Does Experience Affect Financial Decisions? Evidence from Mortgage Markets *

Stuart J. Webb

University of Miami

December 1, 2017

Abstract – I empirically study a household's choice of an adjustable rate mortgage (ARM) over a fixed rate mortgage (FRM) across time. I show a household's propensity to choose an ARM over an FRM increases with the number of previous mortgages the household has utilized. Households better able to understand mortgage products, such as those who work in finance or have graduate degrees, learn about mortgage products by participating in the market. Expected tenure, budget and liquidity constraints, stabilization of a household's income stream, and rising home prices are ruled out as the source of increasing ARM choice propensity.

*Please address all correspondence to Stuart J. Webb, Department of Finance, School of Business Administration, University of Miami, 5250 University Dr. 514M Jenkins Building Coral Gables, FL 33146 *Phone:* 305-284-9493; *Email:* swebb@bus.miami.edu. For their help and support I would like to thank my advisor, David T. Robinson, and my graduate committee, Lukas Schmid, Manuel Adelino, Gavan Fitzsimmons and Qi Chen. I would also like to thank Jawad Addoum, Fernando Anjos, Cesare Fracassi and seminar participants at Duke University, the University at Buffalo, the University of Texas at Austin, and the University of Miami for helpful comments and valuable suggestions. I am responsible for all remaining errors and omissions.

Introduction

It is an open question if the quality of a household's financial decisions is impacted by its experience in financial markets : do households learn about the financial environment and make better financial decisions over time (Seru, Shumway, and Stoffman, 2010; van Rooij, Lusardi, and Alessie, 2011)? This study seeks to answer this question by studying a household's choice of mortgage product. In doing so, I provide support for the argument that experience in financial markets is an important contributor to the quality of financial decisions. I also add to our knowledge of household behavior, showing that households are more likely to choose adjustable rate mortgage products conditional on more past experience in mortgage markets.

In the majority cases the most important financial product a household will ever utilize is not equity securities or bonds: it is the mortgage the household uses to finance the purchase of its home. The importance of a household's mortgage can be seen in Figure 1, which plots the home value as a percentage of total assets across the wealth distribution. For all but the poorest 30% and wealthiest 10%, house value accounts for over 50% of total asset value. For comparison, the average percentage of total assets accounted for by public equities are also plotted. For the entire wealth distribution, the value of a households home dominates the value of their investment in public equities.

Further, at some point in their lifetime, most households will use a mortgage product. Approximately 65% of all households own their home at any given time, and most (80% in 2009[1]) finance the purchase with a mortgage. Figure 1 shows that mortgage use is important for all levels of wealth where owning a home is common by plotting the proportion of households who have mortgage debt by wealth quantile.

[1] According to the National Association of Realtors

Finally, buying a home and financing it with a mortgage is a transaction likely to be repeated multiple times by the same household. This gives us as econometricians the opportunity to observe changes in financing decisions over time for the *same* household, allowing us to study the learning process of a household while controlling for unobserved heterogeneity.

The mortgage market is an excellent laboratory to study the effect of experience on financial decisions due to the repeated nature of choosing a mortgage and the complexity of mortgage contracts. They are complicated financial instruments that come in two broad classes: fixed rate mortgages (FRMs) and adjustable (or variable) rate mortgages (ARMs). Fixed rate mortgages have a fixed nominal interest rate and constant nominal payment over the life of the loan, which is usually fifteen or thirty years in the United States. While FRMs have a fixed *nominal* capital value, their *real* value varies with real interest rates. If rates are falling, FRMs are expensive and the real wealth of the household falls. If rates are rising FRMs are cheap and the real wealth of the household increases, so there is substantial *real* wealth risk associated with fixed rate mortgages.

Adjustable rate mortgages trade off the real wealth risk of an FRM for real income risk. The interest rate on an ARM adjusts to prevailing nominal rates, usually at a 1-year frequency. Because of these adjustments, ARMs have relatively[2] stable *real* capital values, but have risky nominal payments, so ARMs are expensive if rates rise. In most cases, initial rates for ARMs are lower than FRMs, both to compensate borrowers for taking on this real payment risk and as a marketing ploy to "hook" customers.

Fixed rate contracts historically dominate the mortgage market as seen in Figure 2, with market share generally above 65%. However, little work has been done investigating which

[2]If wages adjusted perfectly with expected inflation and real interest rates were constant, the *real* capital value of ARMs would be constant. Because wages are sticky and do not respond immediately to inflation and nominal rates, we can only say that the real capital value to households is approximately constant.

type of mortgage is best for households, with two exceptions. Campbell and Cocco (2003) build a life-cycle model of mortgage choice and examine the welfare implications of nominal FRMs and ARMs. When their model is calibrated to interest rate data from 1962 to 1999, an FRM is on average 6% worse in constant consumption terms than an ARM. Additionally, Tucker (1991) finds similar results, showing that ARMs are better, in a welfare sense, for all but the oldest borrowers. Given this evidence, why do fixed rate mortgages dominate the market?

I hypothesize FRM market dominance is a consequence of the complexity of adjustable rate contracts (as opposed to FRMs) and the bounded rationality of mortgage market participants. Inexperienced households lack the education and understanding of financial products to effectively evaluate ARMs, so they choose the relatively simple FRM contract. If this is true, we should see households learning about adjustable rate mortgages as they gain experience in the mortgage market. A result of this learning process should be an increased propensity to choose an ARM over time, which is what I find in this study.

Households obtaining their second primary mortgage are about 8 percentage points more likely to acquire some form of adjustable rate loan than they were for their first mortgage. This is very large in comparison to the average market share of ARMs since 1995 of 17.2%[3]. Households who have extensive experience in the mortgage market are even more likely to use an adjustable rate contract. Having 5 or more previous mortgages translates to a 20 percentage point increase in the probability of choosing an ARM as compared to the household's first mortgage. Increased propensity to choose an adjustable rate mortgage appears to be the byproduct of a learning process, in which the household gains an understanding of different mortgage contracts through participation in mortgage markets. The effects of factors previously shown to influence the choice of an ARM over a fixed rate mortgage, such as likelihood of moving, income volatility, and pricing variables, are consistent with

[3]From Fannie Mae's Arm Share Survey - http://www.freddiemac.com/finance/refi_and_arm_monthly.html

previous literature, but these factors do not explain the observed pattern.

This study's most significant contribution is to the recently growing literature on household choice in financial contexts. The link between financial literacy and financial market decisions is well established. Financial literacy has been linked to retirement savings (Lusardi and Mitchell, 2008, 2007), stock market participation (van Rooij, Lusardi, and Alessie, 2011), diversification (Goetzmann and Kumar, 2008) and planning for retirement (Lusardi and Mitchell, 2008, 2007). Hilgert, Hogarth, and Beverly (2003) establish the link between financial knowledge and better financial decisions, while Guiso and Jappelli (2005) show that awareness of financial products has a significant impact on the decision to participate in equity markets. This paper adds to this literature by directly showing that experience in financial markets has an important impact on household financial decisions.

This study is also related to the literature on mortgage choice. Phillips and Vander Hoff (1991) show that mortgage choice is sensitive to initial "teaser" rates on ARMs and the ratio of points on FRMs to points on ARMs. They also find that the level of housing prices is positively related to the choice of an ARM. Using the Survey of Consumer Finances (SCF) Coulibaly and Li (2009) give evidence further supporting the role of pricing in mortgage choice. Additionally, they give empirical support to the argument of Campbell and Cocco (2003) that more risk averse home buyers will have a lower propensity to choose an adjustable rate mortgage. Koijen, Hemert, and Nieuwerburgh (2009) show that the bond risk premium, defined as the difference between long term interest rates and expected average short rates for the same horizon, explains a large portion of ARM share in the aggregate and ARM choice at the micro level. They find that a household decision rule using the average of recent short rates and long term treasury yields is the best predictor of ARM market share. This paper shows experience in mortgage markets has an economically significant impact on the propensity to choose an adjustable rate mortgage.

Empirically, Dhillon, Shilling, and Sirmans (1987) argue that mortgage pricing variables are the main determinant of mortgage choice and that borrower characteristics play little to no role in this decision. One possible caveat to this which the authors discuss is borrower mobility. Because of the lower initial interest rates of ARMs and the relative stability of interest rates over short horizons, a borrower who expects to move in the near future should be more likely to choose an adjustable rate mortgage. Brueckner and Follain (1988) add support for this argument. This paper extends these analyses to the time series, and shows that a borrower's choice of mortgage product changes over time for reasons unrelated to loan pricing variables.

Borrower characteristics have been shown to play a role, however, when differentiated ARM contracts are considered. Sa-Aadu and Sirmans (1995) show that when different types of variable rate mortgages are available, such as 5/1 or 7/1 ARMs, more mobile and younger borrowers choose shorter initial fixed rate terms. Additionally, Stanton and Wallace (1998) show that the menu of points and rates given for FRM contracts serves as a method of separating higher mobility borrowers from lower mobility borrowers, with higher mobility borrowers paying less in points and taking a higher interest rate. Brueckner (1994) shows that the most mobile borrowers will self-select into ARM contracts, and as discussed earlier, Campbell and Cocco (2003) add to the theoretical support for the argument that highly mobile borrowers benefit from the lower rates on ARMs. My study expands the list of borrower characteristics affecting mortgage choice to include experience in mortgage markets.

Overall, this paper adds to the mortgage choice literature by analyzing the evolution of mortgage choice within a household and showing that the extent of borrower experience in the mortgage market significantly affects mortgage choice. Beyond its contribution to the literature, this study also has significant policy implications. Simulations presented in Section show that in present value terms, a borrower with a holding period equal to

the median expected tenure in the home (9 years in 2011[4]) can expect to pay about 2% of principal *more* in present value terms servicing a fixed rate mortgage than servicing an ARM. This suggests an opportunity for policy makers to improve financial outcomes through targeted education about financial products and the decisions consumers will face early in their interactions with financial markets. More specifically, the newly created Consumer Financial Protection Bureau, which has a federal mandate to educate the public about financial choices, has made mortgage choice a priority. According to the agency's website[5], it wants to "help consumers make smarter decisions about mortgages." My results suggest educating consumers about adjustable rate mortgages and how they are an appropriate mortgage type for many home buyers could improve outcomes for households in mortgage markets.

Recent History of Mortgage Markets

In recent years the one year ARM, where the interest rate adjusts annually starting with the first year and which has been the standard variable rate contract, has all but disappeared from the market. A hybrid contract with an initial fixed rate period, usually 3, 5, or 7 years, followed by a period where rates are adjusted annually, has become the dominant form of adjustable rate mortgages. This paper will treat all mortgages that have any adjustable rate period as ARMs, including hybrid mortgages.

In the United States, fixed rate mortgages are by far the dominant mortgage type. Figure 2 shows the fixed rate mortgage market share over from 1990 to 2012. FRMs have been the prevailing contract in the market, ranging between sixty-five percent in the early 2000s

[4]According the National Association of Realtors' Profile of Home Buyers and Sellers - http://www.realtor.org/sites/default/files/reports/2011/profile-of-home-buyers-and-sellers-2011-highlights.pdf

[5]http://www.consumerfinance.gov/ - February 13, 2015

and ninety percent of the mortgage market today.

There are a number of potential reasons for this fact. First, risk aversion might push borrowers into fixed rate contracts so that each monthly payment is known in advance. Second, the relative complexity of adjustable rate mortgage terms, including length of term, benchmark index and annual and lifetime increase limits may intimidate borrowers who are uncomfortable with financial terminology and products. Third, government supported liquidity in mortgage markets has kept the discount to adjustable rate contracts relatively low. Government sponsored enterprises such as Fannie Mae, Ginnie Mae and Freddie Mac have had mandates to increase and maintain liquidity in the home financing industry since the Great Depression. Securitization of mortgage loans by these three enterprises has maintained a highly liquid secondary market for mortgages keeping fixed mortgage rates low relative to adjustable rate contracts. Finally, cultural traditions might explain the dominance of fixed rate mortgages. Adjustable rate contracts were not available until the 1980s, when they enjoyed some popularity due to high interest rates. However, by this time government supported fixed rate contracts were what most people thought about when discussing mortgages and looking for financing; little has changed today.

Data

Data from several sources are used to examine household mortgage choice decisions, including the Primary Mortgage Market Survey (PMMS), Survey of Consumer Finances (SCF) and the Panel Study of Income Dynamics (PSID).

Panel Study of Income Dynamics

The primary data for the analysis come from the Panel Study of Income Dynamics (PSID). The PSID is the longest running longitudinal study in the world and was administered annually from 1968 until 1997. Since 1997, data have been collected biennially and the most recent year for which data are available is 2009. Data from the 1978 wave onward are used to impute the number of mortgage contracts a given household has used in its lifetime. Regression analysis uses ten unbalanced panels, the PSID waves from 1996-1997 and the biennial surveys from 1999 to 2009.

The PSID asks "Do you have a mortgage or loan on this property [home]?" in every year of the survey since 1983 and in the 1979-1981 period. The questionnaire goes on to ask "What year did you obtain that loan?" since the 1997 survey. Responses to these two questions are used to impute the number of mortgages the household has had and to create a sample of mortgage choice decisions. Additionally, the survey asked "What is the current interest rate on that loan?" since 1996, and in the years 1996, 2007 and 2009 "Is the interest rate on that mortgage or loan fixed or variable?" Responses to the second question give a direct answer to the question of the loan being an FRM or ARM, but changes in the reported interest rate can be used to impute the loan type (ARM vs. FRM) by comparing rates across years for loans within a household with the same origination year.

Table 1 has summary statistics for the PSID. Panel B gives summary statistics by year for wealth, income, and demographic variables. Panel (A) gives values for the whole sample, (B) for homeowners, (C) for mortgagors, and panel (D) gives summary statistics for households with a new mortgage. Homeowners tend to be wealthier than non-homeowners, consistent with Figure 1, however, there is no appreciable difference in total assets between all homeowners and the subset of homeowners with mortgages. Mortgagors have higher income than homeowners in general, likely due to a larger fraction of retirees owning their

homes outright. We see the rise in home values associated with the run-up to 2007, followed by the subsequent fall in house prices. There are no appreciable differences in education between new mortgagors and mortgagors in general. If the household enters the sample with a mortgage, that is assumed to be the first mortgage contract the household has ever had. The average age at which households enter the estimation sample is 30 years of age, so it is likely that any mortgage held when entering the sample is close to the first mortgage of the household. Panel (E) gives the distribution of total mortgages a households has held when a new mortgage is taken out. We see there is substantial variation across the number of mortgages previously held. Analysis will account for the systematic differences shown here.

Survey of Consumer Finances

The Survey of Consumer Finances, normally a cross-sectional survey administered every three years, extended their 2007 study to include a 2009 re-interview, creating a longitudinal data set. This panel includes almost 4,000 (3,857) households and includes an oversample of the wealthy. Weights are included so unbiased estimates for US totals can be calculated. Participants give extensive data about mortgages, financial assets and expectations. Additionally, household characteristics are collected, including employment, education, and demographics. Table 1 gives summary statistics by year and mortgage status for financial and mortgage variables, using the weights provided by the survey.

The last panel of Table 1 has statistics for the whole sample, and we see that wealth, measured as both total assets and net worth, fell between 2007 and 2009, as did income. The proportion of the sample who owned their home was relatively stable at about 70%. The second section of the table gives summary statistics for these homeowners. Almost 69% of homeowners had a mortgage in 2007, which fell slightly to 65% in 2009. Importantly,

house values fell considerably during this time period, dropping nearly 17% from a little over $300,000 to about $250,000. The third section of Table 2, which shows statistics for households with a mortgage, indicates that the number of mortgages initiated in the previous year rose slightly from 29% to about 32%. We also see that about 14% of mortgages outstanding were variable rate in 2007, which fell slightly to about 12% in 2009. More significantly, the proportion of new mortgages that were adjustable rate fell dramatically between 2007 and 2009, which can be seen in the final section of the table. The last section shows statistics for those who took out a mortgage in 2007 or 2009. We see that a little over 18% of newly initiated mortgages were adjustable rate in 2007, but this fell to just over 8% in 2009. Additionally, the proportion of new mortgages that were refinances rose significantly between 2007 and 2009, jumping from 39% to over 50%. Overall, households increased their refinancing activity and decreased their usage of adjustable rate mortgage instruments.

