

# Do Women Pay More for Mortgages?

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**Abstract** This paper documents women on average pay more for mortgages than men. The disparity cannot be fully explained by traditional variables such as mortgage features, borrower characteristics, and market conditions. While the persistence of gender disparity may suggest discrimination, we offer a different explanation: women pay higher rates because they are more likely to choose lenders by recommendation while men tend to search for the lowest rate. Our empirical test confirms that search effort is rewarded in marketplace, and suggests that gender disparity in mortgage rates may be addressed by policies aimed at improving women's financial literacy and search skills.

**Keywords** Mortgage · Gender discrimination · Borrower behavior · Interest rates

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## Introduction

A fairly recent study released by the Consumer Federation of America (Fishbein and Woodall (2006)), which was immediately covered by the *New York Times* and other news media,<sup>1</sup> reported that women are much more likely to borrow subprime mortgages, despite the fact that they tend to have slightly higher credit scores than men. The report finds that women are 32% more likely to receive subprime mortgages than men, and that, regardless of the loan type, such likelihood tends to increase with the level of their income. In addition, the report finds that women are more likely than men of the same race to receive subprime mortgages, and women of color are much more likely to receive subprime mortgages than white men.

These findings are both interesting and puzzling. Given that the U.S. mortgage market is generally perceived to be highly competitive in making long-term loans at a very thin spread over the lenders' cost of funds (Holmes and Horvitz (1994)), and the increasing use in recent years of automated underwriting systems (which are supposed to eliminate potential human biases), significant gender disparity in mortgage rates warrants thorough examination for the issue's social sensitivity. In this study, we expand the Consumer Federation of America (CFA) investigation to a broader range of mortgage products and ask these questions: Do women tend to pay higher interest rates than men on all mortgages including both prime and subprime loans? If so, what is the nature of the gender disparity, and what factors may be attributed to such gender difference?

First of all, gender disparity in mortgage rates, if it indeed exists, may simply be the fair outcome of an unbiased lending system that assesses individual borrower's risk based on objective measures that are gender-blind. For example, if women on average tend to have less education and earn less income than men, or if women are more likely to buy houses with less down payment, or if women simply prefer to borrower 30-year fixed rate mortgages (which tend to have the highest interest rate among all common mortgage products), then it is entirely reasonable to expect that the average mortgage rates for women should be higher than that for men. However, if this indeed is the case, one would expect that, once all the objective measures (mortgage features, borrower characteristics, and market conditions, etc.) are controlled for, the gender disparity should disappear in a properly conducted analysis.

But what if such disparity persists despite proper control of those objective measures? Logically, we could speculate that, on one hand, perhaps the lending system is not gender-blind after all, or on the other hand, there may be other borrower-related reasons that cause women to pay higher interest rates than men under the same conditions. Given the socially sensitive nature of gender disparity, the issue should be examined from both perspectives of the borrowers and of the lenders. That being said, these are separable, though closely interlinked, research questions that can be examined from different perspectives with different sources of information. In this paper, we approach the investigation from the borrower's perspective.

<sup>1</sup> See "Mortgage: Why Women Pay Higher Interest," by Tedeschi, B., *The New York Times*, January 21, 2007.

Compared to the extensive body of literature on racial disparity in nearly all aspects of mortgage lending, research on gender disparity is virtually nonexistent.<sup>2</sup> But the issue of gender is significant because the share of women borrowers (particularly among single women and woman-headed households) has increased significantly in the past decade. Citing various sources, CFA reports that the share of single women homebuyers has doubled from about one in ten homebuyers 15 years ago to about one in five 2003. More than half (53%) of woman-headed households are homeowners, up from just below half (48%) in the early 1980s. And the number of single female homeowners grew by four million between 1994 and 2002, from 13.9 million to 17.5 million. Given the size and term of typical mortgage loans, a slightly higher interest rate can cost the borrower significantly more over the life of the mortgage, thus diminishing the value of homeownership as a major wealth building pathway for these borrowers. Since women (single-women or woman-headed households), according to our data, tend to earn less income than men to begin with, their financial well-being is likely to be more adversely impacted by having to pay higher mortgage rates. Therefore, understanding the cause of the rate disparity is a necessary first step toward forming effective policies aimed at reducing its negative impact on women.

We seek such understanding with this study. Our objectives are: (1) to find out whether gender disparity in mortgage rates indeed exists; and (2) to search for a plausible explanation for such disparity if it does exist. In addition to follow the conventional research methods (i.e. literature on racial disparity in mortgage market), our study differs from previous studies in that we examine whether there is behavioral difference between men and women in how they go about searching for mortgages, and whether the behavior difference explains the disparity in interest rates they receive.

