# The Impact of Financial Sophistication on Adjustable Rate Mortgage Ownership

Hyrum Smith, Michael S. Finke, and Sandra J. Huston

*The influence of a financial sophistication scale on adjustable-rate mortgage (ARM) borrowing is explored. Descriptive statistics and regression analysis using recent data from the Survey of Consumer Finances reveal that ARM borrowing is driven by both the least and most financially sophisticated households but for different reasons. Less sophisticated households are more likely to choose ARMs when they are income constrained, while more sophisticated households are more likely to choose ARMs to take advantage of higher interest rate spreads between fixed-rate mortgages and ARMs. These results highlight the importance of financial sophistication in making effective mortgage decisions and the value financial counselors and planners can provide in helping households understand the benefits and risks of ARM borrowing.*

*Key Words: adjustable-rate mortgages, financial sophistication, mortgage choice, Survey of Consumer Finances*

## Introduction

For the majority of households, a mortgage represents the largest liability on their balance sheet. Selecting a mortgage may be one of the most important financial decisions a household will make, and choosing between fixed-rate (FRM) or adjustable-rate (ARM) mortgages can be challenging. The recent mortgage crisis has drawn attention to the vulnerability of households who choose ARMs. Surveys prior to the mortgage crisis reported that younger, lower income, less educated, or minority households preferred ARMs over FRMs (Aversa, 2008; Consumer Federation of America, 2004). The media also tends to emphasize inappropriate ARM borrowing by vulnerable or less educated households (Fleishman, 2005; Lukasova, 2009).

While the use of ARMs by lower income, less educated households generates concern, some researchers suggest that ARMs are favored by higher income, more educated, or less financially distressed households (Coulibaly & Li, 2007; Schwartz, 2007). Indeed, ARMs expose households to greater interest rate risk and potential fluctuations in consumption. However, they also offer several advantages such as the ability to purchase more home for less money, to have lower borrowing costs if interest rates remain low relative to FRMs, and to have lower initial payments for homeowners likely to move (Campbell & Coco, 2003; Finke, Huston, Siman, & Corliga, 2005). The popularity of ARMs outside the U.S. provides evidence that consumers view ARMs as a competitive home financing product (Campbell & Coco, 2003; Greenspan, 2004).

Bergstresser and Beshears (2010) investigated how certain cognitive characteristics, such as understanding of complex mortgage products, distrust of complicated mortgages, or optimism, relate to the likelihood of using an ARM. The current research study contributes to the literature by investigating more directly the influence of financial sophistication upon mortgage choice during the years leading up to the recent mortgage crisis. To accomplish this objective, the researchers developed a more comprehensive proxy for financial sophistication using six different questions from the Survey of Consumer Finances (education, health, degree to which respondents shop around when making borrowing or savings decisions, stock ownership, and ability of respondents to understand questions in the SCF). This financial sophistication scale contrasts the use

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of general proxies for financial sophistication in previous studies, such as by Bergstresser and Beshears (2010), who only used the SCF question which assesses the respondent's ability to understand survey questions, or by Schwartz (2007), who only used education as a proxy for sophistication. While these variables may capture a portion of financial sophistication, such as endowed human capital, additional variables that relate more specifically to household financial decisions were used in this study to create a factor score proxy of financial sophistication. Using a more comprehensive proxy for financial sophistication allows one to better isolate the influence of financial sophistication, and not just income, wealth, education, or other general characteristics, on ARM borrowing.

The objective of the current study was to examine differences in ARM borrowing prior to the 2007 financial crisis to better understand how financial sophistication affects mortgage choice. Changes in predictors of ARM choice across survey years suggest that financial sophistication plays an important role in explaining how changes in the mortgage market affect the characteristics of mortgage borrowers. Understanding characteristics associated with ARM borrowing can help financial counselors and financial planners better advise their clients in making the most appropriate mortgage decision.

## Literature Review

Using nationally representative data from the SCF, Finke et al. (2005) found that while the overall trend in the proportion of ARMs to total mortgages declined between 1989 and 2001, the distribution of ARMs shifted to lower income, less wealthy, single, and credit troubled households less equipped to weather the shocks of interest rate increases. From the early 2000s to shortly before the financial crisis, the proportion of ARMs to total mortgages rose from 12% in 2001 to 35% in 2004 before dropping to 10% in 2007 (Joint Center for Housing Studies, 2009). Several studies have attributed much of the rise in ARM borrowing during this period to more exotic adjustable-rate products such as subprime, interest only loans (Fishbein & Woodall, 2006; Immergluck, 2008; Joint Center for Housing Studies, 2009). Many of the more exotic mortgages allowed income-constrained households to borrow larger amounts when faced with high housing inflation.

Schwartz (2007) found that wealth, income, education, and mobility were positively related to ARM preference. In addition, educated, higher income households were more likely to hold ARMs when mortgage spreads (i.e., the spread between FRMs and ARMs) were high. In contrast, less educated, credit constrained households were influenced less by mortgage spreads and more by less stringent affordability constraints when choosing ARMs.

Using SCF data from 1995 through 2004, Coulibaly and Li (2007) found that pricing variables, such as the mortgage spread as well as other borrowing characteristics, influenced the likelihood of holding an ARM. For example, borrowing characteristics, such as being more likely to move, having longer mortgage terms, or being financially constrained, were positively associated with the likelihood of ARM ownership. Risk aversion and more risky sources of income were negatively associated with holding an ARM. Using SCF data over a longer period from 1989 through 2007, Bergstresser and Beshears (2010) provided similar evidence that households that were credit constrained or had a greater probability of moving, were more likely to hold an ARM. These results were consistent with other studies that found factors, such as lower risk aversion, stable income, financial constraints, or a greater probability of moving, were positively associated with ARM borrowing (Campbell, 2006; Campbell & Coco, 2003; Dhillon, Shilling, & Sirmans, 1987; Sa-aadu & Sirmans, 1995; Schwartz, 2007).