Mortgage Choice in the PSID

Model and Variables

The long running PSID, with its panel structure and extensive data, is a valuable resource to investigate within-household financial decision making. The empirical model of interest is the household fixed-effect model,

$$ARM_{it} = \Gamma * PREV\ MORTG_{it} + \beta * X_{it} + \Psi * AFE_{it} + \epsilon_{it} \tag{1}$$

The dependent variable, ARM_{it}, is an indicator variable taking a value of 1 if the household chooses an ARM. The vector $PREV\ MORTG_{it}$ is defined as $PREV\ MORTG_{it} =$

$[PM_{it}^{2}, PM_{it}^{3,4}, PM_{it}^{5+}]$. The first variable takes a value of 1 if the household has had only one previous mortgage (i.e. the current loan is only the second one in the life of the household). The second component takes a value of 1 if the current loan is the third or fourth in the life of the household, and the final element takes a value of 1 if the current loan is the fifth or greater for the household and zero otherwise.

The vector of controls, X_{it}, includes several sets of variables. First, is a group of indicator variable measuring the likelihood of moving in the next two years, as reported by the household in the PSID. This is split into three variables of increasing likelihood of moving, with the baseline omitted variable being "definitely not moving."

The vector X_{it} also includes measures of financial well-being, including total income, income relative to housing payments, net worth, net worth normalized by home value, and loan-to-value. There are also employment variables indicating if the household is employed or retired, and a host of demographic characteristics including age, marital status and presence of children. For a detailed discussion of these variables, please see the appendix.

We also have an additional control vector, AFE_{it} which consists of various fixed effects beyond the household fixed effect estimator being used. These include $REGION_{it}, YEAR_t$, and $TIME_t \times INDUSTRY_{it}$. Historically, ARMs have been a more popular choice in certain geographic areas of the country. The Western portion of the United States, where real estate prices are relatively high has had a greater proportion of mortgages originated as adjustable rate loans. Regional fixed effects, $REGIONS_{it}$, are included to control for these systematic differences in the propensity to choose an ARM across geographic areas. The price of an adjustable rate mortgage relative to a fixed rate mortgage has varied over time. Additionally, there are other time specific factors that should be controlled for in a regression context, such as regulation (Campbell, Ramadorai, and Ranish (2012)), the overall health and performance of the economy, and the interest rate environment at any given

time (Koijen, Hemert, and Nieuwerburgh, 2009). These factors should influence mortgage choice, and time fixed-effects are included to account for them. Additionally, time-industry interaction effects are included to account for income volatility within industry and across time. Income volatility will be discussed in more detail later.

Regression Results

Results for the main specification are in Table 2. It is important to remember that the within-estimator is being used and that these values should be interpreted as changes in *within* household propensity to choose an ARM with changes in the dependent variables. In the most basic model, not including any variables besides measures of mortgage market participation and fixed effects, coefficients on the PM_{it}^{j} terms are positive, monotonically increasing, and marginally significant, with values of 5.3%, 10.2%, and 14.2%, respectively. These indicate that a household is, for example, 5.3 percentage points more likely to choose an adjustable rate mortgage when getting their second mortgage than they were on their first mortgage. This is within the same household. This is an important result, not previously documented. Previous participation mortgage markets increases the propensity to choose an adjustable rate mortgage when taking out a new mortgage. As demonstrated in the recent financial crisis, household mortgage activity can have significant effects on the wider economy, and it is important to understand how households make their home purchase financing decisions, and more broadly, how participation in financial markets affects household financial decision making.

As discussed earlier, borrower mobility has been shown in both a theoretical (Brueckner (1994), Campbell and Cocco (2003)) and an empirical (Sa-Aadu and Sirmans (1995), Brueckner and Follain (1988), Dhillon, Shilling, and Sirmans (1987)) context to influence the choice of an ARM versus an FRM. It is predicted that higher mobility should corre-

late with a higher propensity to choose an ARM. In the second model of Table 2, these measures of borrower mobility are included as $MAYBE\ MOVE_{it}$, $LIKELY\ MOVE_{it}$, $DEFINITELY\ MOVE_{it}$. We see that the propensity to choose an ARM is increasing in the self-reported probability of moving, as expected. This is the first time that a borrower's directly reported probability of moving has been included in an analysis of the mortgage contract type decision. The magnitudes of the coefficients are similar in size and significance to those for mortgage market participation. Having recently moved is not an important factor when considering self-reported likelihood of moving, as shown by the lack of significance for the coefficient on $MOVED_{it}$. Importantly, the pattern for mortgage market participation not only survives the inclusion of these measures of borrower mobility, but the pattern of increasing propensity to choose an adjustable rate mortgage with mortgage market participation is stronger, indicating it is not an artifact of borrowers with greater mobility generally having more experience in the mortgage market.

In model 3 of Table 2, measures of income and liquidity are included, none of which significantly affect the results presented in the first two columns. The same is true in column four, where household net worth and net worth relative to house value are included, in the absence of income measures. As well, including measures of income and net worth simultaneously does not affect our main result, that households are more likely to choose an ARM the more they have participated in mortgage markets. In the last column, loan-to-value and its value squared are included to measure how the amount of equity the household has in the home affects the borrowing decision. As discussed above, we would expect the loan-to-value ratio to have a negative relationship with the choice of an ARM, which is what we see; however, the coefficient is not statistically significant. Interestingly, the only affordability measure that shows up significantly in the full model is $INCOME/PMT_{it}$, though the coefficient of a 100th of a percent is not economically significant. As well, coefficients on measures of borrower mobility are monotonically increasing in the borrower's

likelihood of moving, with values of 12.0%, 15%, and 19.2%, respectively, as we would expect. Finally, inclusion of loan-to-value measures strengthens the results about mortgage market participation, and we see that the coefficients on PM_{it}^{j} are now all statistically significant at the 5% level, with values of 8.6%, 13.6%, and 21.9% for $j = 2, 3-4$, and 5+.

Unreported results on the impact of demographic variables on mortgage choice, included in Table 2 as "Demographics", the head of the household changing from a woman to a man, as in the case of a marriage, results in a significant increase in the propensity to choose an ARM (30%). There is a significant quadratic relationship between ARM choice propensity and age, with coefficients on AGE_{it} and $AGE_{it}^{2}/100$ of -5.53% and 6.13%, respectively. This is a slight "U" shaped pattern, with the general effect of increased age decreasing the propensity to choose an ARM. The effects of age on mortgage choice have not been documented previously. Finally, a change in the marital status, relative to a never-married single, to $MARRIED_{it}$ increases the propensity to choose an ARM. This is most likely the result of increased labor market flexibility, on average. A single income household with two people will have the option for the second, non-working individual, to enter the labor market in the event of an increase in interest rates. As well, a household's marital status changing to $SEPARATED$ has a significant positive coefficient. This could reflect a more tightly binding liquidity or budget constraints of halving wealth and income in the event of a divorce, pushing households toward the lower initial payments of ARMs.

These results are consistent with Deng, Quigley, and Order (2000) finding "trigger" events (such as divorce or separation) being important in the default and prepayment behavior of households. Further investigation of marital status and its interaction with mortgage choice is left for future work. These results are largely consistent with previous analysis, which showed that borrower mobility is one of the most important individual factors on the contract type decision. However, the increased propensity to choose an ARM with mortgage market participation has not been documented before.

External Validation

As always in empirical work, we should be concerned about the potential for regression results to be a peculiarity of the data used. In an effort to mitigate this concern, I investigate the choice between a fixed or adjustable rate mortgage in the Survey of Consumer Finances (SCF)

The SCF is normally a repeated cross-sectional survey, but with the extraordinary events of 2007-2009, the Federal Reserve Board decided to re-interview the respondents from the 2007 survey in 2009. Using this two panel survey, I can redo some of the analysis done in the PSID. Because of the fact that we only have two panels, we can detect an increase in the number of mortgages only from the 2007 sample. Therefore we have just two mortgage indicator variables. Table 3 presents results for the SCF. The coefficients on the variables for the number of previous mortgages are as expected: positive and monotonically increasing. The coefficients on PM_{it}^2 are significant at the 10% level in all but the full specification, and the coefficients on PM_{it}^2 are statistically significant at the 5% level in all but the full specification. Even with such a short panel, the Survey of Consumer Finances 2009 Panel only has two observations for each household, we get marginal significance for the coefficient on PM_{it}^3.

Looking at the other controls, we see that again, measures of mobility are important determinants of the choice of mortgage contract. Though the coefficients do not increase monotonically, they are mostly significant, and all are positive. The measure $INCOME\ VOLATILITY$ loads significantly, indicating large positive differences between current income and "normal" income increase the propensity to choose an ARM. Contrasting with the estimates for the PSID, $EMPLOYED$ loads positively and with marginal significance; however, similar to the PSID the coefficient on AGE is negative and significant at the 5% level. The coefficient on $CHILDREN$ is negative and marginally

significant. Interestingly, $MARRIED$ and $DIVORCED$ load negatively, while in the PSID the coefficient on $MARRIED$ was insignificant and on $DIVORCED$ was positive and significant.

It is comforting to observe the same increased propensity to choose an adjustable rate mortgage in the SCF that was observed in the PSID. However, due to the short panel nature of the SCF and space limitations, the rest of the analysis will focus on the Panel Study of Income Dynamics. An extended discussion of mortgage choice in the SCF can be found in the appendix.

Bounded Rationality and Mortgage Choice

In this section, I discuss why households have an increased propensity to choose adjustable rate mortgages as their experience in mortgage markets increases. I argue that ARMs have important advantages over fixed rate mortgages, and that households learn about these advantages by participating in mortgage markets.

ARMs vs FRMs: Which is Better?

When calibrating their life-cycle model to 1986-2001 interest rate data, Campbell and Cocco (2003) find that nominal ARMs dominate nominal FRMs in all of their simulations. In the authors' calibration, the real wealth risk of fixed rate mortgages dominates the real income risk of adjustable rate mortgages. It should be said that the authors do not stress this point, but it is suggestive that ARMs may be better, in a household welfare sense, than many people think.

Empirically, if we look at the ex post costs of adjustable rate mortgages during the same

time period, we see that ARMs would have saved homeowners a significant amount of money. Panel (A) of Table 4 shows the average relative interest costs at multiple horizons from 1986 to the most recent year available. Mortgage interest rate data comes from the Federal Home Loan Mortgage Corporations (Freddie Macs) Primary Mortgage Market Survey (PMMS). Rates are taken from a survey of the largest mortgage lenders and are quoted offers, not closed deals. Adjustable rates use the initial rate published in the PMMS for the first adjustment period, and then the one year treasury yield together with the PMMS published margin. The values in the table are the annual average differences in the cost of an FRM relative to an ARM initiated in the same month for the given horizon. With this definition, positive values indicate FRMs were ex-post more expensive. At a 5 year horizon, there are only 3 years between 1986 and 2011 in which actual 5 year interest costs were higher for an adjustable rate mortgage versus a fixed rate mortgage, and in these cases the difference was on the order of 1-2%. In contrast, the advantages can be quite large. An individual who took out a fixed rate loan in 2000 would have paid 30% more in the first five years of the loan than if an ARM had been chosen. This is during a time when more than 50% of households had a housing tenure of 6 years or less, according to the National Association of Realtors. We should also take note of the difference in total interest costs, which are even larger than for overall payments, indicating that not only would homeowners have paid less, they would have paid down the loan principal and built equity more quickly.

These results are tempered somewhat if we look at expected interest costs at the time of acquiring a mortgage, as implied by simple forward rates, during the same time period. Panel (B) of Table 4 presents these figures. Calculations are made using the implied forward treasury rate from year t to t+1. We see that fixed rate mortgages have far lower expected costs than ARMs. It should be noted, however, that these rates do not account for any possible liquidity or term premium that may be a component in the forward rates,

and should be regarded as an upper bound on the expected interest costs for an adjustable rate loan.

Table 4 presents results for ex-post realized payments (Panel A) and upper bounds on the difference between expected future mortgage payments (Panel B) for FRMs vs. ARMs; however, it is the expected present value of payments that is relevant to homeowners. Tucker (1991) simulated interest rate paths out to 30 years from the time of mortgage origination and compared the present value of total FRM costs to total ARM costs at different holding periods. The 1-year constant maturity T-bill rate was modeled as $r_t^{TB} = r_{t-1}^{TB} + \sigma_{TB} \times \epsilon_t$, where σ_{TB} is the one year standard deviation of $\Delta r_t^{TB} = r_t^{TB} - r_{t-1}^{TB}$ and ϵ_t is a standard normal random variable. The parameter σ_{TB} was estimated using date from 1974 to 1989. He calculated the present value of FRM and ARM payments for different holding periods using this simulated interest rate process for the 50 months from January of 1985 through February of 1989. The present value of paying off the remaining principal at the end of the holding period is included in the calculation. Tucker found that for a discount rate of 4% and holding periods of less than 19 years, the expected present value of FRM payments exceeded the expected present value of ARM payments. For discount rates larger than 8%, the expected present value of fixed rate mortgage payments was larger for all holding periods.

One concern with Tucker's study is the model of interest rate used. In reality, interest rate processes are more stable and exhibit more excess kurtosis than a random walk with a normal disturbance. Supplementing Tucker (1991), two different interest rate simulations were performed. The first model is a random walk with a disturbance which has a T-distribution. The model used is $r_t^{TB} = r_{t-1}^{TB} + \sigma_{TB} \times \eta_t$, where σ_{TB} is now the standard deviation of monthly changes, $\Delta r_t^{TB} = r_t^{TB} - r_{t-1}^{TB}$, and η_t is a random variable following a T distribution with kurtosis to match that of the Δr_t^{TB} process and scaled to have a mean of zero and variance of one. The second simulation, following Brenner, Harjes,

and Kroner (1996), models the change in interest rate as $\Delta r_t^{TB} = \alpha + \beta \times r_{t-1}^{TB} + \epsilon_t$ and models the volatility of the interest rate as a GARCH(1,1) process, where $E_{t-1}(\epsilon_t^2) = \sigma_t^2 = a_0 + a1 \times \epsilon_{t-1}^2 + b \times \sigma_{t-1}^2$. Parameters were estimated using the 1-year constant maturity T-bill rate from 1960 through 2011. Simulations were performed for monthly fixed and adjustable mortgage rates taken from Freddie Mac's Primary Mortgage Market Survey from 1986 through 2011. Present values were calculated for initial principal of \$100,000 and discount rates of 4%, 6%, 8%, and 10%. The difference in the present value of payments for FRMs and ARMs is plotted against the holding period in years in Figure 3. Results are largely consistent with Tucker (1991). The present value of FRM payments is greater for all discount rates for holding periods of less than 15 years in the random walk model. For the GARCH(1,1) model, the present value of FRM payments are greater for all holding periods and all discount rates, except for a discount rate of 4%, where the expected present value of ARM payments exceeds those for FRMs for holding periods of greater than 25 years. Clearly, ARMs can have significant cost advantages over fixed rate contracts.

Taken together, the theoretical evidence of Campbell and Cocco (2003) and empirical evidence of Table 4 and Figure 3 suggest ARMs have significant advantages over FRMs. This suggests a possible explanation for the increased propensity to choose an ARM with experience in the mortgage market: that households do not know about or understand the advantages of ARMs early in their experience with mortgages and gain this understanding over time.

