benchmark borrower, as theory predicts. In contrast, a young, single borrower with low income, no co-borrower, in an unskilled trade occupation, and in a high unemployment rate environment is over 14 percent more likely to take a CM product than the benchmark borrower.[17] Interestingly, status as either self-employed or a small business proprietor does not have a significant effect in the specification including *all* of the mortgage cost, market conditions and borrower characteristics –only when the estimation is performed using the restricted variable set of borrower characteristics alone are these effects significant, as shown in column (4) of the tables.

Although income risk may be low, *borrowing constraints* may be binding and restrict the contract choice. To capture borrowing constraints we consider real income level and age, living expenditure, mortgage payment-to-income ratio (PTIR) and presence of dependent children.[18] Our results show small, but statistically significant effects consistent with theory on borrowing constraints in the following ways. Younger applicants tend to choose a CM product, as do those with young children and those with higher living expenditure. While all individuals are sensitive to the interest rate differential between products, this is particularly evident for low income borrowers – the interaction term between $RATEDIFF$ and income level is significantly negative. As an exemplar of this category, we calculate that a borrower under 30 years old, with children under 5 years old, where their real

[17]This result seems to contrast with the conclusion in Cocco (2013), who finds that higher income risks decrease the probability of alternative mortgage products (AMPs). However, in Cocco (2013) AMPs are compared to principal repayment mortgages, while in our paper both CMs and ARMs are both principal repayment mortgages with different interest rate fixation.

[18]LaCava and Simon (2003) show that older borrowers, a large family size, renter status, unemployed status, females, disabled, low income level, low dwelling value, high income from government benefits and few credit cards result in a higher probability of cash-constraint.

gross monthly income is $1,000 lower than average, and monthly living expenses are $1,000 more than average, is 6.5 percent more likely to take a CM than an ARM. The most important of the influences they face in choosing their mortgage contract is seeking the lowest interest rate.

We use variables from both market conditions and borrower characteristics to capture *wealth risk*. High net wealth and liquid assets together with low short-term liabilities suggest that borrowers could repay the mortgage sooner and have lower default risk; these effects are statistically significant, but without economic impact. The presence of a co-borrower gives a bigger pool of wealth to the household, and decreases wealth risk; again the effect is relatively small. However, potential capital gains through housing exercise a relatively large impact. Borrowers expecting equity growth on their property are significantly more likely to hold the interest rate risk of an ARM in order to access the expected equity gain. (In the Australian market, borrowers who wish to upgrade to a new property by taking advantage of equity gain, face prepayment penalties in CM products as well as transaction costs.) Improvements in the household perception of the state of the housing market measured by the change in the dwelling index increase the probability of taking an ARM by 21 percent.

In line with existing results on *mobility risk*, applicants who are purchasing a property in a different postcode to their current address, whom we identify as more mobile, are 2.3 percent more likely to take an ARM. This result reflects that CMs have higher associated pre-payment penalties in Australia than ARMs.

A number of other interesting results are apparent. The literature suggests that females, older individuals and those with dependent children tend to be more risk averse; and these effects are supported in our results. Our model predicts that a female borrower with 2 children under 5 years old is 4.5 percent more likely to take a CM than a male borrower with no dependents. Moreover, females and first home buyers are usually less financially experienced. A female first time buyer is 4.7 percent more likely to take a CM than a repeated male buyer. We identify borrowers with several credit accounts and credit facilities, and who have a long history with the bank (5 more years), as potentially more financially sophisticated, and find that these effects operate to increase the probability of choosing an ARM product by 5.4 percent.

The results presented here are a powerful validation of the theoretically expected signs of borrower characteristics on mortgage choice. For the first time a relatively complete set of borrower characteristics has been available to examine mortgage product choice. This database has high quality income and household characteristic data and has not had to rely on imputed or survey data to describe the household. Nor, in the Australian market, are there institutional arrangements which interfere with our observation of the risk allocation between household and financial institution in mortgage transactions. The direct consequence has been that we are able to show that as anticipated; income risk increases the probability that the household will choose a product which reduces its exposure to payment variability, at least in the first part of the contract; mobility risk leads households to choose more flexible ARM products. The CM products help households manage their income and wealth risk, but also allow households to enter the housing market when they believe that potential rising house prices and rising inflation will result in a real wealth transfer from creditors to debtors.

6. Loan-to-valuation ratio (LTV)

Although there are many papers discussing the impact of Basel capital requirements on mortgage providers[19] we are not aware of previous direct evidence on the outcomes of these requirements for individual mortgage applicants. During the sample period Australian mortgages attracted a concessional risk weight of 50 percent when LTV was less than 80 percent, or 60 percent for low-doc loans. Loans which did not meet these criteria only qualified for the capital requirement discount if they were fully insured – which in the Australian context requires the loan applicant to take a private insurance contract which pays directly to the bank in the event of default. While our database does not specifically distinguish low-doc loans, Figure 1 reveals the bimodal distribution of the LTV data for the contract applications, precisely around the 60 and 80 percent Basel capital cut-off points; a third mode occurs at 95 percent.

LTV ratios at origination are known to be associated with higher default risk for the lender; see Von Furstenberg (1969), Vandell (1978), and Qi and Yang

[19] See Calem and LaCour-Little (2004) and Allen (2004).

(2009). Campbell and Dietrich (1983) and Calem and LaCour-Little (2004) find this is less important than the current LTV ratio, and indeed that initial LTV may be negatively associated with default risk. In addition, there is some evidence of endogeneity for LTV with respect to borrowers' income and wealth in the Netherlands in Cunha et al (2013).