Despite a common belief that ARMs are more popular among borrowers who do not understand the risks of a variable rate loan, no studies existed that investigated the impact of financial sophistication on ARM choice. The current study examined how a measure of financial sophistication influences recent ARM choice among households while accounting for both the impact of financial constraints and pricing.

## Model

Coulibaly and Li (2007) developed a conceptual model of mortgage choice that was adapted as the framework for this current research. Assuming that the borrower's payoff ($V$) under the two different mortgage contracts are represented by $V_F^i = V(R_F, B^i)$ and $V_A^i = V(R_A, B^i)$ the borrower decision will be based on the following:

$$\begin{cases} V_F^i = V(R_F, B^i) > V(R_A, B^i) = V_A^i & \text{Choose a FRM} \\ V_F^i = V(R_F, B^i) < V(R_A, B^i) = V_A^i & \text{Choose an ARM} \end{cases} \quad (1)$$

To simplify the analysis, it was assumed that (a) there were only two types of mortgages (FRM and ARM), (b) borrowers have different financial situations, expectations, and preferences (represented by borrower characteristics

$B^i$), and (c) the mortgages had identical terms, such as maturity, points, or prepayment options, except for interest rates at time of origination. Thus, each borrower (*i)* must make the mortgage decision based on initial FRM interest rates ($R_F^i$) and ARM interest rates ($R_A^i$) that have been essentially tailored by the lender to the borrower based on borrower characteristics $B^i$. Given that the lender does not have full information and due to the economies of scale from offering similar rate contracts, the lender will choose to offer limited $R_F$ and $R_A$ rates to similar creditworthy customers.

After further separating borrower characteristics into financial sophistication (FS), borrowing constraints (BC), mortgage spread ($R_{FA}$), and other characteristics (OC), the household's decision to choose an ARM contract can be modeled as follows:

$$\text{Likelihood of entering ARM contract} = f(FS^i, BC^i, R_{FA}, OC^i) \quad (2)$$

It was hypothesized that a larger $R_{FA}$ (difference between the initial FRM and ARM interest rate) will increase the likelihood that a household will prefer an ARM (Campbell & Coco, 2003; Coulibaly & Li, 2007; Schwartz, 2007). Campbell and Coco (2003) reported that life cycle factors, such as greater risk tolerance and less risky labor income, were positively associated with ARM ownership. Risk aversion and less certain future income streams should reduce likelihood of holding ARMs. Greater borrowing or credit constraints might increase the likelihood of holding ARMs if the lower initial payments from ARM contracts are used to increase the amount of money a household can borrow. Controls for other demographic characteristics and household expectations were included in the model. The probability of moving, expectations of income increasing, greater wealth, and greater income might be associated with increased preference for ARM ownership, while expecting interest rates to increase and refinancing might reduce preference for ARM borrowing (Campbell & Coco, 2003; Coulibaly & Li, 2007; Schwartz, 2007).

In terms of interactions, we hypothesized that financial sophistication increases the likelihood of more price sensitive mortgage choice proxied by the spread between adjustable-rate and fixed-rate mortgages. If less sophisticated consumers are not fully aware of the added risk of ARMs, we hypothesized that they will be more likely to hold ARMs when faced with greater borrowing constraints. Testing these hypotheses allowed us to focus on whether ARM borrowing is influenced by not only less financially sophisticated, borrowing constrained households, but also by more financially sophisticated borrowers taking advantage of more periodic mortgage spreads that represent a temporary change in the relative pricing of ARMs versus FRMs.

## Method

### *Data*

This research extends the previous work on ARMs conducted by Coulibaly and Li (2007) and Schwartz (2007) by including the most recent 2007 SCF wave in the analysis. The SCF is a triennial, cross-sectional survey sponsored by the Federal Reserve Board (FRB) and has detailed mortgage, financial, and other household information relevant to this research. Given that the primary interest of the current study was testing the determinants of ARM ownership over the recent period leading up to the financial crisis, data from the 2001, 2004, and 2007 years of the SCF were used.

The SCF is composed of two separate samples, one with the purpose of obtaining broad coverage of characteristics of households nationwide, and a second that is a disproportionate sample of relatively wealthy households selected to obtain information on those households that tend to have a greater influence on the economy. In order to adjust for the disproportionate amount of wealthy households, SCF sampling weights provided by the FRB were used to generate more nationally representative descriptive statistic estimates. Since the SCF uses multiple imputation to estimate five values for each missing data or response, the repeated-imputed inference technique was used in our regression analysis as recommended by Montalto and Sung (1996).

### *Sample*

The number of households interviewed was 4,442 in 2001, 4,519 in 2004, and 4,418 in 2007. Since the focus of the current study was on recent ARM originations, data from these years were censored by those who entered a mortgage contract on their primary residence within the last three years. This selection process resulted in a total sample size of 3,596 households over the three survey years.

## Analysis

A binomial logistic regression model was used to model predictors of recent ARM borrowers. Given the desire to evaluate the structural determinants of ARM ownership, the variables were not weighted in performing the regres-

sion analysis. The dependent and independent variables were operationalized or coded using the SCF as follows.