Learning & Financial Sophistication

To test if households are gaining an understanding of ARMs through participation in mortgage markets, we target households who should have an advantage making financial decisions. Though van Rooij, Lusardi, and Alessie (2011) explain that education is not

necessarily a good proxy for financial sophistication, if households are increasing their usage of ARMs because of a learning process, we might expect households with graduate degrees to be better able to identify the advantages of financial products with repeated exposure financial markets than a less educated household. We can include interaction terms of a variable equal to 1 if the head of the household has received a graduate degree, GS_i, with the measures of mortgage market participation. Coefficients on the interaction terms, given in Table 5 are positive, and for $j > 2$, significant, indicating households with graduate degrees increase their usage of ARMs with participation faster and to a greater degree than other households. This is consistent with households who have an advantage recognizing the benefits of ARMs learning about those advantages faster and to a greater degree than those with less ability.

Authors van Rooij, Lusardi, and Alessie (2011) show that frequent use of finance and economics in the work place is associated with higher participation rates in the stock market and greater financial sophistication. Therefore, we might expect that people working in the financial, insurance or real estate, renting and leasing sectors might be better able to understand the advantages of ARMs and should increase the usage of ARMs faster with participation. To test this, we add the variable FW_{it}, taking a value of one if the head of the household works in the financial or real estate sectors, to the main specification. This variable is also interacted with our PM_{it}^{j} variables and included in the regression. As discussed above, we expect the coefficient on FW_{it} to be positive. Results are presented in column 1 of Table 5. There is an increase in propensity to choose an ARM for households with a head working in the financial sector. Though not statistically significant, the magnitude of the coefficient on FW_{it} is quite large. The coefficients on the interaction terms are also not significant, but they too are large and increasing, consistent with financial workers learning faster about advantages of ARMs. With only 260 observations for households with a head in the financial or real estate sector, statistical power is low;

however, magnitudes and directions are as we would expect if ARMs are advantageous and financial workers are better able to realize this. It should also be noted that the pattern of increasing usage of ARMs with mortgage market participation is still strong for households not in the financial sector. Here, as before, the coefficients are monotonically increasing, consistent with a slower learning process than households working in a financial industry.

We can also narrow the scope of the idea of "financial sophistication" to sophistication in real estate markets specifically. The PSID includes the question, "What was the total dollar cost of the additions or improvements, plus the value of any work you may have done yourself?" for the 1989, 1994, and 1999 through 2009 waves of the survey. We define the concept of "flipping" as expecting to move soon (the household responded "probably move" or "definitely move" to the PSID's question regarding the likelihood of moving) and spending in the top 30% of all homeowners on home improvement. Households who flip are buying, improving, and selling homes quickly. Presumably, they should become very familiar with mortgage markets during this process. We would expect "flippers" to learn more quickly about the advantages of ARMs, as they are interacting with mortgage brokers and banks on a regular basis, and ARMs are also more advantageous for these people. Adding an indicator variable, $FLIP_{it}$ and interactions terms of $FLIP_{it}$ with PM_{it}^{j} variables, we get results presented in column 2 of Table 5. Though not significant, the coefficient on the interaction term for $j = 2$ we see that it essentially negates the coefficient on the raw PM_{it}^{2} term. For $j = 3$ or 4, the coefficient on the interaction term is positive, but not distinguishable from zero; however, for $j = 5$ or more, the coefficient is positive and marginally significant. We see that after their second mortgage, the propensity to choose an ARM increases substantially for flippers. The negative coefficient on the indicator variable for flipping is interesting, but it is not statistically significant, and without further theory on the circumstances of households who choose to flip homes, we have no guidance on what the sign of this coefficient should be. It should also be noted that the main pattern

persists for non-flippers, consistent with learning being an important effect over the whole population.

Discussion of the Learning Mechanism

If households are learning by participating in mortgage markets, we should ask how it is they are learning. It could be that the act of purchasing a home is essential to the learning, or it might be that purchase of the home is unimportant, and it is the interaction with mortgage brokers that leads to this increased knowledge and understanding. We can turn to refinancing as a way to test this. An indicator variable for refinancing, $REFI_{it}$ is created and interacted with measures of mortgage market participation. Regression results are presented in Table 6, along with the main specification for comparison and convenience. We see that an indicator variable for the loan being for refinancing purposes is negative and marginally significant, while the interaction terms are approximately zero and not significant. There is a level effect, whereby, refinanced loans are less likely to be into adjustable rate products, but there is little difference in the context of increasing propensity to choose an ARM with mortgage market participation.

This is consistent with the way refinancing loans are treated vis-a-vis purchase money loans in some states [6]. While purchase money loans are universally non-recourse loans, where the most the bank can get back in the event of default is the value of the home, if the loan was for refinancing purposes, the bank can potentially garner wages or force the sale of other assets. With this difference in the treatment of the two loan types, refinance loans are relatively riskier and thus, there is motivation not to choose an ARM. Additionally, one of the primary reasons to refinance quoted in most personal finance books is to "lock in a better rate." To the extent households adhere to this type of advice and it affects

[6] for example, that state of California for loans originating before January 1, 2013

all households relatively equally, we would expect refinancing loans to be FRMs relatively more often. This would also show up as a level effect in this specification. The increasing propensity to choose an ARM even among households choosing to refinance suggests that households are not learning through the purchase process, per se, but through the financing process. Originating/refinancing a mortgage seems to have a similar effect, suggesting interaction with mortgage brokers and associated research is what drives the "learning."

Alternative Explanations

In this section, we investigate several possible factors that may explain why households are more likely to use adjustable rate mortgages when they have more experience in mortgage markets.

Liquidity and Budget Constraints

We know that wealth and income are both important considerations when choosing a mortgage, and theory suggests that both factors should have a positive relationship with the propensity to choose an ARM. While net worth and income are included in the main specification, we could ask if the increased propensity to choose an ARM with participation in the mortgage market can be explained by income or wealth increasing at the same time. In Table 7, regressions are presented interacting net worth and income terciles for mortgage originators in the year in which the mortgage was taken out, with number of mortgages. The main specification is also included for comparison. Looking first at the second column, we see that though the strength of the pattern is different over the wealth distribution, the overall pattern holds. Propensity to use an ARM increases the most in the first and second terciles. In the lowest quantile, the coefficient on PM_{it}^2 is large, at 13.4%, and statistically

significant. With four or more previous mortgages, the propensity to choose an adjustable rate mortgage is 25.3 percentage points larger than when taking out a first mortgage for a household in the lowest net worth tercile. In the top wealth quantile, the pattern persists, though it is less pronounced and not statistically significant.

This difference between the top tercile of net worth and the rest of the net worth distribution seems to have two main drivers. First, households in the top tercile of net worth, but not in the top tercile of income, do not seem to increase their usage of ARMs. This can be seen in Table 8, Panel (B), by the negative coefficients on the interaction terms between $INC_{it}^{1,2}$, which indicates a household belonged to the first or second tercile of income, but to the top tercile of net worth, and PM_{it}^{j}. All coefficients are from the same regression with interactions being row variables interacted with column variables. They are not statistically significant; however, the relatively few number of households with high net worth and lower income does not allow a very precise estimate. Households with high net worth, but relatively lower income still have a house value similar to their high net worth peers (roughly 55% of net worth). Since they have similarly large homes but lower income, these households are much more exposed to negative interest movements. In the event interest rates increase, they might have to liquidate assets, or default on the home. These are consequences their peers with higher income do not face, and they are, therefore, much less inclined to use adjustable rate mortgages.

Second, homeowners who were of an age to buy their first home in the early 1980s, when ARMs were first introduced to the American market and interest rates increased sharply (peaking at over 16% for 1 year t-bills) seem to have been turned off to ARMs. It is likely many of them used adjustable rate mortgages (two thirds of mortgages originated in 1984 were ARMs (Brueckner and Follain, 1988)) and were financially exposed to the high and variable interest rates of the 1980s. The interaction of BUY^{80}, which indicates a homeowner was 25 or older in 1980, and the PM_{it}^{j} terms also have negative coefficients,

indicating that on average these households do not increase their usage of ARMs. It should be noted that coefficients are not statistically significant; however, the relatively few number of observations who were buyers in 1980 and are observed with a large number of mortgages, where the effect should be most pronounced, is relatively small. Importantly, once these two affects are properly controlled for, the third tercile of wealth exhibits the same behavior as the other two terciles. The coefficient on the interaction of NW_{it}^3 and PM_{it}^3 is approximately 0.28, vs 0.33 and 0.30 for $PM_{it}^{3,4}$ and PM_{it}^2, respectively, and statistically significant at the 5% level. Coefficients are similar in magnitude on other interaction terms across net worth terciles. Tests of the null hypothesis that coefficient estimates are equal across net worth quantiles cannot be rejected.

Another possible explanation for the increasing usage of ARMs with mortgage market participation is more tightly binding liquidity constraints. If lower income households are moving more frequently to chase jobs, this might be driving the observed results. However, the interaction of income and participation shows a similar pattern to that of wealth and participation. The second column of Table 7 shows the distribution of income for new mortgagees interacted with the measures of mortgage market participation. Column 3 of Table 7 shows that for each tercile of income, participation is positively related to choosing an ARM. Estimates for the coefficient on PM_{it}^2 range from 3.95 percentage points in the lowest income quantile to 14 percentage points higher for the largest income quantile. The propensity to choose an ARM increases with the number of previous mortgages used, our measure of mortgage market participation, uniformly across the entire income distribution. If more tightly binding liquidity constraints for households with more extensive experience in the mortgage market were driving results, we would not expect the propensity to choose an ARM to be increasing with participation in the higher quantiles of income.

While the propensity to choose an ARM increases across all three terciles of income and wealth, the cutoffs for being in the third tercile of net worth and income are $192 thousand

and $102 thousand, respectively. It is unlikely that all households in the top terciles are unconstrained in their optimal choice of housing consumption. However, we can look at those at the extreme tails of the distribution. Table 10 presents results for households we will term "unconstrained." The first column includes interactions of an indicator variable equal to 1 if the household has a net worth greater than $750 thousand, which translates to the 92^{nd} percentile of the wealth distribution, with the measures of mortgage market participation. The coefficients on the interaction terms are small and statistically insignificant, indicating that very wealthy households, which are unlikely to be constrained by wealth, do not behave differently from the rest of the population. Similar results were obtained for a net worth of $1.25 million, which translates to the 95^{th} percentile.

The second column of Table 10 shows regression results for a comparable analysis of high income households. Here, the indicator variable in the interaction terms is 1 if total household income is greater than $300 thousand, which translates to the 98^{th} percentile of the wealth distribution. Again, the coefficients on the interaction terms are small and insignificant, indicating households which are not constrained by income in their choice of housing consumption do not behave differently than the rest of the population. They also have an increased propensity to choose ARMs with increasing participation in mortgage markets.

Columns three and four of Table 10 present regressions for ratios of wealth to house value and mortgage payments to income, respectively. In column three, an indicator variable taking a value of 1 if the ratio of net worth to house value is greater than 2.8, which corresponds to the 90^{th} percentile, is interacted with the number of previous mortgages, as before. The coefficients on the interaction terms are not statistically significant and are monotonically increasing. These unconstrained households exhibit the same pattern of increasing usage of ARMs with mortgage market participation, but potentially at a different rate, as the relatively more constrained households. Column four interaction terms include

an indicator variable equal to 1 if the ratio of housing expenses, defined to be the sum of mortgage payments, real estate taxes, and homeowners insurance, to the mean of 5 year lagged income is less than 8.5%, corresponding to the 15^{th} percentile of the distribution of this ratio. Mortgage underwriting standards mandate that the ratio of housing costs to income should be 28% or less. Households with relatively low ratios of housing expense to income could most likely afford a larger home and were probably unconstrained in their choice of housing consumption. Coefficients on the interaction terms are not statistically significant. Moreover, if we add coefficients on interaction terms and raw mortgage market participation variables, we get 18.75%, 21.5%, and 26.3% for 2, 3-4, and 5+ previous mortgages, respectively. This shows increased usage of ARMs with mortgage market participation for these unconstrained households as well, and demonstrates this phenomenon is not confined to households with binding budget or liquidity constraints.

The final two columns of Table 10 investigate the propensity of households who are significantly increasing their housing consumption in terms of value of home, and also those who moved to get a better home, either in terms of physical plant or location. Column 5 interacts an indicator variable, HI_{it}, equal to 1 if the value of the household's new home is 2.7 (90^{th} percentile) times or more than the value of its previous home. Presumably, households with large increases in housing consumption are more likely to be constrained, and potentially more likely to use ARMs as result. We find that this is the case, with those who increase their housing consumption significantly having a much higher propensity to choose ARMs. Importantly, though, we see the propensity to choose ARMs increasing in mortgage market participation for both those with significantly larger housing consumption and those with less extreme changes in consumption. Results for the 50^{th} and 75^{th} percentiles are similar.

Following a similar argument to that for column 5, if households are expanding their housing consumption immediately upon being able to afford a larger or better home, and

bumping into budget or liquidity constraints as a result, we would expect those who report they moved to get a larger, better, or more optimally located home to be driving the results presented above. In column 6, an indicator variable taking the value of 1 if the household responds that they moved to get a better house, either in terms of physical characteristics of the home, or location. The PSID asks the question "Why did you move?" if the household responded that they moved. Choices included changing jobs, moving closer to work, responses to involuntary events, and marriage. Respondents could also reply, "expansion of housing: more space; more rent; better place" or "neighborhood related: better neighborhood; go to school; to be closer to friends/relatives." If the respondent gave either of these answers, the variable $BETTER\ HOME_{it}$ was assigned a value of 1. Looking at the coefficients in column 6, we see that the interaction terms are small and not significant for all but the last term. More importantly, the documented phenomenon of increasing propensity to choose an adjustable rate contract with mortgage market participation persists for those who are refinancing or moving for other reasons. Similar results were obtained for either response alone and for a restricted sample which included only households which moved.

We might also be concerned that households living in areas with increasing housing prices, such as the Southwest and California, are being priced out of fixed rate contracts. The sample includes a time period of rapid growth in house prices across the country. If this is the case, we would expect households not in these high growth areas to exhibit different behavior. Table 11 presents coefficient estimates for two models. In column 1, an indicator variable taking a value of 1 if the state in which the household resides has seen home prices increase by 40% or more in the previous five years, as calculated from the Federal Housing Finance Association's state level housing price indexes. This translates to an approximately 7% per year increase, on average. While it seems that households in these states increase their usage of ARMs more rapidly, we also see that those not in high priced states exhibit

the same behavior, refuting the argument that households are being priced out of FRMs by rising home prices. Similar results were obtained for 50% (8.5% annualized) growth in prices over 5 years. Additionally, the second column presents our main specification, restricted to years after 2005, a period marked by falling home prices. We see the pattern persists, also inconsistent with rising home prices, inducing homeowners to use lower cost ARMs.

The wealth and income results, and those pertaining to financial constraints, are inconsistent with budget or liquidity constraints driving the increased usage of ARMs with participation in mortgage markets. However, it could be the volatility of income that matters, and not the level. This is a possibility discussed below.