We repeat our investigation of mortgage choice distinguishing three subsamples of LTVs: LTV$\leq$ 60%, 60%<LTV$\leq$ 80%, and LTV>80%. Tables 6-8 report the results for these sub-samples. As might be expected borrowers with LTVs greater than 80 percent are more sensitive to the effect of interest rates than those with lower LTV ratios. The largest difference occurs in response to the differential between the SFRM and ARM interest rates (RATEDFIFF). High LTV borrowers are almost 80 percent more likely to take an ARM when SFRMs become relatively more expensive, while low LTV borrowers are only 30 percent more likely to take an ARM under this scenario. Recall, however, that in each of the categories the comparisons of effects are now relative to the benchmark 40 year old, single salary earning male borrower, with no co-applicant and no-coborrower who is not buying his first property, with a loan of under A$500,000 and in the same LTV category.

Married applicants, or those with co-borrowers, are more likely to take an ARM for a low LTV loan, but more likely to take a CM with a high LTV relative to their respective benchmarks. This result suggests that borrowers with low default risk (low LTV) may be more prepared to bear the interest rate risk of an ARM when they can combine their income with other income earners. Skilled- and unskilled-trade borrowers are more likely to prefer CMs when facing large LTVs. More mobile borrowers are likely to take an ARM if their LTV is very high, however the mobility motive is not a relevant factor in mortgage type choice for borrowers with low LTV who enjoy higher house equity. Borrowers with current high LTVs may be willing to bear the interest rate risk of ARMs, consistent with the strong, almost 20 percent increase in probability of taking an ARM for all groups in the face of perceived good buying conditions as indicated by the change in the Melbourne Institute Dwelling Index.

The examplar households from the previous section illustrate the effect of the LTV categories on the role of borrower characteristics in mortgage choice. In the full sample results, a higher income borrower, from a professional occupation

category, who is married with a co-borrower and faces low unemployment risk was 12.5 percent more likely to choose an ARM than the benchmark. However, once we adjust for LTV category – which means that the benchmark borrower is also in that LTV category – borrowers with low LTV are 15.8 percent more likely to choose an ARM than the benchmark borrower in their LTV category. In the over 80 percent LTV category, they are only 7.1 percent more likely to choose an ARM than the average borrower with a greater than 80 percent LTV. The second exemplar is a borrower under 30 years old, with children under 5 years old and gross monthly income $1,000 lower than average and living expenses $1,000 higher than average who was 6.5 percent less likely to choose an ARM than the sample benchmark applicant. When compared with the benchmark borrower in the low, less than 60 percent LTV category, these borrowers are almost 10 percent less likely to choose an ARM product, but this drops to only 3.5 percent less likely in the over 80 percent LTV category.

The results of this section show that we can identify, by their borrower characteristics, a group of applicants, who when faced with high LTV loans prefer CMs in order to lower their risk exposure. Other borrowers with high LTVs may be prepared to hold more risk; this group includes particularly young borrowers and first home buyers. The results highlight the potential importance of LTV, and its relationship with prudential capital rules. While the borrowers may be unaware of it, the prudential regulations around capital requirements on lenders, are demonstrably interacting with the borrower characteristics in influencing mortgage product choice.

7. Robustness

The results presented in this paper are robust against an extensive set of alternative specifications. We calculated the average interest rate on contracts using daily rather than monthly data, we used the market spreads between interest rates on these products rather than those reported by the bank. We have investigated the role of other non-reported explanatory variables such as: the Reserve Bank of Australia target interest rate, yield spread between long- and short-term bonds/bills, expected inflation, monthly real mortgage repayments, age as a continuous variable, experience represented by quadratic age, net real monthly income,

time at current and previous address, time at current and previous employment. State levels of unemployment, inflation and housing price inflation did not provide further information than the national levels. A hybrid log and level specification, using log transformations for real wealth variables, or a log specification for all real monetary values, were also qualitatively the same. Finally, we find that market condition variables are more informative than simply substituting for these with yearly or monthly dummies for fixed time effects.

Our preferred specification –column (2) in Tables 3-5 – predicts correctly 65.21 percent of the cases. The sensitivity (probability of predicting an ARM on borrowers who take an ARM) is 80.36 percent, while the specificity (probability of predicting a CM on borrowers who take a CM) is 43.85 percent. We checked the consistency of our preferred specification by estimating the probability of taking a CM rather than an ARM, used both Probit and Logit, and we obtain qualitatively similar results.

In summary, subject to this wide-range of robustness checks, the results of the paper are maintained. Borrower characteristics are significant explanators of mortgage choice. Importantly, the prudential regulatory capital requirements on LTV ratios resulting from Basel II are shown to have a significant influence on the role borrower characteristics play in influencing household mortgage choice.

8. Conclusion

Borrower characteristics should proxy for the risk profiles of mortgage applicants - in theory divining income, wealth and mobility risk from observable features. Existing empirical evidence for this, however, is mixed and inconclusive. In a unique proprietary dataset for an economy where banks fund the majority of mortgages and this debt is held on-balance-sheet, we now produce evidence completely aligned with theoretical predictions about the impact of borrower characteristics on mortgage product choice. Our Australian database consists of verified financial and demographic information on over half-a-million mortgage applications for ARM and CM products.