***Dependent Variable***

The SCF includes a question about the mortgage on the respondent's primary residence: "Is this an adjustable rate mortgage; that is, does it have an interest rate that can rise and fall from time to time?" If the household responded yes, the household was considered to have an ARM and coded 1, otherwise coded 0.

***Independent Variables***

*Financial Sophistication.* Since the SCF does not contain questions that specifically measure the financial sophistication of the household, a factor analysis method similar to that used by Van Rooij, Lusardi, and Alessie (2007) was employed to generate a financial sophistication factor score for each household. While education has been used to proxy financial sophistication (Amromin, Huang, & Sialm, 2007; Coulibaly & Li, 2007), formal education may not accurately capture human capital related to financial choices. Survey questions from the SCF were used in this study to represent more advanced knowledge that was most closely related to the ability to effectively choose between an ARM and a FRM. Six questions were used to create a factor score to proxy financial sophistication: level of education, understanding of the SCF survey questions, health status, amount of shopping when making major borrowing decisions, amount of shopping when making major saving or investment decisions, and stock ownership.

Highest level of education of the head of household was ranked from lowest to highest as follows: no high school, high school/GED degree, some college, college degree, and graduate degree. Near the end of the survey, the interviewer recorded on a 4-point scale (poor, fair, good, excellent) how well they believed the respondent understood the SCF questions. The health status of the head of household was based on a 4-point scale (poor, fair, good, excellent). Perlmutter and Nyquist (1990) found that both self-reported physical and mental health can explain a significant amount of the variation of performance on intelligence tests. Respondents were also asked, on a scale of 1 (almost never) to 5 (a great deal), the degree to which they shop around for the best deal or terms when making major borrowing and savings or investment decisions. These questions were used to create two separate variables, one for borrowing and one for saving. Finally, similar to other research that has associated financial sophistication with stock ownership (Calvet, Campbell, & Sodini, 2009; Van Rooij et al., 2007), a variable for stock ownership (whether the household owns any equity within its portfolio) was included. After creating these six different variables for each household in the SCF years 2001 through 2007, factor analysis was performed on these variables using the iterated principal factor method (Van Rooij et al., 2007) to create a factor score used to proxy financial sophistication. Factor loadings are reported on the six different variables in the Appendix.

*Mortgage Spread.* Since the SCF only reports the current interest rates of the mortgage contracts for each household and the year entered into the contract, an average market spread was used to estimate the household specific FRM-ARM spread similar to Coulibaly and Li (2007). Specifically, the FRM-ARM spread was calculated by taking the yearly average spread between a FRM and a 1-year ARM for each year based on national average rates provided by Freddie Mac's Primary Mortgage Market Survey[1]. Given that the average interest rate on a 15-year FRM is predominantly lower than that on a 30-year FRM, the FRM-ARM spread on mortgages with maturity terms was calculated at or below 15 years by subtracting the average interest rate on a 1-year ARM from the average interest rate on a 15-year FRM the year the household took out the mortgage. For all other households, the FRM-ARM spread was calculated by subtracting the average interest rate on a 1-year ARM from the average interest rate on a 30-year FRM in the year the household entered the mortgage contact. Determining the mortgage spread in this manner further controlled for the influence of mortgage maturity and better isolated the effect of the FRM-ARM spread on ARM ownership.

*Borrowing Constraints.* A household was considered income constrained if it had a mortgage payment-to-income (PTI) ratio of at least 28%. A loan-to-value (LTV) ratio of at least 90% was used to measure collateral constraints, and being turned down at least once for credit over the last 5 years was considered credit constrained (Schwartz, 2007). To further account for credit constraints and the rise in ARMs that were subprime during the period under study, a subprime variable was included. Since the SCF does not report whether a household holds a subprime mortgage, the household's current mortgage interest rate and treasury yields were used in a manner similar to the method employed by Coulibaly and Li (2007). If the household's current interest rate was more than three

percentage points higher than the Treasury security of a comparable maturity, the household was considered to hold a subprime mortgage.

*Other Characteristics*. Net worth and income calculations for each household were based on the code provided by the FRB and adjusted for inflation using the CPI index[2]. Net worth and income were measured in $100,000 units in the regression model. Race was included in the model to control for possible discrimination in mortgage origination or racial preference. If a household described themselves as part of a race category other than white (i.e., Black/African-American, Hispanic/Latino, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, other) the household was considered non-White. Respondents were asked about the chances, on a scale of 0-100, that they would be living at their current address in the next two years. To calculate the probability of moving, 100 was subtracted from their response. A dummy variable for whether the recent mortgage was a refinance was included to control for the tendency of households to refinance from ARMs to FRMs (Coulibaly & Li, 2007; Schwartz, 2007).

Response to a question that asked whether the respondent expects interest rates to be higher, lower, or the same as today in five years was used to measure future interest rate expectations. If the household responded that it expected interest rates to be higher, the household was coded as having higher interest rate expectations. Expected income increase was drawn from a question that asked whether the respondent believed that income would increase, stay the same, or decrease next year relative to price increases. To control for macroeconomic and other factors that commonly affect mortgage preference among households over time, dummy variables were created for each SCF year.

Campbell and Coco (2003) presented a model where risk aversion and labor income risk are major determinants of ARM borrowing. Risk aversion was proxied for in the model using the household's response to the SCF question on how much financial risk it would be willing to take when saving for investments. If the household responded that it would not be willing to take any financial risks, the household was determined to be risk averse (coded 1). If the household responded that it would be willing to take substantial risks with the expectations of earning substantial returns, above average risks expecting to earn above average returns, or take average financial risks expecting to earn average returns, the household was considered to be not risk averse (coded 0). Similar to Schwartz (2007), labor income risk was proxied using the SCF question on whether the household usually had a good idea of next year's income. If the household responded yes, the household's labor risk was determined to be low (coded 1), otherwise coded 0.