Income Volatility

Income volatility should be one of the most important predictors of ARM choice propensity. As Campbell and Cocco (2003) showed, adjustable rate contracts should be less appealing for households with a large volatility of income, as it is more likely that periods of high interest rates and low income will coincide. It could be that as households participate in mortgage markets, their incomes become more stable. If this is the case, we would expect the trend of increased propensity to choose an ARM with mortgage market participation to disappear for households with unstable income. That is, if a household has an unstable income, we should not see the pattern of increasing usage of ARMs with more extensive participation in mortgage markets. In a regression context, this is equivalent to saying the coefficients on our measures of mortgage market participation should not be positive or increasing for households with high volatility of income growth. Results are reported in Table 12. In column 2, results are shown using the standard deviation of trailing earnings growth for the previous five years. An indicator variable, IV_{it}^{L} for being in the

top quintile of income growth volatility in a year when a mortgage is taken out, is interacted with the measures of mortgage market participation. Here $L = HIGH\ IV$. If the null hypothesis that household income is becoming more stable with time, reducing the income risk of ARMs, is true, then increasing propensity to choose an ARM with mortgage market participation is expected to disappear among those with high income volatility. That is, the coefficients on the interaction terms should be negative and significantly different from zero. Only one of these coefficients is negative and none are significant, showing that the propensity to choose an ARM increases with participation in mortgage markets even for high income volatility households. This contradicts the hypothesis that incomes become more stable simultaneously as mortgage market participation increases. Results are qualitatively unchanged when redefining the high income volatility households as the top 10% or top 30% of the income growth volatility distribution.

Alternatively, we could look at the low end of the distribution of income volatility. If households with stable incomes are driving results, we would expect the pattern of increased propensity to choose an ARM to disappear for those not in the lower part of the income volatility distribution. That is, coefficients on the mortgage market participation indicators should not increase monotonically as j increases. In column 3 of Table 12, the same measure of income growth volatility is used; however, now an indicator variable is added if the income volatility is in the lowest 30% of the distribution ($L = LOW\ IV$). We lose some power due to observation attrition, but we see the coefficients on the interaction terms are close to zero and not statistically significant, while the coefficients on the PM_{it}^{j} terms are very similar in magnitude and significance to previous results. This shows that these households do not behave markedly different from those with higher income volatility, and increasing income stability with participation in mortgage markets is not causing the observed increase in propensity to use ARMs. Results are qualitatively similar if the definition of low income volatility is changed to the lowest 20% of the distribution.

Another measure of cash flow volatility is the OLS regression coefficient of income growth on time, β_{INC}. This variable has the advantage of measuring directionality of income changes. Presumably households with recent growth in income will expect similar growth in the future and will be in a better position to weather any unfavorable interest rate environments. Households with large and positive income growth should be more apt to choose an ARM, as they expect future income growth to be positive as well. If income growth is more likely to be positive at the same time as mortgage market participation increases, we would see the observed increases in ARM choice propensity. Assigning the value of IV_{it}^{L}, $L = \beta_{INC}$ to be one when a household's β_{INC} is in the top quintile of all households and interacting IV_{it}^{L} with our PM_{it}^{j} variables, we include these in the same manner as before. Looking at the fourth column of Table 12, we see the propensity to choose an ARM is unchanged for households with a high β_{INC}, except for early in the experience with mortgage markets, with coefficients on the interaction terms ranging from 18% and significant at the 5% level for one previous mortgage, to -2% and not significant for four or more previous mortgages. We see that for the rest of the sample, coefficients on mortgage market participation are largely unchanged, contrary to the hypothesis that large income growth is driving this phenomenon.

Confounding and Compositional Effects

There are several reasons a household may make a mortgage decision for reasons unrelated to housing, including the need to extract equity from a home to pay for a business, education of children, medical bills or the lost income from an extended illness. Any of these could confound the results presented so far. For example, a household may be more likely to have college expenses the older it is, making the lower initial payments of an ARM more desirable. This could induce the observed pattern of an increased propensity to choose an

adjustable rate mortgage with participation in mortgage markets. Similarly, as households age their annual medical bill should increase, on average, making the payment structure of ARMs more attractive.

In the appendix, I test these possible confounding effects by including indicator variables for self employment, college aged children, medical expenses and time away from work (and their interactions with the measures of participation) in the regressions. The results are unchanged. The increased propensity to choose an adjustable rate mortgage conditional on greater previous experience in mortgage markets persists when controlling for these potential confounding effects.

We might also be concerned about the potential for systematic differences between households who take out few mortgages in the sample period and households that take out relatively more mortgages. It is possible that households who reach 5 or more mortgages in the sample period are systematically different than households who only reach 3 or 4 mortgages, who may in turn differ significantly from households who reach only 2 mortgages in the sample.

In the appendix, I compare summary statistics for socio-economic variables across these different groups and find no systematic differences. The distribution of employment sector is also relatively constant across the three different groups. Finally, I investigate the effects of participation on each group separately, and find that there may be a systematic difference between the two mortgage group and the 3 or 4 mortgage group and the 5 mortgage group, but that the latter two seem to be very similar. Both exhibit an increased propensity to choose an adjustable rate mortgage with more previous mortgages.

Conclusion

A household's choice between an adjustable rate mortgage and a fixed rate mortgage has never been empirically investigated in a time-series context. Previous studies have looked at mortgage contract choice in a cross-sectional framework only. The positive relationship between mortgage market participation and propensity to choose an ARM discussed in this paper is a novel stylized fact not previously documented. This pattern is robust to an array of cross-sectional factors previously shown to influence the choice of an adjustable rate mortgage. Evidence is presented supporting household learning as a possible explanation for this observed pattern. Additionally, this phenomenon is not confined to a single data set, but is observed in both the PSID and the SCF.

Based on the evidence of this study, it is likely financial market participation has significant effects on households other markets as well. As van Rooij, Lusardi, and Alessie (2011) show, stock market participation is highly correlated with financial literacy, however, the direction of causality is not known. It is unclear if households who are financially literate participate, or households who participate become financially literate. While this paper gives some evidence that participation may affect literacy, this needs to be investigated in other contexts. One potential avenue is investigating diversification in the context of stock market participation.

As well, households changing their choice of mortgage contract as their experience with mortgages becomes more extensive suggests an opportunity for policy makers to improve financial outcomes. Targeted education about financial products and the financial decisions consumers will face early in their interactions with financial markets could lead to better choices. More specifically, the newly created Consumer Financial Protection Bureau, which has a federal mandate to educate the public about financial choices, has made

mortgage choice a priority. According to the agency's website[7], it wants to "help consumers make smarter decisions about mortgages." My results suggest educating consumers about adjustable rate mortgages and how they are an appropriate mortgage type for many home buyers could improve outcomes for households in mortgage markets.

Finally, if participation influences decisions, what is changing for households? Is it an understanding of the risks involved, the institutional details of the market, or just a general understanding of financial concepts? If they are acquiring information by participating in financial markets, it suggests better education is needed prior to entering the marketplace. However, without knowing what it is households might be learning, no recommendation can be made regarding what information should be presented to consumers. The evidence presented suggests theory should account for experience in financial markets when household decisions are being considered. Guidance is needed for empirical researchers regarding how a household's acquisition of information influences financial markets, and how households interact with those markets.

[7]http://www.consumerfinance.gov/ - February 13, 2015

References

Brenner, Robin J., Richard H. Harjes, and Kenneth F. Kroner, 1996, Another look at models of the short-term interest rate, *The Journal of Financial and Quantitative Analysis* 31, pp. 85–107.

Brueckner, Jan K., 1994, Borrower mobility, adverse selection, and mortgage points, *Journal of Financial Intermediation* 3, 416 – 441.

——— , and James R. Follain, 1988, The rise and fall of the arm: An econometric analysis of mortgage choice, *The Review of Economics and Statistics* 70, pp. 93–102.

Campbell, John Y., and Joo F. Cocco, 2003, Household risk management and optimal mortgage choice, *The Quarterly Journal of Economics* 118, 1449–1494.

Campbell, John Y., Tarun Ramadorai, and Benjamin Ranish, 2012, How do regulators influence mortgage risk: Evidence from an emerging market, Working Paper 18394 National Bureau of Economic Research.

Coulibaly, Brahima, and Geng Li, 2009, Choice of mortgage contracts: Evidence from the survey of consumer finances, *Real Estate Economics* 37, 659–673.

Deng, Yongheng, John M. Quigley, and Robert van Order, 2000, Mortgage terminations, heterogeneity and the exercise of mortgage options, *Econometrica* 68, pp. 275–307.

Dhillon, Upinder S., James D. Shilling, and C. F. Sirmans, 1987, Choosing between fixed and adjustable rate mortgages: Note, *Journal of Money, Credit and Banking* 19, pp. 260–267.

Goetzmann, William N., and Alok Kumar, 2008, Equity portfolio diversification*, *Review of Finance* 12, 433–463.

Guiso, Luigi, and Tullio Jappelli, 2005, Awareness and stock market participation, *Review of Finance* 9, 537–567.

Hilgert, Marianne A, Jeanne M Hogarth, and Sondra G Beverly, 2003, Household financial management: The connection between knowledge and behavior, *Federal Reserve Bulletin* 89, 309.

Koijen, Ralph S.J., Otto Van Hemert, and Stijn Van Nieuwerburgh, 2009, Mortgage timing, *Journal of Financial Economics* 93, 292 – 324.

Lusardi, Annamaria, and Olivia S Mitchell, 2007, Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth, *Journal of monetary Economics* 54, 205–224.

Lusardi, Annamaria, and Olivia S. Mitchell, 2008, Planning and financial literacy: How do women fare?, *American Economic Review* 98, 413–17.

Orman, Suze, 2011, *The Money Class* (Randome House, Inc.) first edition edn.

Phillips, Richard A., and James Vander Hoff, 1991, Adjustable- versus fixed-rate mortgage choice: The role of initial rate discounts., *Journal of Real Estate Research* 6, 39.

Sa-Aadu, J., and C. F. Sirmans, 1995, Differentiated contracts, heterogeneous borrowers, and the mortgage choice decision, *Journal of Money, Credit and Banking* 27, pp. 498–510.

Seru, Amit, Tyler Shumway, and Noah Stoffman, 2010, Learning by trading, *Review of Financial Studies* 23, 705–739.

Stanton, Richard, and Nancy Wallace, 1998, Mortgage choice: What's the point?, *Real Estate Economics* 26, 173–205.

Tucker, Michael, 1991, Comparing present value cost differentials between fixed- and adjustable-rate loans: A mortgage simulation, *Financial Review* 26, 447–458.

van Rooij, Maarten, Annamaria Lusardi, and Rob Alessie, 2011, Financial literacy and stock market participation, *Journal of Financial Economics* 101, 449 – 472.

Appendix

Discussion of Variables

Table A1 presents the elements of X_{it}. As discussed earlier, the shorter the expected tenure of a household in a given home, the larger the relative benefits of an adjustable rate mortgage. If the household is moving soon, interest rates should be relatively stable over the household's expected life of the loan and the household can take advantage of the lower initial interest rate. The PSID includes the question, "Would you say you definitely will move [in the next couple of years], probably will move, or are you more uncertain?" Indicator variables for the households expected probability of moving are included to account for this effect in a non-parametric way. Household mobility is encoded as four variables (see Table A1). The variable $DEFINITELY\ MOVE_{it}$, which takes a value of one if the household reports it will move with certainty. If the household reported it would "probably" move, $LIKELY\ MOVE_{it}$ is set to one. Finally, $MAYBE\ MOVE_{it}$ is one when the household reports its likelihood of moving as "more uncertain". The baseline case is if the household reports it will not be moving. Following the literature, an additional control for mobility is included in the form of an indicator variable if the new mortgage is the result of a move, $MOVED_{it}$, the idea being that households which have recently moved will likely move sooner than those who have had a long tenure in their current home.

Previous research has shown (Campbell and Cocco, 2003) that the risks associated with variable rate loans are less important to high net worth households. If interest rates adjust unfavorably, higher wealth households will be able to pay their mortgage out of wealth stock if necessary, mitigating the potential for costly downward adjustments in consumption. The variable $NET\ WORTH$ is included to account for this level effect. Additionally, the house size relative to net worth can be important. Even if a household has a large stock

of wealth, if the mortgaged house is expensive relative to wealth, potential payments in an unfavorable interest rate environment could be large. The ratio of net worth to principal, $NW/HOUSE\ VALUE_{it}$ is included as a measure of the possible impact of the mortgage on the wealth of the household.

The burden of the mortgage on household income is also important. The inherent variability of ARM payments will be less of a consideration for high income households because, in a high interest rate, and consequently mortgage payment environment, high income households will be less likely to require adjustments to consumption to meet their mortgage obligations. $TOTAL\ INCOME_{it}$ is included because of this potential influence on mortgage choice. Obviously, a household's mortgage obligation relative to its income is also an important consideration. Families with large mortgage payments relative to income will be more likely to require costly adjustments to consumption in unfavorable interest rate conditions if using an ARM. To measure and control for this effect, the ratio of annual income to annual mortgage payments, $INCOME/MPMT_{it}$ is included in the analysis.

If interest rates rise when house prices fall, $LOAN-TO-VALUE_{it}$, the ratio of originating principal to the purchase price of the house, may be an important factor when deciding on a type of mortgage. When interest rates are high, a household with an adjustable rate mortgage may no longer be able to afford mortgage payments. Selling the home and reducing housing consumption is a potential option for dealing with this situation. However, if house prices are simultaneously low, the home may be underwater, and selling the home would not provide enough proceeds to pay off the remainder of the loan. Mortgages originated with a high loan-to-value ratio are at higher risk for this situation (Deng, Quigley, and Order, 2000), and ARMs may be less attractive to home buyers with a high loan-to-value ratio. To account for any non-linearities in this relationship, $LOAN-TO-VALUE_{it}^2$ is also included.

One of the primary motivations for refinancing is to lock in low fixed rates. One recently published popular press personal finance book says, "For those of you eager to reduce your mortgage costs, today's record low mortgage rates offer an incredible deal. As of early 2011, the 30-year fixed-rate mortgage has an average interest rate below 5%" (Orman, 2011). The author mentions only fixed-rate mortgages, and it is implicit in the statement that, in the author's opinion, an FRM is the only type of mortgage one should consider when refinancing. In addition, according to the Refinance Product Transition Report from Fannie Mae, 86% of refinances since 1990 have been to some type of fixed-rate mortgage product. An indicator variable, $REFINANCE_{it}$ is included to account for this. There are important reasons why refinancing might reduce the propensity to choose an ARM. One is that in some states, refinanced loans are recourse loans, while purchase money loans are not, increasing the cost of default. As Campbell and Cocco (2003) showed, households with higher costs of default should be less inclined to choose ARMs. Additionally, if a household is refinancing, presumably they expect to be in the home long enough to recoup the costs, so they may be less likely to move in the near future.

Employment is an important consideration in the choice of mortgage contract, however it's not clear which contract an employed household will favor. While the stable income provided by regular employment might make the lower payments of an ARM contract relatively more attractive, the more tightly binding liquidity constraints of an unemployed household head may push the household toward an ARM as well, so a higher level of housing consumption can be achieved. Additionally, retirement may have an effect on the choice of an ARM. Given the lower income during these years, and the expectation of a certain level of non-housing consumption, the potential for larger mortgage payments may be particularly distasteful. However, the relatively stable income of these years might make the initial savings of an ARM appealing. We will be agnostic about the effect of employment on mortgage choice, however, $EMPLOYED_{it}$ and $RETIRED_{it}$ will be

included to account for their potential impact on the choice of mortgage contract type.

While the literature has shown little evidence that demographic factors have important effects on mortgage choice, it is not unreasonable to think that personal characteristics may influence the choice of an ARM vs. a fixed rate mortgage. Older borrowers could be less concerned with income variability, and households with children may be more concerned about risky payments, as they have to care for a larger family. Several demographic characteristics are added, including AGE_{it} and $AGE_{it}^2/100$, an indicator variable for the presence of children, $CHILDREN_{it}$, and the total number of children in the household. As well, an indicator for sex of the household head, taking a value of 1 if he is male, and a vector of indicator variables for marital status are added. The base case for marital status dummies is being a never-married household head.