CM products lie between the ARM and the standard long-term FRM most often considered in the literature - but which do not exist in Australia. CMs offer

delayed repayments and attract borrowers seeking lower short-run payment commitments. We find the effects anticipated in the theoretical literature, but rarely empirically confirmed; borrowers facing income risk and wealth risk are more likely to choose products which reduce their initial repayments, that is CMs. In contrast, those facing mobility risk are more likely to choose an ARM. While these borrower effects are significant, we confirm the findings elsewhere that mortgage costs are the dominant determinant of product choice. So, a typical young borrower, with dependents and high expenditure have increased probability of choosing a CM, whereas an older, higher income borrower with evidence of job mobility has increased probability of choosing an ARM.

Even more strikingly, we are able to exploit the effects of the LTV ratios defined by Basel capital adequacy requirements which particularly affect lenders who retain mortgage debt on-balance-sheet. Mortgages with LTV of below 80 percent (and 60 percent for low doc contracts) attract a 50 percent discount on Basel capital requirements, and the LTVs in our database are bi-modally distributed around these thresholds.

High LTV borrowers are even more likely to seek the lowest interest rate product than the benchmark applicant. However, the mobility motive for seeking an ARM remains dominant, even when the applicant faces a high LTV. Income risk also interacts with the extent of LTV – married, high income, professional applicants in a low unemployment environment with a co-borrower who have low LTV opt for ARM products, whilst the same applicant with high LTV prefers a CM.

In Australia, where long-term FRMs are non-existent and the securitization market is not facilitated by GSEs, banks cannot redistribute mortgage debt risk to other investors. Therefore, when making a loan decision, the bank will consider the distribution of both the interest rate risk and the credit risk between the borrower and the lender. Consider for example a potentially vulnerable group; first home borrowers with high living expenses and low income. Those with low LTV choose CM products, reducing their repayments in the short-term – and represent high interest rate risk but low credit risk for the bank. However, those with high LTV, where the bank faces higher credit risk, take ARM products and bear the interest rate risk themselves.

We conclude that the mortgage type chosen and the LTV agreed behave as

non-rate terms in mortgage contracts to discriminate and account for credit and prepayment risk variability across borrowers. We intend to extend this line of research in future work.

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[1] Agnew, J.R., Anderson, L.R., Gerlach, J.R., Szykman, L.R., 2008. Who Chooses Annuities? An Experimental Investigation of the Role of Gender, Framing, and Defaults. The American Economic Review 98, 418-422.

[2] Allen, L., 2004. The Basel Capital Accords and International Mortgage Markets: A Survey of the Literature. Financial Markets, Institutions and Instruments 13, 41-108.

[3] Amromin, G., Huang, J., Sialm, C., Zhong, E., 2011. Complex Mortgages (No. w17315). National Bureau of Economic Research.

[4] Badarinza, C., Campbell, J., Ramadorai, T., 2013. What Calls to ARMs? International Evidence on Interest Rates and the Choice of Adjustable Rate Mortgages. Available at SSRN: http://ssrn.com/abstract=2273430orhttp://dx.doi.org/10.2139/ssrn.2273430.

[5] Barber, B.M., Odean, T., 2001. Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment. The Quarterly Journal of Economics 116, 261-292.

[6] Bellante, D., Saba, R.P., 1986. Human Capital and Life-cycle Effects on Risk Aversion. Journal of Financial Research 9, 41-51.

[7] Bernasek, A., Shwiff, S., 2001. Gender, Risk, and Retirement. Journal of Economic Issues 35, 345-356.

[8] Borghans, L., Heckman, J.J., Golsteyn, B.H., Meijers, H., 2009. Gender Differences in Risk Aversion and Ambiguity Aversion. Journal of European Economic Association 7, 649-658.

[9] Bourassa, S., 1995. A Model of Housing Tenure Choice in Australia. Journal of Urban Economics 37, 161-175.

[10] Brueckner, J.K., Follain, J.R., 1988. The Rise And Fall of the ARM: An Econometric Analysis of Mortgage Choice. The Review of Economics and Statistics 70, 93-102.

[11] Brueckner, J.K., Calem, P.S., Nakamura, L.I., 2013. House-price Expectations, Alternative Mortgage Products, and Default. Federal Reserve Bank of Philadelphia Working Paper No.2013-36.

[12] Calem, P.S., LaCour-Little, M., 2004. Risk-based Capital Requirements for Mortgage Loans. Journal of Banking and Finance 28, 647-672.

[13] Calza, A., Stracca, L., Monacelli, T., 2013. Housing Finance and Monetary Policy. Journal of the European Economic Association 11, 101-122.

[14] Campbell, J.Y., 2013. Mortgage Market Design. Review of Finance 17, 1-33.

[15] Campbell, J.Y., Cocco, J.F., 2003. Household Risk Management and Optimal Mortgage Choice. The Quarterly Journal of Economics 99, 1449-1494.

[16] Campbell, T.S., Dietrich, J.K., 1983. The Determinants of Default on Insured Conventional Residential Mortgage Loans. The Journal of Finance 38, 1569-1581.

[17] Cocco, J.F., 2013. Evidence on the Benefits of Alternative Mortgage Products. The Journal of Finance 68, 1663-1690.

[18] Coulibaly, B., Li, G., 2009. Choice of Mortgage Contracts: Evidence from the Survey of Consumer Finances. Real Estate Economics 37, 659-673.

[19] Cunha, M.R., Lambrecht, B., Pawlina, G., 2013. Determinants of Outstanding Mortgage Loan to Value Ratios: Evidence from the Netherlands. EFA 2009 Bergen Meetings Paper. Available at SSRN: http://ssrn.com/abstract=1107822orhttp://dx.doi.org/10.2139/ssrn.1107822.

[20] Davies, M., 2009. Household Debt in Australia. Bank for International Settlements BIS Paper No.46, Household Debt: Implications for Monetary Policy and Financial Stability, 19-30.