The rest of the paper proceeds as follows: The next section discusses preliminary inspection of our data and rationales that lead to our three research hypotheses. We then describe the source of the data and document the key differences in many aspects between female and male borrowers. The “Regression Analysis” section presents a series of regression analyses that lead to the main findings of this study. The last section provides some concluding remarks and discussions.

## Preliminary Analysis and Research Hypotheses

We use data from 2004 Survey of Consumer Finances (SCF) for empirical analysis (more on the data in the “Data” section). Preliminary results reveal several interesting observations that motivate us to examine the issues further. First of all, we find that, unconditionally, women at both the mean and median pay about 40 basis points higher on mortgages than men. Several other differences between men and women are worth noting as well: (1) Women are more likely to borrow 30-year fixed rate mortgages, which tend to have higher interest rate than other

<sup>2</sup> Outside the mortgage market, though, the gender issue is often studied in areas of labor and consumption. For example, Goldberg (1996) investigates the gender difference in the vehicles purchasing prices. Blau and Kahn (2000) provide an overview of gender difference in labor market outcomes.

types of mortgage loans. (2) Women report significantly lower income than men, and the average loan-to-income ratio for women is about 2.4, compared to 1.6 for men. (3) Women are less likely to have college degrees than men. (4) Women are more likely to have past credit applications rejections and are more likely to file for bankruptcy than men. (5) There is a significant behavioral difference in how men and women select their lenders. For example, our data show that 42.1% of men make efforts in searching for the lowest rates available, while only 20.5% of women take this approach (see Table 1). On the other hand, women tend to choose lenders recommended by other people (41.2% for women vs. 25.2% for men).

These results prompt us to reason that the interest rate disparity between men and women may be, among other factors, related to the ways in which borrowers obtain their loans. The impact of behavioral difference between men and women is particularly interesting to us as the issue has not been investigated in the context of mortgage lending.

Any person who has the experience of searching for a mortgage knows that finding the best loan is not a trivial task. It involves complex comparisons of terms and rates among numerous mortgage offerings from numerous lenders and mortgage brokers, each using various marketing tricks to lure potential borrowers. The lenders' disclosure of Annual Percentage Rate (APR) is not always helpful because APR assumes the borrower will hold the loan until maturity, while a typical homeowner sells the house and pays off the loan long before it matures. So average borrowers can easily get frustrated and intimidated by such a daunting task, and thus tend to take different approaches to solve the problem.

Previous studies in the literature have found that men and women differ significantly in their attitude, ability, and self-perception of ability in coping with complex tasks. Several studies have shown that, compared to men, women are less certain about their abilities and less willing to explore and test their abilities in challenging situations. (Niederle and Vesterlund (2007), Niederle and Yestrumskas (2008)) As a result, women are much more likely to rely on "short-cuts" such as other peoples advises and experiences to approach complex tasks. Such behavior often results in different economic outcomes (i.e. salaries and promotions at workplaces). (Blau and Kahn (2000)) With regard specifically to personal finance matters, a recent Prudential survey reports that, across various age-groups, about two-thirds of women feel they are inadequately prepared to make important personal financial decisions, and that family, friends, and advisors rank as the #1 place for women to learn about financial products.<sup>3</sup>

Given the complexity of mortgage shopping, we want to know whether women, due to their reported lack of adequate knowledge and confidence in handling financial matters, are less likely to commit effort in searching for the lowest-rate loans by themselves and thus simply deal with lenders that are recommended to them by their friends and family. If this indeed is the case, it may provide a simple explanation as to why women tend to receive higher interest rates than men — search effort is rewarded by the marketplace and the women's lack of search is likely to result in higher prices (interest rates) for their desired goods (mortgages).

<sup>3</sup> 2008–2009 Prudential Study, "Financial Experience & Behaviors Among Women". ([www.prudential.com/women](http://www.prudential.com/women))

**Table 1** Lender choice by gender

Shopping behavior	Women (F)	Men (M)	Difference in gender
Recommended by Others	41.2%	25.2%	<b>16.0%</b>
Search Lowest Rate	20.5%	42.1%	<b>-21.6%</b>
Others	38.3%	32.7%	5.6%

Data Source: Survey of Consumer Finances

Moreover, since the benefit of a search effort is likely to increase with the complexity of the product, one would expect that a lack of search effort by women would result in more costly choices with more complex mortgages such as the adjustable-rate mortgages (ARM).

Based on the preliminary results and the above discussion, we form three hypotheses for formal test: (1) Women tend to pay higher interest rates on mortgages than men of similar characteristics (income, education, credit, etc.); (2) The gender disparity in mortgage rates is largely attributable to the behavioral difference of men and women in shopping for mortgage loans, namely, the search effort or the lack of it; (3) The effect of the behavior difference is more pronounced for more complex mortgage products such as ARM than for the conventional fixed-rate mortgages (FRM).