Variables in the SCF

The SCF is usually structured as a series of representative cross-sectional surveys. However, the Federal Reserve Board chose to re-interview the 2007 sample to gage how the extraordinary economic events of the 2007-2009 period affected household finances. Because there are only two panels in the survey, only a *relative* measure of previous mortgages could be imputed. In both the 2007 and 2009 surveys, the questionnaire asks "Is there a mortgage or land contract on this property, or another type of loan that uses this property as collateral?" The survey goes on to ask "Did you take out this mortgage to: refinance or rollover an earlier loan, borrow additional money on your home equity, or to do both? " The answers to these two questions can be used to impute a measure of previous mortgages. If the household had a loan in 2007, but it was not to refinance a previous loan, the number of mortgage is set to one. If the purpose of that loan was to refinance an earlier contract, then we know the household has had at least two mortgages in its history. If a

new mortgage is taken out between 2007 and 2009 we add one to the number of previous loans. In the end we are only interested in within-household variation, so this relative measure of the number of mortgages is sufficient and we do not need to worry about how many loans a household actually had before the sample period.

The model in which we are interested is:

$$ARM_{it} = \Gamma * PREVIOUS\ MORTGAGE_{it} + \beta * X_{it} + \Theta * HFE_i + \epsilon_{it} \qquad (2)$$

Where ARM_{it} is, as before, an indicator for whether household i chose an adjustable rate mortgage at time t. The vector Γ is the coefficient on $PREVIOUS\ MORTGAGE_{it}$, which is also defined as before, however now we have $j \in \{2, 3\}$. The variable X_{it} is a vector of control variables including those listed in Table A2 most of which were discussed above. Because we are interested in *within* household variation, the within-estimator is used, which is equivalent to including household binary variables, HFE_i. It is important to note that the estimation sample contains only mortgage choice decisions observed in the 2007 survey for loans that were acquired in 2006 or 2007 and mortgage choice decisions in the 2009 survey for loans that were acquired in 2008 or 2009.

As discussed earlier, the shorter the expected tenure of a household in a given home, the larger the relative benefits of an adjustable rate mortgage. The measures of moving probability are slightly finer in the Survey of Consumer Finances. The SCF's panel survey included the question, "Using any number from zero to 100, where zero equals no chance and 100 equals absolutely certain, what do you think the chances are that you will be living at your current address two years from now?" Indicator variables for the households expected probability of moving are included to account for this effect in a non-parametric way. These variables include $DEFINITELY\ MOVE_{it}$, which takes a value of one if the household reports zero chance of staying at their current address. For a reported probability

of staying greater than zero, but less than or equal to 20%, $LIKELY\ MOVE_{it}$ is set to one. The variable $PROBABLY\ MOVE_{it}$ takes a value of one for reported probabilities between 20% and 80%, not inclusive, and $MAYBE\ MOVE_{it}$ is one when the reported probability of staying is greater than or equal to 80%, but less than 100%. The baseline case is if the household reports it is staying at its current address with 100% probability.

The coefficient vector of interest is $\Gamma = [\gamma_2\ \gamma_3]$. If households are increasing their usage of adjustable rate mortgages as they participate in the mortgage market, γ_2 and γ_3 should be positive, and monotonically increasing. That is, we should have $\gamma_2,\ \gamma_3 > 0$ and $\gamma_3 > \gamma_2$.

The SCF does not have information in the public release data files on geographic location of households, so unlike in the PSID, regional fixed effects are not included. However, broad employment industry dummy variables and a measure of the volatility of income are included. One of the most important considerations in the mortgage choice decision is household income volatility, which is correlated to industry of employment. The SCF collapses employment industry into seven broad categories, and an indicator for each of these industries is added to the regression. Additionally, the SCF asks the question "Is this [total] income unusually high or low compared to what you would expect in a "normal" year?" The survey goes on to ask, "About what would your total income have been if it had been a normal year?" and the "normal " income is then recorded. As an additional measure of income volatility, the variable $INCOME\ VOLATILITY_{it}$, which is equal to the ratio of total reported income to the reported value of "normal" income, is included.

Additional Regression Results from the SCF

We can repeat some of the analysis from above. Table A3 presents additional specifications, with the first column showing the main specification for comparison, the second through fourth columns relating to income, and the final two relating to education and information

acquisition. Column 2 presents results investigating the interaction of household beliefs about inflation and their income, and the choice of an ARM in the context of mortgage market participation. In both 2007 and 2009, the SCF asked respondents "Over the next year, do you expect your total (family) income to go up more than prices, less than prices, or about the same as prices?" An indicator variable taking a value of 1 if the respondent felt their purchasing power would increase over the next year was included and interacted with the relative number of mortgages the household has used. We would expect those who expect real income to increase in the future to be more inclined to risk the variable payments of an ARM, and this is what we see, though coefficients are not significant. In the third column, results are presented for a regression including a variable equal to 1 if the household indicates they "usually have a good idea" of what their family's income will be the following year. Coefficients on the interaction terms are positive and increasing, however, they are insignificant. The fourth column analysis if those who had a large positive shock to income (in the top 25% of households, measure relative to normal income) are driving the results. Interestingly, the interaction term for 3 mortgages is negative and significant. It is possible these households are not expecting future income to be as high, and are unwilling to risk the variable payments of an ARM.

The fifth column of Table A3 interacts an indicator equal to 1 if the household head has a graduate degree with the measures of mortgage market participation. Coefficients are again insignificant, however, the pattern on raw participation variables persists, and is more pronounced for those with a graduate degree. Additionally, the direction of the coefficients is consistent with those from the PSID. In the sixth column, a variable taking a value of 1 if the household head uses the internet as his primary source of information about borrowing is included and interacted with participation variables. Coefficients on the interaction terms are close to zero, and the pattern for mortgage contract choice, though again not significant, is still there for those who do not use the internet as their primary

source for information on borrowing.

Also notice that, though significance is lost in all but the specification for a large income shock, the pattern of increasing propensity to choose an ARM increasing with mortgage market participation is a feature of the SCF as well as the PSID. With such a short panel, statistical power is low for within-household effects, however, results align with those from the PSID, particularly in the case of mortgage market participation. Though results are not as significant, it is clear that the phenomenon of increasing propensity to choose an ARM is not isolated to the PSID.

Confounding

The potential for confounding effects of other variables is present in any regression analysis. In this section to address the largest potential confounding effect in the context of this study: households making housing decisions for non-housing related reasons. In this section, I investigate if households who are potentially removing equity from their home in order to pay for extreme expenses might be driving the overall result that the propensity to choose and adjustable rate mortgage increases with participation in mortgage markets.

One of the primary reasons a household might extract equity is because it is an entrepreneurial one in which home equity is required to invest in the "family" business. In the PSID, data are obtained indicating weather the head of the household is self employed. An indicator variable ($SELFEMP^t$) if the household head is self employed is interacted with the measures of mortgage market participation. Results are presented in the first column of Table A4. We see that self employed households may not increase their usage of ARMs as soon as other households, as indicated by the marginally significant coefficient of -13.75% on the interaction with PM^2, but importantly, this effect is not driving the general result. As well, self employed seem to exhibit the same pattern, with the possible

exception discussed above.

A second reason a household might extract equity is that a child or children might be attending, or about to attend, college. The PSID does not provide data exactly covering if dependents are in college, but we can see the age of the youngest child. I condition on the youngest child in the household being over 15 with the idea that if the youngest child is 15, she will soon be in college and any siblings will either be in college, be in college in the near future as well, or have recently graduated college. Results are presented in column 2 of Table A4. An indicator variable taking a value of one if the youngest child is over 15 ($CHILD^{15}$) is interacted with measures of mortgage market participation. Coefficients on the interacted terms are universally insignificant, and the main pattern continues to hold. This analysis was repeated for the youngest child being older than 16 and 17, with similar outcomes. Results are consistent with children nearing, or in, college not confounding the main result.

The PSID also directly measures school expenses. This could be for a child's college tuition, as above, or for a household head's own education. Creating an indicator for high school expenses relative to income ($SEI^{0.2}$), which takes a value of one if school expenses exceed 20% of total household income, interactions with the mortgage market participation variables are created. Column 3 of Table A4 presents results. Coefficients on interaction terms are universally statistically insignificant, though the magnitude on $SEI^{0.2}$ interacted with PM^2 is relatively high, suggesting households might be switching to ARMs early in their dealings with the mortgage market. Importantly, however, the general result that households have an increased propensity to use ARMs with mortgage market participation is not significantly influenced by accounting for high school expense.

Household heads who spend a large amount of time away from work due to illness or unemployment might pull equity out of the home to pay for daily expenses. Additionally,

they might find it more difficult to qualify for a loan, pushing them toward adjustable rate products. The PSID includes data on time spent away from work due to illness or unemployment, and indicator variables are created taking a value of one of the household head was away from work for at least a month in the previous year. The last two columns of Table A4 present results where an indicator variable for a large amount of time spent ill ($ILLTIME^{30}$) or spent unemployed ($UEMPTIME^{30}$) is interacted with measures of mortgage market participation. Results are similar in both cases, with significant interaction terms with PM^2 in both cases, and with $PM^{3,4}$ in the case of $UEMPTIME^{30}$. This indicates households may be pushed to ARMs to some degree by the difficulties of unemployment, whether for medical reasons or otherwise. It is important to note, however, that the main results continue to hold, if with a slightly lower level significance for PM^2 and $PM^{3,4}$ than before. This is consistent with unexpected expense having an effect on housing choices, but not driving the main result that households increase their usage of adjustable rate mortgages as the participate in the mortgage market.

Composition

It is possible that households who reach 5 or more mortgages in the sample period are systematically different than households who only reach 3 or 4 mortgages, who may in turn differ significantly from households who reach only 2 mortgages in the sample. Table A5 presents means for relevant variables by year, maximum number of mortgage reached in the sample, and number of mortgages reached by each year. There appear to be few differences across categories. Table A6 presents major financial and demographic variables across different maximum mortgage groups (MM^2, $MM^{3,4}$ and MM^{5+}), with equal number of mortgages, across time. That is, I compared MM^2 and $MM^{3,4}$, where current number of mortgages was 2, at each year from 1999-2009. I did the same for current mortgages of 3

or 4 and compared $MM^{3,4}$ and MM^{5+}. Comparing means for MM^2 and $MM^{3,4}$ indicates few differences overall. Possibly lower income for the MM^2 group, but the MM^2 group has the same, or perhaps slightly higher, income/housing expense ratio, with some years being higher and some years lower. The other potential difference is the MM^2 group is less likely to have a male head. All these considerations are controlled for in the regression and based on this type of summary statistic there appears to be little difference. Medians show a similar pattern. Comparing $MM^{3,4}$ and MM^{5+}, each with 3 or 4 mortgages, across years shows little systematic difference. Some years $MM^{3,4}$ has higher income or net worth and other years MM^{5+} has higher values for these variables. When not conditioning on comparing groups with the same number of mortgages, MM^2 seems to have systematically lower income and net worth, but this makes sense as they never reach more than 2 mortgages and are likely to be earlier in their life cycle, with less chance for wealth accumulation and income growth.

In Table A6, Panel (A) presents the distribution of observations over the different maximum mortgages categories, by year. We see that, overall, the distribution is fairly constant. Households belonging to MM^2 tend to comprise approximately 30% of the sample in any given year, while $MM^{3,4}$ and MM^{5+} households account for about 55% and just under 20%, respectively. This shows that there are not truncation issues, with most of the MM^2 households clustering near the end of the sample, but in fact the distribution across years is roughly stable. Panel (B) of Table A6 presents the distribution of maximum mortgage categories across industry of employment for the head of the household. In general, the distribution is relatively consistent across MM^2, $MM^{3,4}$ and MM^{5+}). Notable exceptions are that MM^2 households seem to be have a lower percentage of households in manufacturing and a higher percentage of households in retail, relative to the other categories. However, they are more similar to MM^{5+} in their percentages represented in real estate and rental and leasing, and professional, scientific and technical services. In

general, there is little to suggest a systematic difference between different groups.

Finally, if households who take out more mortgages are simply more inclined to use adjustable rate mortgages, this compositional effect could produce the observed pattern of increasing propensity to choose an adjustable rate mortgage with mortgage market participation when the different groups are aggregated in the same specification. To test if this is the case, an indicator variable for the maximum number of mortgages the household reaches in the sample period is created. The variables MM_i^2, $MM_i^{3,4}$ and MM_i^{5+} take values of one if the maximum number of mortgages for the household is 2, 3 or 4, or 5 or more, respectively. These are then interacted with the measures of mortgage market participation. Table A7 presents relevant coefficient estimates. We see that the coefficient on the PM^2 interaction term for $MM_i^2 = 1$ is positive, as we would expect, however not significant. The coefficients on PM^2 and $PM^{3,4}$ are positive and increasing for $MM_i^{3,4} = 1$, with values of 16.2% and 17.9%. With a p-value of 9.3%, an F-test of the null hypothesis that coefficients on $MM_i^2 \times PM^2$ and $MM_i^{3,4} \times PM^2$ are equal cannot be rejected at the 5% level. The coefficients for $MM_i^{5+} = 1$ are also positive and increasing, with values of 25.4% and 31.9%. An F-test of the hypothesis that coefficients on $MM_i^{3,4} \times PM^{3,4}$ and $MM_i^{5+} \times PM^{3,4}$ are equal is also not rejected, and has a p-value of 45.2%. While there could be differences across groups, we see propensity to choose an ARM increasing in mortgage market participation for all categories. Statistical significance in the PM^2 variable might be due to the effects of the $MM^{3,4}$ group, but comparing the $MM^{3,4}$ and MM^{5+} groups, estimates on $PM^{3,4}$ are positive and significant for both $MM^{3,4}$ and MM^{5+} groups, which is consistent with the overall results.

Figures and Tables

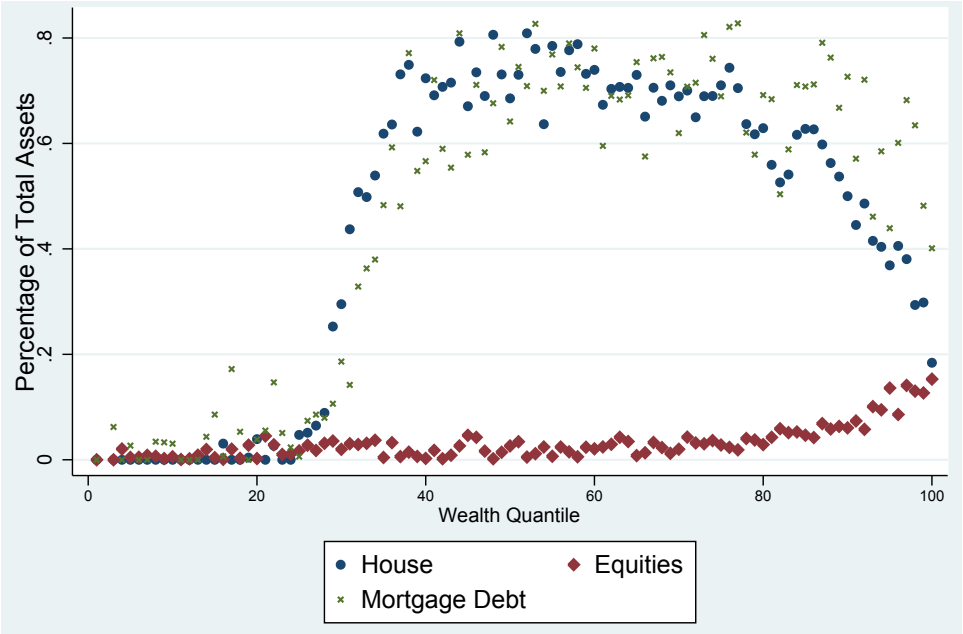

Figure 1
This graph plots household home prices ("house") and public equity value as a percentage of household assets against the distribution of wealth. "Mortgage Debt" gives the percentage of each wealth quantile that carries mortgage debt. Data come from the 2009 Survey of Consumer Finances (SCF) panel study.