[21] Deakin, J., Aitken, M., Robbins, T., Sahakian, B.J., 2004. Risk Taking During Decision-making in Normal Volunteers Changes With Age. Journal of International Neuropsychological Society 10, 590-598.

[22] Debelle, G., 2008. A Comparison of the US and Australian Housing Markets. Reserve Bank of Australia Bulletin June, 35-46.

[23] Debelle, G., 2009. Whither Securitisation?. Reserve Bank of Australia, Address to the Australian Securitisation Conference, Sydney, 18 November 2009.

[24] Debelle, G., 2010. The State of the Mortgage Market. Reserve Bank of Australia, Address to Mortgage Innovation Conference, Sydney, 30 March 2010.

[25] Dhillon, U.S., Shilling, J.D., Sirmans, C.F., 1987. Choosing Between Fixed and Adjustable Rate Mortgages: Note. Journal of Money, Credit and Banking 19, 260-267.

[26] Dungey, M., Wells, G., Thompson, S., 2011. First Home Buyer's Support Schemes in Australia. Australian Economic Review 44, 468-479.

[27] Ehrmann, M., Ziegelmeyer, M., Forthcoming. Household Risk Management and Actual Mortgage Choice in the Euro Area. European Central Bank Working Paper.

[28] Fortowsky, E., LaCour-Little, M., Rosenblatt, E., Yao, V., 2011. Housing Tenure and Mortgage Choice. The Journal of Real Estate Finance and Economics 42, 162-180.

[29] Frame, W.S., White, L.J., 2005. Fussing and Fuming Over Fannie and Freddie: How Much Smoke, How Much Fire?. The Journal of Economic Perspectives 19, 159-184.

[30] Gabriel, S.A., Rosenthal, S.S., Forthcoming. The Boom, the Bust, and the Future of Homeownership. Real Estate Economics.

[31] Green, R.K., Wachter, S.M., 2005. The American Mortgage in Historical and International Context. The Journal of Economic Perspectives 19, 93-114.

[32] Kohler, M., Rossiter, A., 2005. Property Owners in Australia: A Snapshot. Reserve Bank of Australia Discussion Paper No.2005-03.

[33] Koijen, R.S.J., Van Hermet, O., Van Nieuwerburgh, S., 2009. Mortgage Timing. Journal of Financial Economics 93, 292-324.

[34] LaCour-Little, M., Yang, J., 2010. Pay Me Now Or Pay Me Later: Alternative Mortgage Products and the Mortgage Crisis. Real Estate Economics 38, 687-732.

[35] La Cava, G., Simon, J., 2003. A Tale of Two Surveys: Household Debt and Financial Constraints in Australia. Reserve Bank of Australia Discussion Paper No.2003-08.

[36] Landier, A., Sraer, D., Thesmar, D., 2013. Banks Exposure to Interest Rate Risk and the Transmission of Monetary Policy (No. w18857). National Bureau of Economic Research.

[37] Lea, M., 2010(a). International Comparison of Mortgage Product Offerings. Research Institute for Housing America. Available at SSRN: http://ssrn.com/abstract=1683472orhttp://dx.doi.org/10.2139/ssrn.1683472.

[38] Lea, M., 2010(b). Alternative Forms of Mortgage Finance: What Can We Learn From Other Countries?. 46th Annual AREUEA Conference Paper. Available at SSRN: http://ssrn.com/abstract=1717114.

[39] Lee, L., Trost, R.P., 1978. Estimation of Some Limited Dependent Variable Models with Application to Housing Demand. Journal of Econometrics 8, 357-382.

[40] Miles, D., 2004. The UK Mortgage Market: Taking a Longer-term View. HM Treasury, London, UK.

[41] Miles, D., 2005. Incentives Information and Efficiency in the UK Mortgage Market. The Economic Journal 115, 82-98.

[42] Morin, R., Fernandez Suarez, A., 1983. Risk Aversion Revisited. The Journal of Finance 38, 1201-1216.

[43] Paiella, M., Pozzolo, A.F., 2007. Choosing Between Fixed and Adjustable Rate Mortgages. University of Molise, Dept. SEGeS, Economics and Statistics Discussion Papers. Available at SSRN: http://ssrn.com/abstract=976346orhttp://dx.doi.org/10.2139/ssrn.976346.

[44] Qi, M., Yang, X., 2009. Loss Given Default of High Loan-to-value Residential Mortgages. Journal of Banking and Finance 33, 788-799.

[45] Riley, W.B., Chow, V.K., 1992. Asset Allocation and Individual Risk Aversion. Financial Analysts Journal 48, 32-37.

[46] Rosenthal, S.S., Zorn, P., 1993. Household Mobility, Asymmetric Information, and the Pricing of Mortgage Contract Rates. Journal of Urban Economics 33, 235-253.

[47] Sa-Aadu, J., Sirmans, C.F., 1995. Differentiated Contracts, Heterogeneous Borrowers, and the Mortgage Choice Decision. Journal of Money, Credit and Banking 27, 498-510.

[48] Sapienza, P., Zingales, L., Maestripieri, D., Heckman, J.J., 2009. Gender Differences in Financial Risk Aversion and Career Choices Are Affected by Testosterone. Proceedings of the National Academy of Sciences of the United States of America 106, 15268-15273.

[49] Scanlon, K., Lunde, J., Whitehead,C., 2008. Mortgage Product Innovation in Advanced Economies: More Choice, More Risk. European Journal of Housing Policy 8, 109-131.

[50] Schubert, R., Brown, M., Gysler, M., Brachinger, H.W., 1999. Financial Decision-making: Are Women Really More Risk-averse?. The American Economic Review 89, 381-385.