## Data

The SCF data is a triennial survey of the balance sheet, pension, income, and other demographic characteristics of U.S. families. The study is sponsored by the U.S. Federal Reserve Board in cooperation with the U.S. Department of the Treasury. Since 1992, data have been collected by the National Organization for Research at the University of Chicago (NORC). Data from the SCF are widely used in academic research, as well as in economic analysis at the Federal Reserve and other branches of government.

The SCF survey is conducted among a representative sample of the U.S. households. It contains information on mortgages as well as on broader household finances and demographics. The data are suitable for our study for three reasons: First, the data contains a large random sample of borrowers who obtained various types of mortgages of various terms from a variety of different lending establishments. This allows us to extend the examination of gender disparity in mortgage rates to all types of mortgage loans rather than just subprime loans. Second, the survey provides detailed data on borrower characteristics including race, gender, mortgage terms, creditworthiness, personal wealth, and education levels. Third, and most importantly, the survey contains explicit questions on how the borrowers selected their lenders—whether the decision was based on a search for the lowest rates or recommendations by other people. Response to this question provides an explicit measure of how much search effort the borrower had committed before he or she accepted the mortgage offer from the lender, which is exactly the variable we need for testing the effect of behavioral difference between men and women.

Our initial data sample contains about 1,600 observations, each of which represents a surveyed household who obtained a mortgage during the period of

2000–2004. All the mortgages are either for purchase or refinancing purposes. Home equity loans are excluded. In addition, we apply three screenings to the sample. First, we eliminate observations with missing variables or irregular values (negative income); second, we eliminate observations in the top and bottom one percent of the mortgage rate distribution (a few households reported paying a 0% interest rate on the mortgages, while some households reported paying a 33% interest rate on their mortgages); third, we eliminate observations with either extremely small loan amounts or extremely low loan-to-income ratios. The final sample contains a total of 1,511 observations, of which 192 mortgages are identified as women (single-women, or woman-headed households), and the remaining 1,319 are men. Table 2 displays the list of variables in the sample.

**Table 2** The variables descriptions

Variables	Descriptions
Rate	Interest rate (in basis points) on mortgage
Gender	Indicator for whether the borrower is female or male
Race	Indicator for whether the borrower is White, Black, Hispanic or other ethnic groups
Year	Indicator for whether the mortgage was originated in 2000, 2001, 2002, 2003 or 2004
<b>Mortgage Info.</b>	
ARM	Indicator for whether the mortgage is adjustable rate mortgage or fixed rate mortgage (FRM)
Term	The maturity of the mortgage whether the loan is 15-year, 30-year or other mortgage
LTV	Indicator for whether the loan-to-value ratio for purchase is bigger than 95%, not bigger than 80% or others
Refi.	Indicator for whether the mortgage is refinancing or purchase
<b>Borrower Info.</b>	
Income	Borrower's household income bracket
Checking	Indicator for whether the borrower has the checking account
Saving	Indicator for whether the borrower has the saving or money market account
Rejection	Indicator for whether the borrower has ever been rejected any credit application in the past five years prior to the survey, or no application at all
Bkrupt	Indicator for whether the borrower filed for bankruptcy before
Edu	Indicator for whether the borrower is college educated, high school educated, or others
<b>"Shopping" Behavior</b>	
Shopping	Indicator for whether the borrower's lender choice is based on search for lowest rates, recommendation by other people, or other reasons
shopARM	Categorical variable that is the product of two variables - Shopping and ARM, which indicates six scenarios: ARM by search, ARM by recommendation, ARM by other reasons, FRM by search, FRM by recommendation, and FRM by other reasons.
shopARMrefi	Categorical variable that is the product of three variables - Shopping, ARM and loan purpose (refi or purchase), which indicates 12 scenarios: search-ARM-purchase, recommend-ARM-purchase, other-ARM-purchase, search-ARM-refi, recommend-ARM-refi, other-ARM-refi, search-FRM-purchase, recommend-FRM-purchase, other-FRM-purchase, search-FRM-refi, recommend-FRM-refi, other-FRM-refi

Each observation contains detailed loan information including type of mortgage, loan amount, term, interest rate, time of origination, etc. Other variables include detailed household income and demographic information, such as the borrower's age, race, highest level of education, as well as whether they own any banking accounts. The borrower's credit worthiness is measured in part by whether they filed bankruptcy or their credit applications were rejected in the past 5 years. The data of most interest to us is how the borrowers respond to questions on how they choose their lenders. The questions are: What was the most important reason for you to choose this lender? Was it because they were recommended to you by others, or because they had the lowest rates or fees, or because of the location of the office, or because you had done business with them in the past, or because it was easier for you to qualify for the loan, or because of some other reasons? etc. We use the variable "shopping behavior" to indicate whether the lender selection is "by recommendation", "by searching the lowest rates", or "for other reasons".