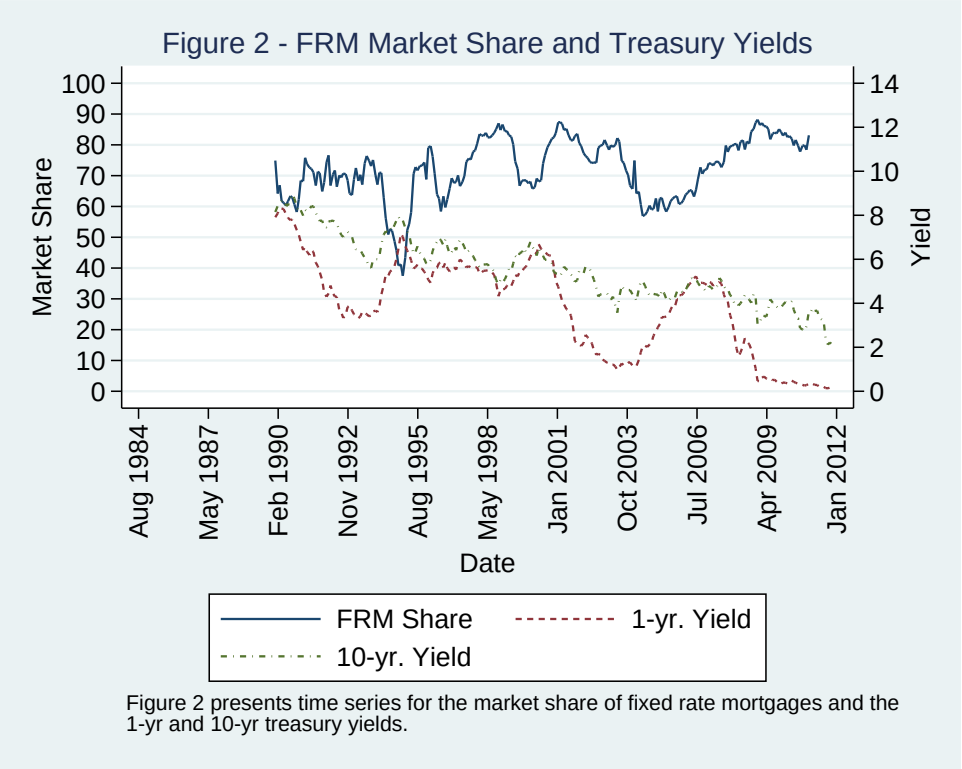

Figure 2
This figure presents time series for the market share of fixed rate mortgages and the 1-yr and 10-yr treasury yields. Data come from the Federal Housing Finance Agency's Monthly Interest Rate Survey (MIRS) and United States Department of the Treasury. MIRS data include information on originations during the last five days of every month over the sample period.

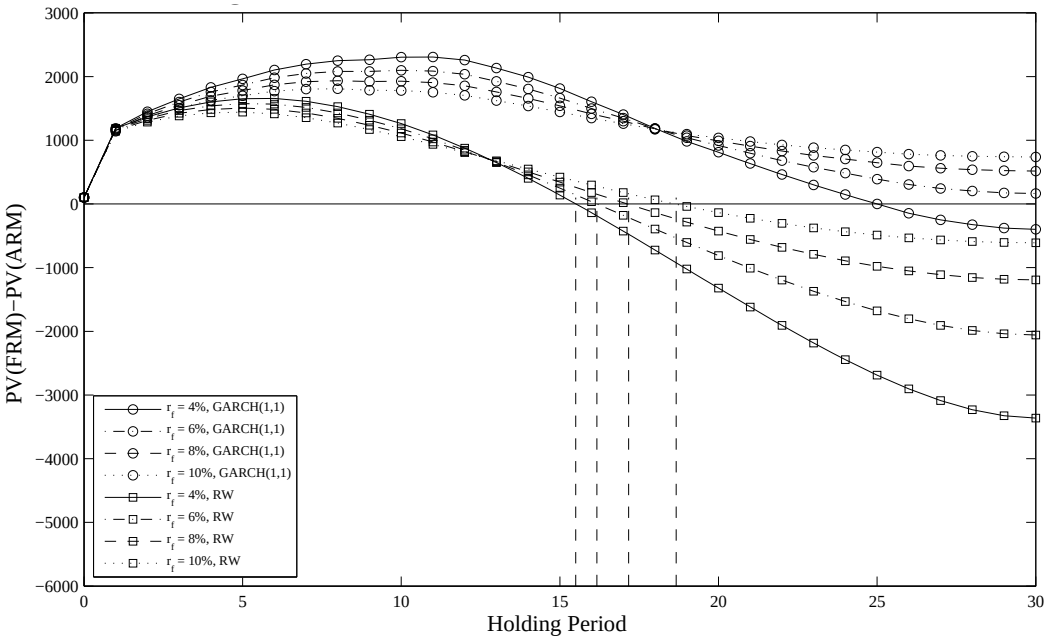

Figure 3
This graph shows the relative costs of ARMs and FRMs. It plots the present value (PV) of the difference E(cost of FRM) - E(cost of ARM) against the holding period in years. Circles indicate a GARCH(1,1) based simulation. A GARCH(1,1) model for monthly changes in the 1-year t-bill rate was estimated using data from 1960 through 2011, following the methodology discussed in Brenner, Harjes, and Kroner (1996). For each month between January of 1986 and December of 2011, 100 simulations of the interest rate process were generated, and the present value of ARM costs for holding periods from 1 to 30 years was calculated. These values were then compared to the present value of an FRM originated in the same month. As a comparison, following Tucker (1991), simulations based on the random walk model $r_t^{TB} = r_{t-1}^{TB} + \sigma_{TB} \times \eta_t$, where σ_{TB}, is the monthly standard deviation of the 1-year Treasury Bill rate. These simulations are indicated with square points. Simulations assume a starting principal of $100,000.

Table 1
This table presents summary statistics for both the Panel Study of Income Dynamics (Panels A-E) and the Survey of Consumer Finances (Panel F). Panels A-D present median values, by year, for total assets, income, principal on mortgages, net worth and house value all in thousands of dollars. Median age and education (in years) are also presented. The final column presents the mean of the population who are homeowners (Panel A), the mean of home owners who have mortgages (Panel B), the mean of mortgagees who have a new mortgage (Panel C) and the mean of new mortgagees who refinanced (Panel D). Panel E presents the percentage of observations with each number of mortgages from one to eight. Finally, Panel F presents means and medians from the 2007 Survey of Consumer Finances and the 2009 reinterview (age and education were omitted from the 2009 section because they are mechanically $age_{2007}+2$ and education is identical across years). Assets, income, principal, net worth and house value are in thousands of dollars. Age and education are in years.

Panel A - Overall

	Total Assets	Income	Principal	Net Worth	House Value	Age	Education	Homeowner
1994	101	50	0	56	65	43	12	0.63
1995	56	47	0	23	56	44	12	0.62
1996	62	46	0	26	62	46	12	0.63
1997	67	47	0	25	67	45	12	0.63
1999	119	51	0	66	77	46	12	0.64
2001	129	52	0	73	85	47	12	0.65
2003	135	50	0	71	93	48	12	0.66
2005	148	49	0	76	99	48	12	0.65
2007	151	50	0	78	98	49	13	0.64
2009	128	50	0	53	89	50	13	0.62

Continued on next page

Table 1 – *continued from previous page*

Panel B - Homeowners

	Total Assets	Income	Principal	Net Worth	House Value	Age	Education	Mortgage
1994	185	64	28	120	123	47	12	0.64
1995	120	62	21	70	127	49	12	0.61
1996	122	60	19	75	123	50	12	0.63
1997	124	61	29	74	127	50	13	0.65
1999	213	64	37	148	130	51	13	0.65
2001	225	66	39	160	151	51	13	0.67
2003	245	65	47	160	163	51	13	0.67
2005	275	65	55	186	187	52	13	0.68
2007	300	68	54	200	207	53	13	0.67
2009	263	69	59	160	180	54	14	0.68

Continued on next page

Table 1 – *continued from previous page*

Panel C - All Mortgages

	Total Assets	Income	Principal	Net Worth	House Value	Age	Education	New Mortgage
1994	200	80	72	103	139	43	14	0.15
1995	141	75	69	56	141	44	14	0.16
1996	134	73	62	60	137	44	13	0.15
1997	134	73	70	60	134	45	14	0.21
1999	210	76	77	117	148	45	14	0.44
2001	228	78	84	127	157	46	14	0.32
2003	246	76	93	129	175	46	14	0.54
2005	278	77	100	152	198	47	14	0.52
2007	303	79	106	167	223	48	14	0.36
2009	257	80	110	123	200	49	14	0.29

Continued on next page

Table 1 – *continued from previous page*

Panel D - New Mortgages

	Total Assets	Income	Principal	Net Worth	House Value	Age	Education	Refinance
1994	203	81	87	98	148	42	14	-
1995	141	71	77	49	141	42	14	0.00
1996	123	63	59	51	123	42	13	0.22
1997	134	67	94	40	134	41	13	0.27
1999	219	78	103	103	161	42	14	0.46
2001	219	77	101	95	164	42	14	0.35
2003	278	84	128	135	209	45	14	0.63
2005	311	82	132	152	220	44	14	0.56
2007	298	76	150	125	233	43	14	0.44
2009	281	81	150	106	205	45	14	0.51

Panel E - Distribution of Number of Mortgages

Mortgages	1	2	3	4	5	6	7	8
	30.67%	35.26%	18.80%	9.54%	4.07%	1.34%	0.29%	0.04%

Continued on next page

Table 1 – *continued from previous page*

Panel F - Survey of Consumer Finances Summary Statistics

		All		Homeowners		All Mortgages		New Mortgages	
	Variables	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2007	Total Assets	498	189	686	299	613	311	564	305
	Total Income	86	48	105	62	108	72	100	68
	Original Principal	185	146	185	146	185	146	210	174
	Net Worth	509	104	697	202	554	173	436	122
	House Value	212	124	303	207	323	229	321	244
	Age	49	48	52.8	52	47.6	47	44.2	42
	Education	13	13	13.6	14	13.9	14	13.9	14
	Homeowner	0.70	1	1	1	1	1	1	1
	Mortgage	0.48	0	0.68	1	1	1	1	1
	ARM	0.07	0	0.10	0	0.14	0	0.18	0
	New Mortgage	0.13	0	0.19	0	0.27	0	1	1
	Refinance	0.22	0	0.31	0	0.45	0	0.39	0
2009	Total Assets	429	170	583	259	519	267	543	282
	Total Income	81	49	97	60	105	75	103	78
	Original Principal	187	148	187	148	187	148	198	159
	Net Worth	411	80	555	151	429	119	430	111
	House Value	180	116	253	175	271	195	294	212
	Homeowner	0.71	1	1	0	1	1	1	1
	Mortgage	0.47	0	0.65	1	1	1	1	1
	ARM	0.05	0	0.08	0	0.12	0	0.08	0
	New Mortgage	0.15	0	0.21	0	0.32	0	1	1
	Refinance	0.08	0	0.11	0	0.17	0	0.50	1

Table 2

This table presents regression results for household fixed-effect models of mortgage choice. Coefficients should be interpreted as the change in the propensity to choose an adjustable rate mortgage, with a change in the dependent variable, within a household. Our measures of mortgage market experience, PM^j are indicator variables if the household has had j mortgages in their history. Coefficients on these variables are interpreted as the change in the propensity to choose an ARM within a household, relative to that households first mortgage choice. PM^1 is the omitted base case, so coefficients on PM^j for $j > 1$ are *relative* to the first mortgage. "Fixed Effects" beneath coefficient estimates include $REGION_{it}, YEAR_t$, and $TIME_t \times INDUSTRY_{it}$ fixed effects. Both purchase money and refinancing mortgages are included. P-values for the coefficients are in parentheses, and use heteroskedastic robust and clustered standard errors.

	(1)	(2)	(3)	(4)	(5)	(6)
PM[2]	**0.053**	**0.0753***	**0.0613**	**0.0642**	**0.0593**	**0.0860****
	(0.1557)	**(0.0632)**	**(0.1297)**	**(0.1086)**	**(0.1396)**	**(0.0475)**
PM[3,4]	**0.1017***	**0.1324****	**0.1260****	**0.1285****	**0.1221****	**0.1359****
	(0.0669)	**(0.0256)**	**(0.0346)**	**(0.0289)**	**(0.0381)**	**(0.0266)**
PM[5+]	**0.1419***	**0.2063****	**0.1938****	**0.2010****	**0.1888****	**0.2194*****
	(0.0615)	**(0.0108)**	**(0.0164)**	**(0.0122)**	**(0.0183)**	**(0.0059)**
MAYBE MOVE		0.1302***	0.1324***	0.1346***	0.1336***	0.1202***
		(0.0036)	(0.003)	(0.0025)	(0.0027)	(0.0084)
LIKELY MOVE		0.0932	0.1017	0.1005	0.104	0.1505**
		(0.2083)	(0.1643)	(0.1767)	(0.1519)	(0.0485)
DEFINITELY MOVE		0.1523***	0.1391**	0.1510***	0.1409**	0.1924***
		(0.006)	(0.0116)	(0.0061)	(0.0112)	(0.0005)
MOVED		-0.0108	-0.0219	-0.0261	-0.0228	-0.0272
		(0.7559)	(0.5218)	(0.445)	(0.5066)	(0.4394)
HVAL/INCOME			-0.0053		-0.006	-0.0036
			(0.4505)		(0.4592)	(0.7357)
TOTAL INCOME			-0.0002		-0.0002	-0.0001
			(0.4867)		(0.5381)	(0.7376)
INCOME/MPMT			0		0	-0.0001***
			(0.4137)		(0.3708)	(0.0001)
NET WORTH				0	0	0
				(0.952)	(0.6547)	(0.9409)
NW/HOUSE VALUE				-0.014	-0.0202	-0.0237
				(0.5105)	(0.3669)	(0.2655)
LOAN-TO-VALUE						-0.0636
						(0.757)
LOAN-TO-VALUE[2]						0.1352
						(0.3274)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.3706	0.391	0.4023	0.3985	0.4033	0.4389
N	4,164	3,920	3,856	3,883	3,856	3,694

Table 3
This table presents household fixed effect estimates for the regression of ARM_{it} on relative measures of mortgage market participation and controls in the SCF. PM^1 is the omitted base case, so coefficients on PM^j for $j > 1$ are *relative* to the first mortgage. Both purchase money and refinancing mortgages are included. Robust p-values are in parentheses next to coefficient estimates. * indicates significance at the 10% level, ** indicates signficance at the 5% level, and *** indicates significance at the 1% level.