[51] Vandell, K.D., 1978. Default Risk Under Alternative Mortgage Instruments. The Journal of Finance 33, 1279-1296.

[52] Von Furstenberg, G.M., 1969. Default Risk on FHA-insured Home Mortgages as a Function of the Terms of Financing: A Quantitative Analysis. The Journal of Finance 24, 459-477.

[53] Warnock, V.C., Warnock, F.E., 2008. Markets and Housing Finance. Journal of Housing Economics 17, 239-251.

[54] Watson, J., McNaughton, M., 2007. Gender Differences in Risk Aversion and Expected Retirement Benefits. Financial Analyst Journal 63, 52-62.

[55] Yamashita, T., 2007. House Price Appreciation, Liquidity Constraints, and Second Mortgages. Journal of Urban Economics 62, 424-440.

Figure 1: Distribution of loan-to-valuation ratios (LTVs).

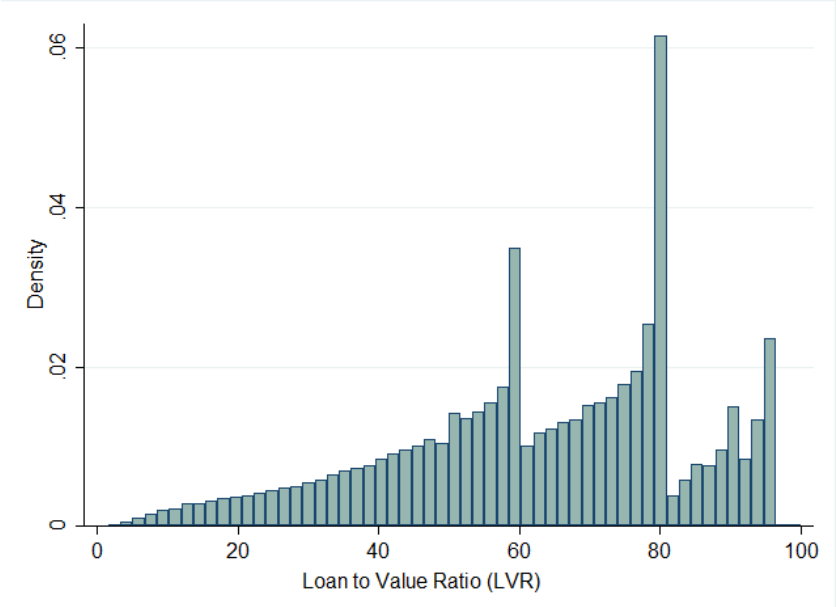

Table 1: Summary Statistics by Mortgage Type: Medians and Standard Deviations Jan 2003 - Aug 2008. All monetary values are in 2006 Q1 $A.

Variable	CM	ARM
Loan Amount	$160323	$204794
	(95079)	(149846)
Repayment (monthly)	$1069	$1205
	(697)	(1008)
Mortgage interest rate	6.85%	7.07%
	(0.92)	(0.74)
Bank fee	$621	$640
	(159)	(161)
Debt service ratio	42.25%	45.11%
	(15.51)	(18.30)
Loan-to-value ratio	67.32%	64.83%
	(20.29)	(21.27)
Loan-to-income ratio	2.59	2.57
	(1.42)	(1.65)
Payment-to-income ratio	6.80%	7.60%
	(14.33)	(15.83)
Age	38	39
	(10.49)	(10.45)
Gross Monthly Income	$5311	$6707
	(3030)	(3760)
H'hold Surplus	$246635	$325787
	(289396)	(357652)
Liquid Assets	$13906	$21990
	(67096)	(86296)
Short-term Liabilities	$847	$1081
	(8670)	(9334)
Living Expenditure	$1213	$1265
	(616)	(605)
Years with bank	6	8
	(6.63)	(6.89)
N	194039	275798

Table 2: Interest Rate Regressions [standard errors]

	$RATE^{ARM}$	$RATE^{HM}$	$RATE^{SFRM}$
90-day Bank Bill	0.04***	0.03***	0.14***
	[0.005]	[0.008]	[0.009]
3-month OIS	1.16***	1.47***	0.82***
	[0.007]	[0.012]	[0.015]
3-month Term Deposit	0.02***	0.05***	-0.03***
	[0.002]	[0.003]	[0.003]
3-year Term Deposit	0.10***	-0.24***	0.27***
	[0.006]	[0.010]	[0.013]
3-year Aus Gov Bond	-0.52***	-0.49***	-0.21***
	[0.004]	[0.006]	[0.007]
Credit Score	0.00***	-0.00***	0.00***
	[0.000]	[0.000]	[0.000]
Selectivity Bias	0.50***	0.19***	-0.08***
	[0.003]	[0.005]	[0.003]
State Dummies	Yes	Yes	Yes
Constant	2.12***	1.59***	1.49***
	[0.015]	[0.027]	[0.030]
N	267730	105629	84355
R^2	0.8287	0.8671	0.8703

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. This table reports OLS estimations for monthly interest rates by type of mortgage contract following the two-stage process with selectivity bias correction described in Section 3.