## Results

### *Descriptive Statistics*

*Total Sample, ARM, FRM Samples*. The descriptive statistics for the total sample of all recent mortgage borrowers (those who originated a mortgage within the last three years of each survey year) as well as statistics for ARM and FRM borrowers are reported in Table 1. Data were pooled from the 2001, 2004, and 2007 SCF datasets. All descriptive statistics reported in this paper included the five implicates and were weighted unless otherwise reported. As shown in Table 1, 15% of all mortgage originations were ARMs within the pooled data from 2001, 2004, and 2007.

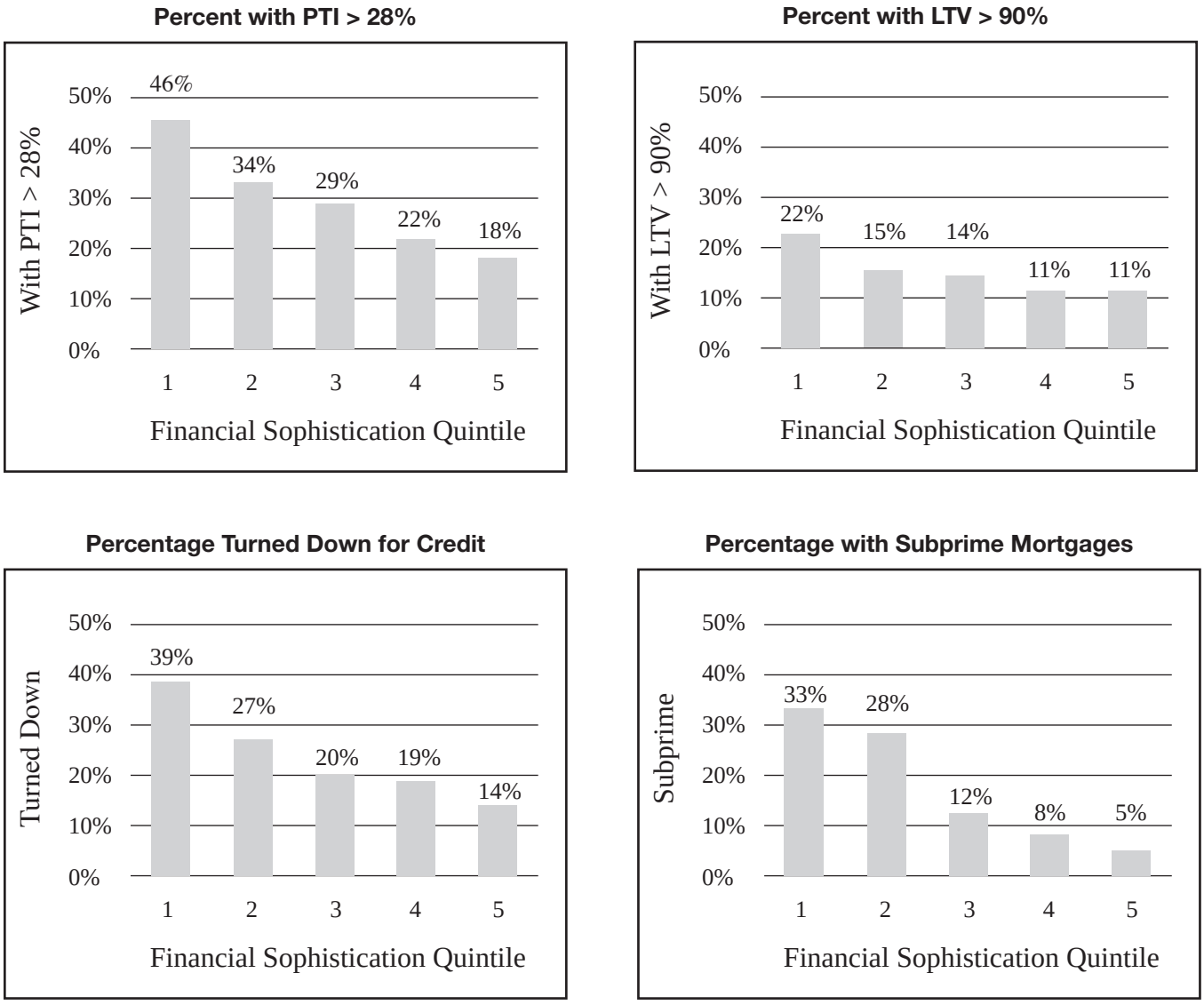
ARM borrowers were most concentrated in the lowest (23%) and highest quintiles (22%) of financial sophistication, and there was no noticeable difference in the distribution of financial sophistication in the total sample or sample of FRM borrowers. Figure 1 presents the percentage within each financial sophistication quintile among ARM borrowers that were income constrained (PTI > 28%), collateral constrained (LTV > 90%), had been turned down for credit at least once in the last five years, and held subprime mortgages are presented in Figure 1. Among ARM borrowers, the households most likely to report financial distress measures were those in the lowest quintile of financial sophistication, while the households least likely to report financial distress measures were those in the highest quintile of financial sophistication. Among ARM borrowers in the lowest quintile of financial sophistication, 46% were income constrained (PTI > 28%), 22% were collateral constrained (LTV > 90%), 39% had been recently turned down for credit, and 33% had subprime mortgages. These findings sharply contrasted with ARM borrowers in the highest quintile of financial sophistication, where only 18% were income constrained, 11% were collateral constrained, 14% had been turned down for credit, and 5% had subprime mortgages. All of the borrowing constrained measures showed a steady decline in the percentage of households that were financially distressed as financial sophistication increased. Less sophisticated households were more likely to hold ARMs due to borrowing or affordability constraints and therefore appeared to be more vulnerable to interest rate increases.