ARM_{it}	(1)	(2)	(3)	(4)	(5)	(6)
PM^2_{it}	0.3069**	0.2813*	0.2685*	0.2542*	0.2415*	0.2132
	(0.0365)	(0.0623)	(0.0781)	(0.0683)	(0.0868)	(0.1435)
PM^3_{it}	0.5400**	0.4999**	0.4788**	0.4906**	0.4690**	0.4125*
	(0.0215)	(0.037)	(0.0471)	(0.026)	(0.0344)	(0.071)
MAYBE MOVE		0.1777**	0.1859**	0.2196**	0.2253***	0.2225**
		(0.0476)	(0.0365)	(0.0124)	(0.01)	(0.0105)
PROBABLY MOVE		0.0244	0.0321	-0.0078	-0.0053	0.0649
		(0.8607)	(0.8181)	(0.9544)	(0.9689)	(0.5379)
LIKELY MOVE		0.3011**	0.3632**	0.5194***	0.5183***	0.4950***
		(0.0257)	(0.0108)	(0.0041)	(0.0031)	(0.0031)
DEFINITELY MOVE		0.1322	0.1386	0.1555	0.1587	0.2440**
		(0.2726)	(0.2479)	(0.1845)	(0.1747)	(0.0415)
NET WORTH			0.0000*		0	0
			(0.0658)		(0.2954)	(0.2194)
NW/PRINCIPAL			-0.0149		-0.0121	-0.0113
			(0.1647)		(0.2173)	(0.2238)
TOTAL INCOME				0.0000*	0	0
				(0.0863)	(0.1448)	(0.2563)
MPMT/INCOME				0.3771	0.3715	-0.2091
				(0.2739)	(0.2865)	(0.5667)
INCOME SURPRISE				0.3815***	0.3819***	0.2929**
				(0.0026)	(0.0024)	(0.0107)
LTV					0.1381	0.1381
					(0.5122)	(0.5122)
LTV^2						-0.0299
						(0.1567)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Employment Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	39%	41%	41%	46%	46%	50%
N	1,028	1,028	1,028	1,027	1,027	1,025

Table 4
Numbers represent the percentage difference in mortgage costs for a fixed rate mortgage relative to the costs of an adjustable rate mortgage initiated in the same month. With this definition, a value of 10% indicates ex post costs of an FRM were 10% more than for an ARM. Initial interest rates come from Freddie Mac's Primary Mortgage Market Survey, which represents the average rates offered to mortgage applicants. ARM rates in the PMMS are indexed to short term treasury rates, so yields from the Federal Reserve Board are used to calculate expected interest costs for ARMs. Panel (A) summarizes actual costs since 1986, while Panel (B) summarizes expected costs over the same period.

Panel A - Actual Differences in Mortgage Payments

Horizon		3	5	7	10
Difference Paid					
	Mean	10.7%	9.6%	10.9%	13.8%
	Median	8.5%	6.7%	10.0%	14.5%
Interest Difference					
	Mean	17.7%	15.1%	16.8%	21.5%
	Median	11.7%	9.7%	16.4%	21.5%

Panel B - Expected Differences in Mortgage Payments

Horizon		3	5	7	10
Difference Paid					
	Mean	2.2%	-3.3%	-6.3%	-8.8%
	Median	1.0%	-3.6%	-6.9%	-9.5%
Interest Difference					
	Mean	3.8%	-4.4%	-8.5%	-11.8%
	Median	1.4%	-4.7%	-9.5%	-12.9%

Table 5
This table presents within-household estimates of propensity to choose ARM. The first column investigates the relationship between mortgage market participation, ARM choice propensity and working in the financial or real estate sectors. The second column addresses households "flipping" properties. The final column investigates the implications of having obtained a graduate degree, and its interaction with mortgage market participation. Household clustered standard errors are in parentheses, with p-values beneath them. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	Finance Worker		Flipping		Graduate School
Dependent Variable	ARM_{it}		ARM_{it}		ARM_{it}
FW_{it}	0.2075	$FLIP_{it}$	-0.1969		
	(0.2324)		(0.1957)		
	0.3721		0.3145		
$FW_{it}*PM^2$	0.082	$FLIP_{it}*PM^2$	-0.1415	GS_i*PM^2	0.1489
	(0.1331)		(0.1783)		(0.1014)
	0.5377		0.4275		0.1421
$FW_{it}*PM^{3,4}$	0.1356	$FLIP_{it}*PM^{3,4}$	0.1191	$GS_i*PM^{3,4}$	0.2612**
	(0.216)		(0.21)		(0.1048)
	0.53		0.5706		0.0127
$FW_{it}*PM^{5+}$	0.2484	$FLIP_{it}*PM^{5+}$	0.5109*	GS_i*PM^{5+}	0.2080*
	(0.2723)		(0.2757)		(0.1208)
	0.3616		0.0639		0.0851
PM^2	0.0830*		0.0995**		0.0855*
	(0.0441)		(0.0431)		(0.0469)
	0.06		0.0209		0.0681
$PM^{3,4}$	0.1331**		0.1378**		0.1160*
	(0.0613)		(0.06)		(0.0647)
	0.0301		0.0217		0.0734
PM^{5+}	0.2091***		0.2122***		0.2110**
	(0.0791)		(0.0783)		(0.0823)
	0.0083		0.0067		0.0104
Controls	Yes		Yes		Yes
R2	44.27%		45.21%		44.87%
N	3,694		3,694		3,502

Table 6
This table presents regression coefficients including an indicator variable, $REFI_{it}$, and interacting it with measures of mortgage market participation. It shows that there is a level effect, whereby households who are refinancing have a lower propensity to choose an ARM, but do increase their usage with participation. Robust p-values are in parentheses. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

	Main	Refinance
Dependent Variable	ARM_{it}	ARM_{it}
PM^2	0.0860**	0.0538
	(0.0475)	(0.2702)
$PM^{3,4}$	0.1505**	0.1394**
	(0.0266)	(0.0412)
PM^{5+}	0.2194***	0.2322**
	(0.0059)	(0.0123)
$Refi_{it}$		-0.1124*
		(0.0544)
$Refi_{it}*PM^2$		0.0939
		(0.1449)
$Refi_{it}*PM^{3,4}$		0.0339
		(0.6443)
$Refi_{it}*PM^{5+}$		0.0247
		(0.7707)
Controls and FE	Yes	Yes
R^2	43.89%	44.06%
N	3,694	3,694

Table 7
This table gives estimates for changes in within household propensity to choose an ARM with mortgage market participation interacted with wealth and income distribution, as well as the main specification for comparison. Standard errors are in parentheses, with p-values beneath them. The dependent variable, ARMit, is an indicator variable taking the value one if the household chose an adjustable rate mortgage. * indicates significance at the 10% level, ** at the 5% level and *** at the 1% level.

	Main		Net Worth		Income
Dependent Variable	ARM_{it}		ARM_{it}		ARM_{it}
PM^2	0.0860**	$NW^1_{it}*PM^2$	0.1340***	$INC^1_{it}*PM^2$	0.0395
	(0.0434)		(0.049)		(0.0553)
	0.0475		0.0063		0.4759
$PM^{3,4}$	0.1359**	$NW^1_{it}*PM^{3,4}$	0.1880***	$INC^1_{it}*PM^{3,4}$	0.1683**
	(0.0613)		(0.07)		(0.0732)
	0.0266		0.0073		0.0216
PM^{5+}	0.2194***	$NW^1_{it}*PM^{5+}$	0.2531**	$INC^1_{it}*PM^{5+}$	0.2022**
	(0.0797)		(0.1071)		(0.1029)
	0.0059		0.0182		0.0496
		$NW^2_{it}*PM^2$	0.0682	$INC^2_{it}*PM^2$	0.0669
			(0.0561)		(0.0462)
			0.2245		0.1482
		$NW^2_{it}*PM^{3,4}$	0.1162*	$INC^2_{it}*PM^{3,4}$	0.1224*
			(0.0658)		(0.0649)
			0.0775		0.0596
		$NW^2_{it}*PM^{5+}$	0.2466***	$INC^2_{it}*PM^{5+}$	0.2242***
			(0.088)		(0.0861)
			0.0051		0.0093
		$NW^3_{it}*PM^2$	0.0127	$INC^3_{it}*PM^2$	0.1398**
			(0.0582)		(0.0603)
			0.8267		0.0206
		$NW^3_{it}*PM^{3,4}$	0.0652	$INC^3_{it}*PM^{3,4}$	0.1239*
			(0.0708)		(0.0686)
			0.3578		0.071
		$NW^3_{it}*PM^{5+}$	0.126	$INC^3_{it}*PM^{5+}$	0.2122**
			(0.0892)		(0.0887)
			0.158		0.0167
Controls	Yes		Yes		Yes
HH Fixed Effects	Yes		Yes		Yes
Region Controls	Yes		Yes		Yes
Time Fixed Effects	Yes		Yes		Yes
Industry Fixed Effects	Yes		Yes		Yes
Time*Industry FE	Yes		Yes		Yes
R^2	43.89%		44.60%		44.36%
N	3,694		3,689		3,689

c

Table 8
This table shows how households with a high net worth differ in their mortgage choice decisions. It reports point estimates with p-values in parentheses beneath. Panel (A) displays the net worth regression from Table 7, but including indicator variables for belonging to the second and third terciles of net worth, for convenience and comparison. Panel (B) repeats the analysis, but includes interaction terms for households who have a high net worth, but low income, and households who were likely buying their first home in the early 1980s. Please see the text for a detailed discussion of these variables and results. * indicates significance at the 10% level, ** at the 5% level and *** at the 1% level.

Panel A

	PM^{2}	$PM^{3,4}$	PM^{5+}
NW^{1}_{it}	0.1269**	0.1778**	0.2407**
	(0.0243)	(0.0244)	(0.0322)
NW^{2}_{it}	0.0695	0.1152	0.2433***
	(0.2382)	(0.1014)	(0.0075)
NW^{3}_{it}	0.0369	0.0912	0.152
	(0.6914)	(0.3689)	(0.1899)

Panel B

	PM^{2}	$PM^{3,4}$	PM^{5+}
NW^{1}_{it}	0.1403**	0.2021**	0.3044***
	(0.0101)	(0.0158)	(0.0079)
NW^{2}_{it}	0.0835	0.1461**	0.3283***
	(0.1406)	(0.0417)	(0.0014)
NW^{3}_{it}	0.0464	0.1586	0.2873**
	(0.6902)	(0.1776)	(0.0297)
$INC^{1,2}_{it}*NW^{3}_{it}$	-0.0292	-0.1465	-0.1714
	(0.8772)	(0.4382)	(0.3746)
BUY^{80}	0.0044	-0.0268	-0.1772
	(0.9736)	(0.8683)	(0.3257)

Table 10
This table presents fixed-effect regression results for households with net worth greater than $750,000, income greater than $300,000 and with a net worth to house value ratio greater than 2.8. These households represent those least likely to be constrained when they make their housing consumption decision. Column 5 includes interaction terms for mortgage market participation and an indicator if the respondent moved and the new house is greater than 2.7 times the value of the old house. The last column interacts an indicator if the respondent indicated they moved to get a "better"home, either in terms of physical plant or location. Controls, region effects, time effects and the interaction of time and industry effects are included in all regressions. Please see the text for a detailed discussion of these variables. P-values are in parentheses below point estimates. * indicates significane at the 10% level, ** at the 5% level and *** indicates significance at the 1% level.

Interaction	NW > $750K	INC > $300K	NW/HVAL > 2.8	PMT/INC < 8.5%	HI > 2.7	BETTER HOME
Dependent Variable	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}
PM^2	0.0895**	0.0897**	0.0835*	0.0815*	0.0681*	0.0932**
	(0.0391)	(0.0383)	(0.0561)	(0.065)	(0.0946)	(0.0364)
$PM^{3,4}$	0.1340**	0.1367**	0.1289**	0.1354**	0.1025*	0.1525**
	(0.0318)	(0.0263)	(0.036)	(0.0277)	(0.065)	(0.0177)
PM^{5+}	0.2246***	0.2256***	0.2082***	0.2250***	0.1946***	0.2395***
	(0.0064)	(0.0053)	(0.0093)	(0.0059)	(0.0066)	(0.0028)
$IND_{it}*PM^2$	-0.084	-0.0742	-0.1425	0.1061	-0.0253	0.0145
	(0.4303)	(0.5898)	(0.2701)	(0.2673)	(0.6402)	(0.7954)
$IND_{it}*PM^{3,4}$	0.0337	0.0546	-0.0447	0.0794	0.5494***	-0.0366
	(0.6444)	(0.6084)	(0.7773)	(0.33)	(0)	(0.5419)
$IND_{it}*PM^{5+}$	-0.0408	-0.0342	0.0677	0.038	0.8571***	-0.3044***
	(0.6984)	(0.8169)	(0.5762)	(0.6599)	(0)	(0.0024)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Region Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time*Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	43.99%	43.98%	44.00%	44.18%	47.38%	44.30%
N	3,694	3,694	3,694	3,694	3,694	3,694

Table 11
This table presents results for high housing price growth areas and a restriction of the sample period to post 2005, when real estate values fell across the country. The indicator variable in the first column indicates 5 year real estate price growth of 40% or higher. Please see the text for a detailed discussion of these variables. P-values are in parentheses below point estimates. * indicates significane at the 10% level, ** at the 5% level and *** indicates significance at the 1% level.

Interaction	5-yr Price Growth > 40%	After 2005
Dependent Variable	ARM_{it}	ARM_{it}
PM^2	0.0561	0.1420**
	(0.205)	(0.0177)
$PM^{3,4}$	0.1082*	0.2373***
	(0.0951)	(0.0051)
PM^{5+}	0.1820**	0.3162***
	(0.0351)	(0.0011)
$IND_{it}*PM^2$	0.0874*	
	(0.0644)	
$IND_{it}*PM^{3,4}$	0.0572	
	(0.1755)	
$IND_{it}*PM^{5+}$	0.1147	
	(0.1136)	
Controls	Yes	Yes
Region Controls	Yes	Yes
Time Fixed Effects	Yes	Yes
Time*Industry FE	Yes	Yes
R^2	44.38%	50.72%
N	3,694	2,883

Table 12
This table shows regression results investigating income volatility as a driver for the result that the propensity to choose an adjustable rate mortgage increases with previous participation in mortgage markets. The first column presents the main result for comparison, while the second separates out those households in the highest quintile of income volatility. The third column separates out households in the lowest quintile of income volatility and the final column separates out households in the top quintile of income trend. Please see the text for a detailed discussion of these variables. P-values are in parentheses below point estimates. * indicates significane at the 10% level, ** at the 5% level and *** indicates significance at the 1% level.

	Main	Lagged IV: High	Lagged IV: Low	IV Time Trend
	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}
PM^2	0.0860**	0.0123	0.0197	0.0038
	0.0475	0.7996	0.7267	0.9417
$PM^{3,4}$	0.1359**	0.0869	0.0823	0.0818
	0.0266	0.2141	0.2567	0.271
PM^{5+}	0.2194***	0.1657*	0.1609*	0.1936**
	0.0059	0.0675	0.0834	0.0464
$IV^L_{it}*PM^2$		0.1025	0.0292	0.1800**
		0.1577	0.6165	0.0166
$IV^L_{it}*PM^{3,4}$		-0.0894	-0.0392	0.0451
		0.1232	0.2614	0.4525
$IV^L_{it}*PM^{5+}$		0.1177	-0.0028	-0.0204
		0.1763	0.9582	0.7912
Controls	Yes	Yes	Yes	Yes
R^2	43.89%	48.38%	48.38%	48.94%
N	3,694	2,889	2,889	2,893

Table A1
This table lists and explains the main covariates used in the regression analysis for the Panel Study of Income Dynamics

Variable	Description
DEFINITELY MOVE	Indicator for self reported probability of moving in the next 2 years of
LIKELY MOVE	Indicator for self reported probability of moving in the next 2 years being "probably move"
MAYBE MOVE	Indicator for self reported probability of moving in the next 2 years being "maybe move"
MOVED	Indicator if the household moved
NET WORTH	Assets less liabilities of the household
NW/HOUSE VALUE	Net worth normalized by original principal on the mortgage
HVAL/INCOME	Value of the home normalized by total income
TOTAL INCOME	Total household income from all sources for the year in which the mortgage was originated
INCOME/MPMT	Total annual mortgage payments normalized by total income
LOAN-TO-VALUE	Original principal as a percentage of the purchase price of the home
LOAN-TO-VALUE^2	Loan-to-value squared
REFINANCE	Indicator equal to 1 if the loan was to refinance an existing mortgage
EMPLOYED	Indicator equal to 1 if the head of the household is employed
RETIRED	Indicator equal to 1 if the head is retired.
AGE	Age of the head of the household
AGE^2/100	Age of the head squared
CHILDREN	Indicator equal to 1 if children are part of the household
NUM CHILDREN	The number of dependent children in the household
MALE	Indicator equal to 1 if the head of the household is male
WIFE POWER	A measure of the realative bargaining power of the wife in the household
MARRIED	Indicator equal to 1 if the head of the household is divorced
DIVORCED	Indicator equal to 1 if the head of the household is married
WIDOWED	Indicator equal to 1 if the head of the household is widowed
SEPARATED	Indicator equal to 1 if the head of the household is separated

Table A2
This table presents the main covariates used in the regression analysis of the Survey of Consumer Finances

Variable	Description
DEFINITELY MOVE	Self reported probability of moving in the next 2 years of 100%
LIKELY MOVE	Self reported probability of moving in the next 2 years more than or equal to 80%, but less than 100%
PROBABLY MOVE	Self reported probability of moving in the next 2 years between 20% and 80%
MAYBE MOVE	Self reported probability of moving in the next 2 years less than or equal to 20%, but not definitely staying
NET WORTH	Assets less liabilities of the household
NW/PRINCIPAL	Net worth normalized by original principal on the mortgage
TOTAL INCOME	Total household income from all sources for the year in which the mortgage was originated
MPMT/INCOME	Total annual mortgage payments normalized by total income
INCOME VOLATILITY	Ratio of a household's total income to the household's self reported "normal" income.
LOAN-TO-VALUE	Original principal as a percentage of the purchase price of the home
LOAN-TO-VALUE^2	Loan-to-value squared
REFINANCE	Indicator equal to 1 if the loan was to refinance an existing mortgage
EMPLOYED	Indicator equal to 1 if the head of the household is employed
AGE	Age of the head of the household
AGE^2/100	Age of the head squared
CHILDREN	Indicator equal to 1 if children are part of the household
MALE	Indicator equal to 1 if the head of the household is male
MARRIED	Indicator equal to 1 if the head of the household is divorced
DIVORCED	Indicator equal to 1 if the head of the household is married
WIDOWED	Indicator equal to 1 if the head of the household is widowed
SEPARATED	Indicator equal to 1 if the head of the household is separated
EMPLOYMENT INDUSTRY	Set of indicator variables for the industry in which the household is employed

Table A3

This table gives coefficient estimates from fixed effect regression models of ARM_{it} on the measures of mortgage market participation. All estimates are computed accounting for the multiple imputation methods used by the SCF and using survey provided weights. Household clustered standard errors are in parentheses with p-values beneath them. * indicates significance at the 10% level, ** indicates significance at the 5% level, and *** indicates significance at the 1% level.