Table 3: Average Partial Effects for Mortgage Cost and Market Condition Variables [standard errors]

	$Pr(ARM = 1)$			
	(1)	(2)	(3)	(4)
ARM interest rate	-0.074***	-0.091***	-0.100***	
	[0.003]	[0.003]	[0.002]	
RATEDIFF ($R^{SFRM} - R^{ARM}$)	-0.126***	0.531***	0.667***	
	[0.010]	[0.015]	[0.014]	
RATEDIFF × Income	-0.015***	-0.073***	-0.065***	
	[0.001]	[0.002]	[0.002]	
Discount ($R^{ARM} - R^{HM}$)	-0.091***	-0.042***	-0.384***	
	[0.019]	[0.010]	[0.006]	
Bank Fee (A$1000)	0.387***	0.348***	0.229***	
	[0.005]	[0.007]	[0.005]	
Loan > A500000	0.162***	0.201***	0.218***	
	[0.006]	[0.006]	[0.006]	
Loan-to-value ratio (LTV)	-0.002***	-0.002***	-0.001***	
	[0.000]	[0.000]	[0.000]	
Payment-to-income ratio (PTIR)	-0.002***	-0.002***	0.000***	
	[0.000]	[0.000]	[0.000]	
Unemployment rate	-0.007	-0.061***		
	[0.005]	[0.004]		
Inflation rate	-0.001	-0.011***		
	[0.002]	[0.002]		
Housing Inflation rate	0.023***	0.005*		
	[0.002]	[0.002]		
Dwelling Index Change	0.236***	0.210***		
	[0.006]	[0.006]		
Net Assistance FHBs	-0.002	-0.005***		
	[0.001]	[0.001]		
Lowest Competing SFRM rate	-0.005	-0.011*		
	[0.004]	[0.004]		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table reports only average partial effects for X and W variables. Specification (1) uses monthly average rate differentials in $RATEDIFF$ and $Discount$, while specification (2) uses the fitted rate differentials corrected for selectivity bias in $RATEDIFF$ and $Discount$. Specification (3) only includes mortgage cost variables, while specification (4) only includes borrower characteristics variables and thus has no entries in this table.

Table 4: Average Partial Effects for Borrower Characteristics Variables [standard errors]

	$Pr(ARM = 1)$			
	(1)	(2)	(3)	(4)
Age $<$ 30 yrs.	-0.031***	-0.028***		-0.043***
	[0.002]	[0.003]		[0.002]
Age 30-40 yrs.	-0.005**	-0.006**		-0.006**
	[0.002]	[0.002]		[0.002]
Age 50-60 yrs.	0.009***	0.009***		0.006*
	[0.002]	[0.002]		[0.002]
Age $\geq$ 60 yrs.	0.027***	0.027***		0.023***
	[0.004]	[0.004]		[0.004]
Female	-0.026***	-0.021***		-0.028***
	[0.002]	[0.002]		[0.002]
Married	0.008***	0.006**		0.012***
	[0.002]	[0.002]		[0.002]
Dependent $\leq$ 5 yrs.	-0.011***	-0.008***		-0.006**
	[0.002]	[0.002]		[0.002]
No. Dependents	-0.009***	-0.008***		-0.010***
	[0.001]	[0.001]		[0.001]
Co-Borrower	0.021***	0.009***		0.014***
	[0.002]	[0.002]		[0.002]
First-home buyer (FHB)	0.019***	0.026***		0.008**
	[0.003]	[0.003]		[0.003]
Self-employed	0.001	0.004		0.012***
	[0.002]	[0.002]		[0.002]
Mobility (pc)	0.025***	0.023***		0.033***
	[0.002]	[0.002]		[0.002]
Gross Monthly Income (A$1000)	0.022***	0.020***		0.023***
	[0.000]	[0.000]		[0.000]
Living Expenditure (A$1000)	-0.007***	-0.009***		-0.012***
	[0.001]	[0.001]		[0.001]
Small Business Proprietor	-0.004	-0.004		-0.008*
	[0.003]	[0.003]		[0.003]

Standard errors in brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table reports only average partial effects for mortgage cost variables Z. Specification (1) uses monthly average rate differentials in $RATEDIFF$ and $Discount$, while specification (2) uses the fitted rate differentials corrected for selectivity bias in $RATEDIFF$ and $Discount$. Specification (3) only includes mortgage cost variables and thus has no entries in this table, while specification (4) only includes borrower characteristics variables.

Table 5: Average Partial Effects for Borrower Characteristics Variables [standard errors]

	$Pr(ARM = 1)$			
	(1)	(2)	(3)	(4)
Professional	0.032***	0.029***		0.035***
	[0.002]	[0.002]		[0.002]
Office	-0.005	-0.002		-0.011***
	[0.003]	[0.003]		[0.003]
Service	-0.044***	-0.034***		-0.049***
	[0.003]	[0.003]		[0.003]
Skill trade	-0.022***	-0.020***		-0.031***
	[0.002]	[0.002]		[0.002]
Unskilled trade	-0.042***	-0.035***		-0.064***
	[0.003]	[0.003]		[0.003]
Agriculture	-0.043***	-0.031***		-0.085***
	[0.008]	[0.008]		[0.008]
Unemployed	0.016***	0.025***		0.022***
	[0.003]	[0.003]		[0.003]
Net wealth (A$10000)	0.000	0.000*		0.000***
	[0.000]	[0.000]		[0.000]
Liquid Assets (A$10000)	0.000***	0.000***		0.000***
	[0.000]	[0.000]		[0.000]
Short-term Liabilities (A$10000)	-0.000***	-0.000***		-0.000***
	[0.000]	[0.000]		[0.000]
Time with Bank (yrs.)	0.005***	0.004***		0.004***
	[0.000]	[0.000]		[0.000]
No. Credit Accounts	-0.011***	0.020***		0.007***
	[0.001]	[0.001]		[0.001]
No. Credit Facilities	0.018***	0.014***		0.021***
	[0.001]	[0.001]		[0.001]
Sate dummies	Yes	No	No	No
N	457580	457714	457714	469826
$Pseudo - R^2$	0.0752	0.0737	0.0630	0.0456

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table reports only average partial effects for mortgage cost variables Z. Specification (1) uses monthly average rate differentials in $RATEDIFF$ and $Discount$, while specification (2) uses the fitted rate differentials corrected for selectivity bias in $RATEDIFF$ and $Discount$. Specification (3) only includes mortgage cost variables and thus has no entries in this table, while specification (4) only includes borrower characteristics variables.