**Table 1. Descriptive Statistics of Recent Mortgage Borrowers**

| Variable | Total borrowers ($N$ = 3,596) % | ARM borrowers ($n$ = 661) % | FRM borrowers ($n$ = 2,935) % |
|---|---|---|---|
| **Dependent variable** | | | |
| ARM borrower | 15.19 | 100 | |
| FRM borrower | 84.81 | | 100 |
| **Independent variables** | | | |
| Financial sophistication | | | |
| 1st Quintile | 20.17 | 23.41 | 19.59 |
| 2nd Quintile | 19.81 | 15.55 | 20.57 |
| 3rd Quintile | 19.43 | 21.41 | 19.07 |
| 4th Quintile | 20.58 | 17.31 | 21.16 |
| 5th Quintile | 20.02 | 22.32 | 19.60 |
| Mortgage spread | *M* = 1.39<br>*Mdn* = 1.36 | *M* = 1.43<br>*Mdn* = 1.38 | *M* = 1.38<br>*Mdn* = 1.36 |
| Borrowing constraints | | | |
| PTI > 28% | 21.81 | 29.96 | 20.35 |
| LTV > 90% | 13.18 | 14.87 | 12.87 |
| Turned down for credit | 18.49 | 24.03 | 17.50 |
| Subprime | 8.79 | 17.11 | 7.31 |
| Other characteristics | | | |
| Net worth | *M* = $584,189<br>*Mdn* = $172,217 | *M* = $869,380<br>*Mdn* = $215,235 | *M* = $533,104<br>*Mdn* = $168,856 |
| Income | *M* = $115,702<br>*Mdn* = $ 76,644 | *M* = $133,587<br>*Mdn* = $ 76,458 | *M* = $112,498<br>*Mdn* = $ 77,201 |
| Probability of moving | *M* = 15.13<br>*Mdn* = 0.00 | *M* = 21.00<br>*Mdn* = 0.00 | *M* = 14.08<br>*Mdn* = 0.00 |
| Refinance | 35.03 | 29.73 | 35.97 |
| Non-White | 21.02 | 25.65 | 20.19 |
| Expect rates to increase | 73.73 | 70.62 | 74.29 |
| Expect income to increase | 25.96 | 30.01 | 25.24 |
| Risk averse | 26.05 | 22.69 | 26.65 |
| Not know income | 22.93 | 23.24 | 22.88 |

*Note.* All statistics reported are weighted using the weighting variable x42001 provided within the SCF in order to provide statistics that are more representative of the national population. Both net worth and income were adjusted for inflation using the Consumer Price Index and the same methodology employed by the Federal Reserve Board when reporting on the SCF.

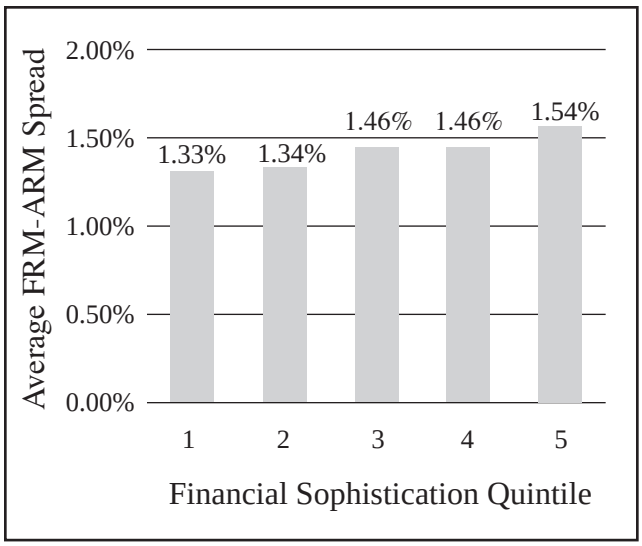
**Figure 1. Among ARM Borrowers, Percent Borrowing Constrained by Financial Sophistication Quintile**




The average mortgage or FRM-ARM spread by financial sophistication among ARM borrowers are presented in Figure 2. More financially sophisticated borrowers originated their ARMs in periods when the spread between FRM and ARM was higher. Thus, it appears that the more financially sophisticated may be basing the decision to choose a FRM or an ARM based on periodic changes in their relative cost.

The percentage of ARM borrowers by financial sophistication quintile and year are presented in Figure 3. The proportion of ARM borrowers was highest among the lowest quintile of financial sophistication in 2001 and 2007. In contrast, in 2004 the highest proportion of ARM borrowers was in the highest quintile of financial sophistication. Specifically, in 2001, 30% of ARM borrowers were in the lowest sophistication quintile while 17% were in the highest quintile of financial sophistication. In contrast, the percentage of ARM borrowers in 2004 from the lowest quintile of financial sophistication declined to 20% while the percentage in the highest quintile almost doubled to 29%. Similar, although less dramatic, drops occurred in the second and third quintiles from 2001 to 2004, and a slight increase was experienced in the fourth quintile over that same time period. There appears to have been a shift in the percentage of ARM borrowers during a time period when

**Figure 2. Among ARM Borrowers, Average FRM-ARM Spread by Financial Sophistication Quintile**




the FRM-ARM spread was increasing, as a greater proportion of the financially sophisticated entered ARM contracts in 2004.