Indicator		Increasing PP	Knows Income	Pos. Inc. Shock	Grad School	E-Finance
Dependent Variable	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}	ARM_{it}
PM^2_{it}	0.2132	0.1735	0.1843	0.2071	0.2277	0.248
	(0.1456)	(0.1836)	(0.2091)	(0.1615)	(0.1445)	(0.1712)
	0.1435	0.3448	0.3785	0.2	0.1154	0.1477
PM^3_{it}	0.4125*	0.3484	0.2448	0.4284*	0.3569	0.4228
	(0.2282)	(0.2661)	(0.3033)	(0.2367)	(0.2345)	(0.2603)
	0.071	0.1908	0.4198	0.0707	0.1283	0.1047
Indicator		0.0131	0.0335	0.4340*		0.1332
		(0.188)	(0.1827)	(0.2246)		(0.1813)
		0.9446	0.8547	0.0537		0.4626
Indicator*PM^2_{it}		0.0599	0.0221	-0.3195	-0.0934	-0.0803
		(0.2328)	(0.1991)	(0.2602)	(0.1562)	(0.1999)
		0.797	0.9117	0.2197	0.5499	0.688
Indicator*PM^3_{it}		0.321	0.1624	-0.6051**	0.2374	-0.0359
		(0.3022)	(0.1989)	(0.2539)	(0.2429)	(0.2432)
		0.2884	0.4144	0.0174	0.3287	0.8826
Controls and FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	49.96%	51.67%	50.54%	52.88%	51.76%	51.04%
N	1,025	1,025	1,025	1,025	1,025	1,025

Table A4
This table shows regression results investigating potentially confounding effects due to households potentially removing equity from their home in order to pay for certain extreme expenses. This includes self-employment ($SELFEMP^t$), children in or soon to be in college ($CHILD^{15}$), large school expenses relative to income ($SEI^{0.2}$), a large amount of time spent ill and unable to work ($ILLTIME^{30}$) or a large amount of time spent unemployed ($UEMPTIME^{30}$). Indicator variable interacted with measures of mortgage market participation is indicated at the top of each column. Please see the text for a detailed discussion of these variables. P-values are in parentheses below point estimates. * indicates significance at the 10% level, ** at the 5% level and *** indicates significance at the 1% level.

	SELF EMP^t	CHILD^{15}	SEI$^{0.2}$	ILLTIME^{30}	UEMPTIME^{30}
PM^2	0.1052**	0.0865**	0.0843*	0.0658	0.0624
	(0.0355)	(0.0488)	(0.0553)	(0.1644)	(0.1794)
PM^{3,4}	0.1649**	0.1329**	0.1357**	0.1324*	0.1178*
	(0.0215)	(0.0314)	(0.0281)	(0.0502)	(0.077)
PM^{5+}	0.2438***	0.2244***	0.2205***	0.2158***	0.2050**
	(0.006)	(0.0052)	(0.0062)	(0.0096)	(0.0126)
IND$_{it}$*PM^2	-0.1375*	0.0188	0.2797	0.1635**	0.1730**
	(0.0971)	(0.8566)	(0.1341)	(0.0458)	(0.0219)
IND$_{it}$*PM^{3,4}	0.0455	0.0417	-0.0856	0.0781	0.1247*
	(0.5423)	(0.5058)	(0.5142)	(0.3291)	(0.0782)
IND$_{it}$*PM^{5+}	0.1285	-0.0889	-0.0761	0.0704	-
	(0.3362)	(0.1777)	(0.5894)	(0.3974)	-
Controls	Yes	Yes	Yes	Yes	Yes
R^2	45.9%	44.1%	44.1%	44.5%	44.3%
N	3,313	3,694	3,665	3,694	3,694

Table A5
This table presents means for relevant financial, economic and demographic variables separated by year, maximum number of mortgages reached in the sample, and the mortgages reached at each point in time. Panel (A) compares households who achieve a maximum of 2 mortgages with those who reach 3 or 4 mortgages, while Panel (B) compares households who achieve a maximum of 3 or 4 mortgages with those achieve a maximum of 5 or more mortgages.

Panel A: Means - MM^{2}-$MM^{3,4}$, Total Mortgages 2

	1999		2001		2003		2005		2007		2009	
	MM = 2	MM = 3,4	MM = 2	MM = 3,4	MM = 2	MM = 3,4	MM = 2	MM = 3,4	MM = 2	MM = 3,4	MM = 2	MM = 3,4
MAYBE MOVE	0.98	0.85	0.81	0.88	0.88	0.92	0.85	0.88	0.76	0.86	0.78	-
LIKELY MOVE	0.01	-	-	-	0.02	0.06	0.01	0.06	0.08	0.05	0.06	-
DEFINITELY MOVE	-	0.12	0.06	0.12	0.06	0.02	0.05	0.06	0.12	0.05	0.12	-
MOVED	0.57	0.54	0.49	0.65	0.37	0.34	0.46	0.40	0.50	0.46	0.50	-
REFINANCE	0.30	0.31	0.21	0.24	0.70	0.74	0.45	0.56	0.46	0.52	0.45	-
CHILDREN	0.29	0.53	0.62	0.61	0.44	0.54	0.57	0.52	0.50	0.67	0.44	-
TOTAL INCOME	76.27	83.57	55.23	119.00	79.93	87.12	78.69	100.67	75.07	101.63	96.64	-
LOAN-TO-VALUE	0.60	0.83	0.77	0.68	0.69	0.67	0.63	0.58	0.73	0.69	0.73	-
LOAN-TO-VALUE^2	0.42	0.73	0.64	0.51	0.53	0.49	0.45	0.36	0.58	0.52	0.62	-
MALE	0.65	0.69	0.87	0.95	0.60	0.71	0.78	0.94	0.77	0.83	0.76	-
INCOME/MPMT	10.66	6.17	6.31	8.43	6.84	7.07	8.62	6.01	6.41	5.83	9.23	-
NET WORTH	140.44	216.21	179.36	173.41	167.61	140.32	234.50	248.05	134.18	230.23	219.01	-
NW/HOUSE VALUE	0.82	1.14	0.66	0.80	0.80	0.67	0.84	0.75	0.57	0.63	0.88	-
AGE	49.86	41.29	47.13	44.53	44.92	39.07	42.93	39.87	38.40	37.87	43.49	-
AGE^2/100	25.97	17.82	23.94	20.61	21.96	16.34	20.23	17.09	15.80	15.17	20.89	-
NUM CHILDREN	0.55	0.91	1.17	1.32	0.73	1.03	0.99	1.02	0.98	1.12	0.81	-
EMPLOYED	0.70	0.91	0.66	0.89	0.89	0.88	0.81	0.87	0.85	0.95	0.81	-
RETIRED	0.20	0.09	0.28	-	0.09	0.06	0.15	0.12	0.06	0.03	0.09	-
DIVORCED	0.33	0.27	0.15	-	0.28	0.16	0.14	0.05	0.19	0.13	0.18	-
WIDOWED	0.05	0.06	0.13	0.05	0.10	-	0.09	0.06	0.01	0.06	0.06	-
MARRIED	0.60	0.53	0.72	0.95	0.46	0.67	0.67	0.85	0.61	0.66	0.62	-
SEPARATED	-	-	-	-	-	0.00	0.02	-	0.01	0.02	0.01	-

Panel B: Means - $MM^{3,4}$-MM^{5+}, Total Mortgages 3 or 4

	1999		2001		2003		2005		2007		2009	
	MM = 3,4	MM = 5+	MM = 3,4	MM = 5+	MM = 3,4	MM = 5+	MM = 3,4	MM = 5+	MM = 3,4	MM = 5+	MM = 3,4	MM = 5+
MAYBE MOVE	0.92	0.81	0.96	0.81	0.91	0.82	0.90	0.92	0.83	0.81	0.85	-
LIKELY MOVE	-	0.03	-	0.05	0.01	0.02	0.03	-	0.04	0.06	0.03	-
DEFINITELY MOVE	-	0.09	0.04	0.06	0.04	0.04	0.05	0.08	0.07	0.05	0.05	-
MOVED	0.30	0.42	0.55	0.54	0.27	0.21	0.37	0.17	0.39	0.39	0.26	-
REFINANCE	0.77	0.58	0.50	0.30	0.75	0.86	0.61	0.69	0.53	0.58	0.67	-
CHILDREN	0.39	0.47	0.54	0.49	0.38	0.35	0.44	0.46	0.46	0.39	0.54	-
TOTAL INCOME	126.38	119.58	102.28	115.40	124.23	141.82	113.40	111.24	97.93	109.78	110.37	-
LOAN-TO-VALUE	0.62	0.76	0.64	0.54	0.57	0.59	0.57	0.57	0.61	0.59	0.69	-
LOAN-TO-VALUE^2	0.44	0.64	0.45	0.35	0.37	0.39	0.38	0.36	0.43	0.40	0.57	-
MALE	0.95	0.78	0.84	1.00	0.88	0.90	0.88	1.00	0.86	0.82	0.87	-
INCOME/MPMT	8.52	8.29	7.91	8.24	9.23	7.62	8.02	6.96	7.79	7.14	8.32	-
NET WORTH	413.64	225.49	227.15	363.68	438.45	479.31	413.11	250.63	297.69	391.96	316.63	-
NW/HOUSE VALUE	1.39	1.11	0.92	1.01	1.33	1.13	1.09	0.77	0.88	0.99	1.04	-
AGE	49.40	44.50	47.04	45.86	51.27	50.13	46.96	49.59	47.35	52.49	47.45	-
AGE^2/100	25.45	20.25	23.04	22.06	27.41	26.04	23.20	25.46	23.80	29.22	24.00	-
NUM CHILDREN	0.75	0.99	1.02	0.99	0.71	0.74	0.84	0.74	0.90	0.84	0.99	-
EMPLOYED	0.89	0.91	0.83	0.72	0.86	0.91	0.90	0.80	0.91	0.78	0.83	-
RETIRED	0.03	0.06	0.17	0.28	0.10	0.07	0.06	0.11	0.05	0.19	0.11	-
DIVORCED	0.11	0.10	0.19	-	0.11	0.15	0.15	-	0.16	0.18	0.11	-
WIDOWED	0.08	-	0.05	-	0.05	-	0.01	-	0.00	0.00	0.03	-
MARRIED	0.75	0.72	0.69	1.00	0.80	0.80	0.73	1.00	0.74	0.75	0.79	-
SEPARATED	-	0.02	0.06	-	0.00	-	0.02	-	0.02	0.04	0.02	-

Table A6
This table presents, in panel (A), the distribution of observations by year, and in (B), the employment industry across the different categories of maximum number of mortgages reached in the sample. There seems to be little difference across the different categories in the distribution of estimation observations by year. Additionally, there is little systematic variation in in industry of employment across maximum mortgage groups. See the text for a more detailed discussion.

Panel A

	1999	2001	2003	2005	2007	2009
2 Mortgages	25.79%	34.43%	23.56%	30.50%	28.72%	29.12%
3-4 Mortgages	54.21%	51.64%	59.73%	51.88%	45.30%	45.47%
5+ Mortgages	20.00%	13.93%	16.71%	17.62%	25.99%	25.41%

Panel B

	MM^{2}	$MM^{3,4}$	MM^{5+}	Total
Agriculture, Forestry, Fishing,	2.2%	3.0%	0.8%	2.3%
Mining	1.2%	0.4%	0.7%	0.7%
Utilities	0.4%	1.8%	1.5%	1.3%
Construction	9.0%	9.4%	8.9%	9.2%
Manufacturing	15.3%	19.0%	19.3%	18.0%
Wholesale Trade	4.6%	3.9%	3.1%	3.9%
Retail Trade	7.8%	6.0%	3.8%	6.0%
Transportation and Warehousing	3.2%	4.7%	4.0%	4.1%
Information	3.1%	3.4%	4.0%	3.5%
Finance and Insurance	5.3%	5.1%	6.8%	5.5%
Real Estate and Rental and Leasing	2.7%	1.6%	3.0%	2.2%
Professional, Scientific, and Technical Services	8.1%	6.8%	8.8%	7.6%
Management, Administrative and Support	1.6%	1.5%	1.7%	1.6%
Educational Services	7.0%	6.5%	7.6%	6.9%
Health Care and Social Assistance	7.4%	8.0%	7.8%	7.8%
Arts, Entertainment, and Recreation	1.5%	1.5%	1.8%	1.6%
Accommodations and Food Services	5.1%	4.2%	4.5%	4.5%
Other Services	3.5%	3.1%	2.0%	2.9%
Public Administration and Active	10.9%	10.3%	10.1%	10.4%

Table A7
This table presents coefficient estimates for mortgage market participation measures by category of maximum number of mortgages obtained by the household in the sample period. MM^j indicates that the household used a maximum of j mortgages during the sample period. All coefficients are from the same regression. Tests of equality across categories are included. P-values are in parentheses below point estimates. * indicates significance at the 10% level, ** at the 5% level and *** indicates significance at the 1% level.

Interaction			
Dependent Variable	PM^2	$PM^{3,4}$	PM^{5+}
MM^2	0.0441	-	-
	(0.3572)	-	-
$MM^{3,4}$	0.1620**	0.1788**	-
	(0.0128)	(0.0122)	-
MM^{5+}	-	0.2538***	0.3189***
	-	(0.0037)	(0.0007)

Test of $MM^2*PM^2 = MM^{3,4}*PM^2$
F(1, 2997) = 2.82
P-value = 0.0930

Test of $MM^{3,4}*PM^{3,4} = MM^{5+}*PM^{34}$
F(1, 2997) = 0.57
P-value = 0.4522