Table 6: Average Partial Effects for Mortgage Costs and Market Conditions Variables: LTV sub-samples [standard errors]

	$Pr(ARM = 1)$		
	$LTV \leq 60\%$	$60\% < LTV \leq 80\%$	$LTV > 80\%$
ARM interest rate	-0.079***	-0.091***	-0.126***
	[0.004]	[0.004]	[0.007]
RATEDIFF ($R^{SFRM} - R^{ARM}$)	0.307***	0.597***	0.794***
	[0.023]	[0.023]	[0.040]
RATEDIFF × Income	-0.047***	-0.079***	-0.104***
	[0.003]	[0.003]	[0.005]
Discount	0.067***	-0.086***	-0.108***
	[0.015]	[0.015]	[0.024]
Bank Fee (A$1000)	0.444***	0.313***	0.275***
	[0.011]	[0.010]	[0.017]
Loan > A$500000	0.207***	0.174***	0.171***
	[0.012]	[0.008]	[0.016]
Loan-to-value ratio (LTV)	-0.004***	0.000*	-0.001**
	[0.000]	[0.000]	[0.000]
Payment-to-income ratio (PTIR)	-0.002***	-0.002***	-0.001***
	[0.000]	[0.000]	[0.000]
Unemployment rate	-0.074***	-0.063***	-0.047***
	[0.006]	[0.006]	[0.010]
Inflation rate	-0.011***	-0.011***	-0.011**
	[0.003]	[0.003]	[0.004]
Housing Inflation rate	-0.008**	0.010***	0.018***
	[0.003]	[0.003]	[0.005]
Dwelling Index Change	0.212***	0.218***	0.199***
	[0.010]	[0.009]	[0.016]
Net Assistance FHBs	-0.002***	-0.002***	-0.002
	[0.001]	[0.001]	[0.001]
Lowest Competing SFRM rate	-0.015*	-0.011	-0.003
	[0.007]	[0.007]	[0.011]

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table only reports average partial effects for mortgage cost variables X.

Table 7: Average Partial Effects for Borrower Characteristics Variables: LTV subsamples [standard errors]

	$Pr(ARM = 1)$		
	$LTV \leq 60\%$	$60\% < LTV \leq 80\%$	$LTV > 80\%$
Age $<$ 30 yrs.	-0.049***	-0.023***	-0.012*
	[0.005]	[0.004]	[0.006]
Age 30-39 yrs.	-0.013***	-0.002	-0.004
	[0.003]	[0.003]	[0.005]
Age 50-59 yrs.	0.008**	0.005	-0.006
	[0.003]	[0.004]	[0.009]
Age $\geq$ 60 yrs.	0.022***	0.007	-0.026
	[0.005]	[0.008]	[0.023]
Female	-0.025***	-0.016***	-0.018***
	[0.003]	[0.003]	[0.004]
Married	0.015***	0.003	-0.012**
	[0.003]	[0.003]	[0.004]
Dependent $\leq$ 5 yrs.	-0.007*	-0.002	-0.010
	[0.003]	[0.003]	[0.006]
No. Dependents	-0.009***	-0.007***	0.001
	[0.001]	[0.001]	[0.003]
Co-Borrower	0.021***	0.005	-0.017***
	[0.003]	[0.003]	[0.005]
First-home buyer (FHB)	-0.019**	0.001	0.032***
	[0.006]	[0.004]	[0.004]
Mobility (pc)	0.000	0.022***	0.047***
	[0.003]	[0.003]	[0.004]
Self-employed	-0.005	0.014***	0.028**
	[0.003]	[0.004]	[0.010]
Gross Monthly Income (A$1000)	0.022***	0.017***	0.022***
	[0.001]	[0.001]	[0.001]
Living Expenditure (A$1000)	-0.020***	-0.005*	0.008*
	[0.002]	[0.002]	[0.004]
Small Business Proprietor	0.004	-0.003	-0.000
	[0.005]	[0.006]	[0.015]

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table only reports average partial effects for borrower characteristics variables Z.

Table 8: Average Partial Effects for Borrower Characteristics Variables: LTV subsamples (continued) [standard errors].

	$Pr(ARM = 1)$		
	$LTV \leq 60\%$	$60\% < LTV \leq 80\%$	$LTV > 80\%$
Professional	0.026***	0.031***	0.017***
	[0.004]	[0.003]	[0.005]
Office	0.005	-0.005	-0.007
	[0.004]	[0.004]	[0.007]
Service	-0.028***	-0.035***	-0.038***
	[0.005]	[0.005]	[0.008]
Skill Trade	-0.010*	-0.016***	-0.031***
	[0.004]	[0.003]	[0.005]
Unskilled Trade	-0.017***	-0.036***	-0.050***
	[0.004]	[0.004]	[0.006]
Agriculture	-0.018	-0.047***	-0.015
	[0.011]	[0.013]	[0.023]
Unemployed	0.026***	0.014*	0.020
	[0.004]	[0.006]	[0.014]
Net wealth (A$10000)	0.000***	0.000***	-0.000***
	[0.000]	[0.000]	[0.000]
Liquid Assets (A$10000)	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]
Short-term Liabilities (A$10000)	-0.000***	-0.000***	0.000
	[0.000]	[0.000]	[0.000]
Time with Bank (yrs.)	0.006***	0.003***	0.000
	[0.000]	[0.000]	[0.000]
No. Credit Accounts	0.014***	0.025***	0.026***
	[0.002]	[0.002]	[0.003]
No. Credit Facilities	0.013***	0.010***	0.028***
	[0.002]	[0.002]	[0.004]
N	189855	75211	75211
$Pseudo - R^2$	0.0615	0.0972	0.0713

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note. All values are in 2006 Q1 $A. Estimations include the complete set of explanatory variables: mortgage costs X, market conditions W, and borrower characteristics Z. This table only reports average partial effects for borrower characteristics variables Z.