The average FRM-ARM mortgage spread among ARM borrowers was slightly higher at 1.43% compared to 1.38% among FRM borrowers, indicating an increased popularity of ARMs during periods when their interest rates were relatively lower than FRMs. ARM borrowers reported greater frequencies of financial distress measures, with 30% being income constrained (PTI > 28%), 15% collateral constrained (LTV > 90%), 24% credit constrained (turned down for credit at least once in the last five years), and 17% holding subprime mortgages. In contrast, among FRM borrowers 20% were income constrained (PTI > 28%), 13% collateral constrained (LTV > 90%), 18% were credit constrained (turned down for credit at least once in the last five years), and only 7% held subprime mortgages.

ARM borrowers had a higher net worth (median $215,235) and similar income (median $76,458) relative to FRM borrowers who had a median net worth of $168,856 and median income of $77,201. ARM borrowers had a higher average probability of moving (21%) than FRM borrowers (14%). More ARM borrowers were non-White (26%) and expected their income to increase (30%) than FRM borrowers (20% non-White and 25% expected their income to increase). A greater proportion of FRM borrowers expected interest rates to increase over the next five years (74%) and refinanced (36%) compared to ARM borrowers, of whom 71% expected interest rates to increase and only 30% reported that their most recent mortgage was a refinance. ARM borrowers were less risk averse (23%) than FRM borrowers (27%), while 23% of both ARM and FRM borrowers were uncertain of their income next year.

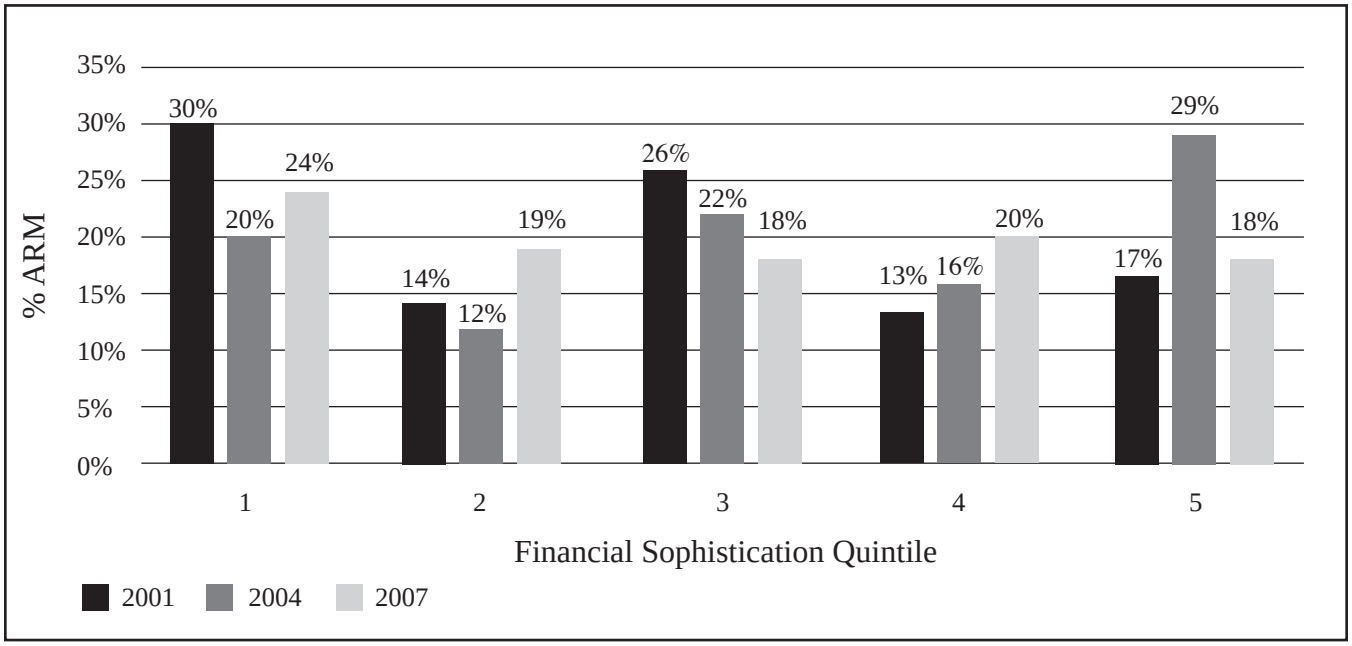
***Logistic Regression***

The first logistic regression model included results from the independent variables without including interaction terms. To test the hypotheses that financial sophistication moderates the likelihood of holding an ARM among the financially distressed and in periods when mortgage spreads are high, interaction terms between financial sophistication and financial distress measures and mortgage spreads were added in the second logistic regression model. The logistic regression results from recent borrowers for both the first and second models are presented in Table 2.

*Model without Interaction Terms*. Results indicated that there was a positive relationship between financial sophistication and ARM ownership. A FRM-ARM spread increase of one percentage point increased the likelihood of ARM choice by 69%. All significant borrowing constraint variables showed positive coefficients. Households with a subprime mortgage were two and a half times more likely to hold an ARM than those holding a non-subprime mortgage and households with a PTI ratio above 28% were 30% more likely to own an ARM than those households that were less income constrained. Owning a subprime mortgage provided more predictive power (standardized beta 0.12) on whether a household held an ARM than whether a household had a PTI ratio above 28% (standardized beta 0.06). Whether a household had a LTV ratio above 90% had very little predictive power in the model.

Household characteristics, net worth, probability of moving, expectations of income increasing next year above inflation, and risk aversion were significant at the $p < .05$ level, and positively associated with the likelihood of recently originating an ARM. A household that expected income next year to increase above inflation was 21% more likely on average to hold an ARM than one who did not. As a household's probability of moving increased by 25% (slightly below one standard deviation of 27%), the likelihood of holding an ARM increased by 17%. Risk averse households were 25% less likely to hold an ARM than those who reported being willing to take at least some risk in their investments.

**Figure 3. Percent of ARM Borrowers by Financial Sophistication and Survey Year**




The dummy year variable for 2004 showed no statistical significance. However, the dummy variable for 2007 was positive and significant, indicating that ARM borrowing increased prior to the financial crisis.

*Model with Financial Sophistication Interaction Terms*. Interaction variables measuring the effect of increasing financial sophistication among mortgage borrowers indicated that greater sophistication among those who were more financially constrained (mortgage PTI above 28%) were less likely to choose an ARM than a FRM. Conversely, greater sophistication and higher FRM-ARM spreads led to increased likelihood of choosing an ARM as more sophisticated borrowers took advantage of reduced borrowing costs. Other interaction terms indicated that greater financial sophistication among those with a high LTV ratio, subprime borrowers, and those who had been turned down for credit in the past were not associated with an increased likelihood of ARM choice. Statistical significance and directional effects of the mortgage spread, life cycle, borrowing constraint, and other demographic variables remained relatively unchanged when adding the interaction terms. However, when the interaction terms were introduced into the model, the financial sophistication factor was no longer significant, suggesting that the influence of financial sophistication on ARM borrowing can be explained by the increased likelihood of ARM choice among less financially sophisticated, more constrained borrowers, and more sophisticated households took advantage of larger FRM-ARM spreads.

## Discussion

After controlling for mortgage spread, borrowing constraints, and other household characteristics, income constrained (PTI > 28%) households are more likely to hold ARMs as financial sophistication decreases, while the more financially sophisticated are more likely to originate ARMs during periods when the FRM-ARM spread is high. Having a LTV ratio greater than 90% and having a subprime mortgage show no significant moderating effects on the influence of financial sophistication on holding an ARM. However, when considering the moderating effects of borrowing constraint measures and average mortgage spreads, the previous positive, significant influence of financial sophistication is no longer significant. Therefore, ARM borrowing is positively influenced by not only less financially sophisticated, borrowing constrained households but also by more financially sophisticated borrowers capitalizing on higher mortgage spread periods. These results are somewhat similar to those presented by Schwartz (2007), who found that mortgage spreads positively moderate the influence of education on ARM borrowing. However, the current research is the first to develop a financial sophistication measure that is then used to test

**Table 2. Logistic Regression Results for Recent Mortgage Borrowers**

| Variable | Model without interaction terms | | | Model with interaction terms | | |
|---|---|---|---|---|---|---|
| | *b* | Point estimate | Standard estimate | *b* | Point estimate | Standard estimate |
| Financial sophistication | 0.193* | 1.213 | 0.075 | -0.119 | 0.888 | -0.046 |
| Mortgage spread | 0.523*** | 1.687 | 0.133 | 0.420** | 1.521 | 0.107 |
| Borrowing constraints | 0.261* | 1.298 | 0.056 | 0.310** | 1.364 | 0.066 |
| PTI > 28% | -0.016 | 0.984 | -0.003 | -0.036 | 0.965 | -0.006 |
| LTV > 90% | 0.086 | 1.090 | 0.017 | 0.094 | 1.098 | 0.018 |
| Turned down for credit | 0.916*** | 2.499 | 0.124 | 0.857*** | 2.357 | 0.116 |
| Subprime | 0.001** | 1.001 | 0.080 | 0.001** | 1.001 | 0.081 |
| Other characteristics | 0.004 | 1.004 | 0.047 | 0.003 | 1.003 | 0.043 |
| Net worth | 0.641*** | 1.898 | 0.094 | 0.668*** | 1.949 | 0.098 |
| Income | -0.161 | 0.851 | -0.044 | -0.189* | 0.828 | -0.051 |
| Probability of moving | 0.028 | 1.029 | 0.006 | 0.020 | 1.020 | 0.004 |
| Refinance | -0.105 | 0.900 | -0.026 | -0.119 | 0.888 | -0.029 |
| Non-White | 0.192* | 1.212 | 0.049 | 0.172 | 1.188 | 0.044 |
| Expect rates to increase | -0.285* | 0.752 | -0.062 | -0.294* | 0.745 | -0.064 |
| Expect income to increase | 0.029 | 1.030 | 0.007 | 0.003 | 1.011 | 0.003 |
| Risk averse | | | | | | |
| Not know income | | | | | | |
| Years (2001) | | | | | | |
| 2004 | 0.003 | 1.003 | 0.001 | -0.015 | 0.985 | -0.004 |
| 2007 | 0.343** | 1.409 | 0.088 | 0.335*** | 1.398 | 0.087 |
| Financial sophistication interaction variables | | | | | | |
| Financial sophistication * PTI > 28% | | | | -0.383* | 0.682 | |
| Financial sophistication * LTV > 90% | | | | -0.029 | 0.971 | |
| Financial sophistication * subprime | | | | -0.054 | 0.948 | |
| Financial sophistication * turndown | | | | -0.286 | 0.751 | |
| Financial sophistication * spread | | | | 0.342* | 1.408 | |
| Intercept | -2.583*** | 0.076 | | -2.470*** | 0.085 | |
| Max-rescaled $R^2$ | 0.0603 | | | 0.0681 | | |

*$p < .05$. **$p < .01$. ***$p < .001$.

the moderating effect of both borrowing constraints and mortgage spreads on the influence of financial sophistication on ARM ownership.