A.1 Definitions of Mortgage Cost and Market Condition Variables

Variable	Description
ARM interest rate	Monthly average ARM interest rate reported by the bank.
RATEDIFF ($R^{SFRM} - R^{ARM}$)	In specification (1) is the difference between the monthly average interest rates for SFRM and ARM reported by the bank. In specifications (2), (3) and (4) is the difference between the fitted interest rates for SFRM and ARM corrected for selectivity bias with the inverse Mills ratio.
RATEDIFF × Income	RATEDIFF ($R^{SFRM} - R^{ARM}$) as previously defined interacted with the main applicant's real monthly gross income.
Discount ($R^{ARM} - R^{HM}$)	In specification (1) is the difference between the monthly average interest rates for ARM and HM reported by the bank. In specifications (2), (3) and (4) is the difference between the fitted interest rates for ARM and HM corrected for selectivity bias with the inverse Mills ratio.
Bank Fee (A$'000s)	Real bank fees as reported by the bank at application,
Loan > A$500000	Dummy=1 when real loan amount is greater than $A500,000.
LVR	Loan-to-value ratio (%).
PTIR	Payment-to-income ratio (%). Monthly mortgage payments to monthly net income.
Unemployment rate	Monthly unemployment rate reported by the ABS Cat. No. 6202.0 G7 Labour Force, unemployed persons as a percentage of labour force.
Inflation rate	Monthly inflation rate calculated from quarterly CPI reported by the ABS Cat. No. 6401.0 G1.
Housing inflation rate	Monthly housing inflation rate from ABS Cat No 6401.0 G1
Dwelling Index Change	Percentage change in the dwelling index reported by the Westpac-Melbourne Institute Survey on Consumer Sentiment. This index tracks responses on 'whether now is a good time to buy a dwelling'.
Net Assistance FHBs	Regional net government assistance for first home buyers (FHBs) of existing dwellings as a proportion of the regional median house price, from Dungey et al (2011).
Lowest Competing SFRM rate	Dummy=1 when the fixed interest rate offered by the bank is lower than competing 3-year fixed rates offered by other lending institutions.

Note. Observations falling into a particular quarter are matched to the relevant quarterly data. All monetary values are expressed in 2006Q1 A$.

A.2 Definitions of Borrower Characteristic Variables

Variable	Description
Age $<$ 30 yrs	Dummy = 1 main borrower is under 30 yrs. old;
Age 30-40 yrs	Dummy = 1 main borrower is at least 30 and under 40 yrs;
Age 40-50 yrs	Dummy = 1 main borrower is at least 40 and under 50 yrs;
Age 50-60 yrs	Dummy = 1 main borrower is at least 50 and under 60 yrs.;
Age $\geq$ 60 yrs	Dummy = 1 when main borrower is at least 60 yrs.
Female	Dummy = 1 if the main borrower is female.
Married	Dummy = 1 if main borrower is married or defacto status
Dependent $\leq$ 5 yrs.	Dummy = 1 if youngest dependent under 5 years old.
No. Dependents	Number of dependents as reported by main borrower.
Co-Borrower	Dummy = 1 if there are joint borrowers.
First-home buyer (FHB)	Dummy = 1 if the main borrower is a first time buyer.
Mobility	Dummy = 1 if the main borrower's current address postcode is different to the securitised property postcode.
Self-employed	Dummy = 1 if the main borrower reports as self-employed.
Gross Monthly Income (A$'000s)	Gross monthly salary (for applicant and spouse); income from part-time and overtime work and commission; interest/dividends; rent received; government benefits or pensions; and other monthly income.
Living Expenditure (A$'000s)	Monthly living expenditure; Includes monthly personal living expenses and other expenses. Excludes: loan, credit card, hire/purchase, rates, tax.
Occupation Dummies	Dummy = 1 for appropriate categories as follows: Small business proprietor, Professional, Office, Service, Skilled Trade, Unskilled trade, Agriculture, and Unemployed.
Net Wealth (A$'0000)	Stock of real surplus/net wealth at application. Difference between total assets and total liabilities.
Liquid Assets (A$'0000)	Stock of real liquid assets at application. Includes: revolving credit limits and amount on deposit with all financial institutions.
Short-term Liabilities (A$'0000)	Stock of real short-term liabilities at application. Includes: revolving credit balance outstanding with all financial institutions.
Time with Bank (yrs.)	Time with bank in years.
No. Credit Accounts	Number of credit accounts with all financial institutions.
No. Credit Facilities	Number of revolving credit facilities with all financial institutions.
State dummies	Regional dummies for Australian States and Territories: ACT, NSW, QLD, SA, TAS, VIC, WA.

Note. Observations falling into a particular quarter are matched to the relevant quarterly data. All monetary values are expressed in 2006Q1 A$.

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