Mortgage spreads, being income constrained (PTI > 28%), having a subprime mortgage, net worth, and the probability of moving are all positively associated with the likelihood of holding an ARM, while risk aversion and refinancing are negatively associated with the likelihood of holding an ARM. These results are similar to those found in previous studies (Campbell, 2006; Campbell & Coco, 2003; Coulibaly & Li, 2007; Dhillon et al., 1987; Shilling & Sirmans, 1987; Sa-aadu & Sirmans; 1995; Schwartz, 2007). However, the dummy year variable for 2007 remains significant, even after considering the factors in this model, suggesting that other factors influenced the increase in ARM borrowing between 2001 and 2007. This period covered a crucial time leading up to the financial crisis. The Joint Center for Housing Studies of Harvard University (2009) suggested that during this time period the lower-term interest rates drove house appreciation, which further motivated households to continue to finance housing purchases through relaxed lending requirements despite the decline in spread between FRMs and ARMs from 2004 to 2007. Future research can explore the influence of factors, such as these suggested, on ARM borrowing during this more recent period.

## Conclusion and Implications

Findings of previous studies (Consumer Federation of America, 2004; Coulibaly & Li, 2007; Schwartz, 2007) and the media (Aversa, 2008; Fleishman, 2005; Lukasova, 2009) indicated that less educated or more vulnerable households are more likely to enter ARM contracts. The purpose of this paper is to investigate the hypothesis that, after controlling for macroeconomic, borrowing constraints, and other household factors, less financially sophisticated borrowers are more likely to hold ARMs when faced with borrowing constraints, while more sophisticated households are more likely to originate ARMs when mortgage spreads are high. Using the Survey of Consumer Finances (SCF), findings of this paper suggest that among income constrained households, the less financially sophisticated are more likely to enter ARM contracts. However, findings of this study also suggest that the more financially sophisticated households are more likely to originate ARMs when the spread between FRMs and ARMs is high. Thus, ARM borrowing over the last decade was not only influenced by less financially sophisticated householders using ARMs to move into homeownership or for marginally financially secure householders to refinance or move into more expensive properties, but also by more financially sophisticated householders taking advantage of higher mortgage spread periods. Both descriptive statistics and regression analysis reveal that less financially sophisticated ARM borrowers are more likely to be financially distressed while more financially sophisticated ARM borrowers are more likely to take advantage of the positive aspects of ARMs. Further, when the moderating effects of borrowing constraints and mortgage spreads on the influence of financial sophistication on ARM borrowing are added as controls, the previous positive influence of financial sophistication is no longer significant. Thus, much of the influence of financial sophistication on the likelihood of holding an ARM can be explained by less sophisticated households using ARMs when income constrained and more sophisticated households using ARMs when the interest rate spread between FRM-ARM mortgages is high.

Based on these results, financial counselors and planners can play a key role in helping households develop the human capital necessary to make informed, rational optimal mortgage decisions such as choosing whether to finance a home purchase or refinance using a FRM or ARM. Characteristics from the financial sophistication scale can be used to provide individualized consultation on the risks and benefits of ARMs to help consumers evaluate their needs. For example, factor analysis suggests that education and stock ownership are good proxies for financial sophistication. While ARMs may allow households the ability to afford a home they would normally be incapable of owning, profit from extended periods of low interest rates, or to take advantage of lower costs if likely to move, interest rate risks may present real threats to less sophisticated ARM borrowers, who are also more likely to be income constrained and more vulnerable to shocks in their income or expenses (i.e., job losses, illness). Given that many households are not able to understand the terms of their mortgages (Bucks & Pence, 2006), financial advisers can provide valuable information on the advantages and disadvantages of using ARMs. For instance, an adviser who realizes that a client is likely to move in the next few years, expects a sharp increase in income (i.e., recent medical student), or expects a wide interest rate spread between FRM and ARM, can remind the client that, despite the increased payment volatility of ARMs, there may be several overriding advantages of using an ARM under these circumstances. In contrast, financial counselors and planners should remind more borrowing or resource constrained households that while ARMs might allow them to

be able to afford a more expensive home, sharp increases in interest rates could result in increased payment volatility and increase the chances of experiencing financial distress or losing the home. Other resources, such as the *Consumer Handbook on Adjustable Rate Mortgages* prepared by the Federal Reserve Board, can also effectively be used to provide valuable insight to clients.[3] While endowed human capital cannot be altered, educating households about the risks and benefits of using ARMs can help them make the most appropriate mortgage choice.

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## Endnotes

[1] The 30 year FRM and 1 year ARM rates were obtained from Freddie Mac's website at http://www.freddiemac.com/pmms/pmms_archives.html.

[2] The SCF programming coding can be found on the Federal Reserve Board's website at http://www.federalreserve.gov/pubs/oss/oss2/bulletin.macro.txt.

[3] A copy of the *Consumer Handbook on Adjustable Rate Mortgages* can be obtained at the Federal Reserve Board's website at http://www.federalreserve.gov/pubs/arms/arms_english.htm.

## Appendix. Factor Loadings for Financial Sophistication

| Variables | Factor loadings |
|---|---|
| Education | .706 |
| Understand survey | .453 |
| Health | .470 |
| Borrow | .239 |
| Save | .291 |
| Own any equity | .619 |