## Descriptive Analysis

A summary of our sample data is displayed in Table 3. The first thing to notice is that, during 2000–2004, the mean (median) mortgage interest rates for women is 40 (37) basis points or 0.4% (0.37%) higher than that for men. On the other hand, the median household income for women is \$42,000, which is significantly less than that of men (\$104,000). As a result, the median loan-to-income ratio is 2.4 for women versus 1.6 for men. To most lenders, higher ratio suggests higher default risk on the borrower holding other things equal. It should be noted that the mortgages in our sample are originated during the period of 2000–2004, but the SCF data only reports the income at the time of survey, which may not match the time when the loan was originated. However, given the fact that the average household income did not change much during the 4-year period, we believe the loan-to-income ratios are reasonably accurate.

The rest of Table 3 shows the sample proportions between male and women in various categorical descriptions. In terms of mortgage preference, women are less likely to borrow adjustable-rate mortgages (ARM) than men (14.1% versus 18.2%), and women prefer long-term mortgages (30-year loans) than men (63.1% versus 53.4%). In addition, women tend to purchase home with less down-payment. 53.3% women finance their home with loan-to-value ratio above 95%, compared to only 35.1% men in the same category. Note that loan-to-value ratios for refinancing are not available because there is no transaction price or reliable appraisal value of the property.

In terms of borrower characteristics, the data indicate that 46.6% of women have college education, compared to 63.1% of men. In addition, women are less likely to have checking or saving accounts than men. While ownership of either checking or saving account is indirect indication of the borrower's credit worthiness, we extract two more direct measures for credit history. The SCF survey asks if the borrower ever had credit application being rejected in the past 5 years prior to obtaining their mortgages. Our sample indicates 25.5% of women had such experience, compared to only 15.5% of men who ever had credit rejection. Also, women are more likely to

**Table 3** Summary statistics of the data

Variable		Full sample (1,511 obs)	Female (192 obs)	Male (1,319 obs)
Median (mean) mortgage rate	basis points	550 (563)	587 (598)	550 (558)
Median loan amount	\$1,000	155	100	170
Median borrower income	\$1,000	93	42	104
Median Loan-to-income ratio		1.7	2.4	1.6
Sample proportions (Percent)				
ARM	Yes	17.7	14.1	18.2
	No	82.3	85.9	81.8
Loan Term	30 years	54.6	63.1	53.4
	15 years	25.0	18.0	26.0
	Others	20.4	18.9	20.7
Loan-to-value ratios (purchase)	LTV≤80	40.1	30.4	42.2
	80<LTV≤95	21.5	16.4	22.6
	LTV>95	38.4	53.3	35.1
Refinance		71.4	59.7	73.1
Education	College educated	61.0	46.6	63.1
	High School educated	18.8	30.5	17.1
	Others	20.2	22.9	19.8
Checking Account	Yes	98.0	95.8	98.3
	No	2.0	4.2	1.7
Saving or money market account	Yes	63.2	58.2	63.9
	No	36.8	41.8	36.1
Credit Applications rejected in last 5yrs	No	77.6	64.9	79.4
	Yes	16.8	25.5	15.5
	No credit record	5.6	9.6	5.0
Bankruptcy	Yes	8.5	13.6	7.7
	No	91.5	86.4	92.3
Shopping Behavior	By recommendation	27.2	41.2	25.2
	By search lowest rate	39.3	20.5	42.1
	Other reasons	33.4	23.3	32.7
Race	White	84.1	75.9	85.9
	Black	5.3	17.3	3.6
	Hispanic	6.0	4.7	6.2
	Others	4.1	2.1	4.4
Year Originated	2000	5.3	7.6	5.0
	2001	10.3	12.7	10.0
	2002	20.3	21.1	20.2
	2003	43.0	35.0	44.1
	2004	21.1	23.5	20.7

Data source: Survey of Consumer Finance



have no prior credit record than men, which tends to be viewed less favorably by mortgage lenders. Another measure of credit quality is whether the borrower had filed bankruptcy in the past. The sample indicates that women are almost twice more likely to have previous bankruptcy than men (13.6% women versus 7.7% men). Overall, our data suggests that female borrowers tend to have poorer credit than male borrowers.

## Regression Analysis

To further examine the relative impact of these differences on the gender disparity of mortgage rates, we conduct several regression analyses in which we gradually increase the number of independent variables that control various aspects of borrower characteristics, mortgage features and others including race, gender, year of borrowing, mortgage type, income, credit, education, and, most importantly, the borrowers' mortgage search behavior. This approach enables us to examine the marginal explanatory power of each variable that enters the models. Six groups of controlled variables are sequentially included to estimate six models. The dependent variable for all regressions is the mortgage interest rate.

### Model 1 — Gender, Race, and Year of Origination

We begin with the basic set of control. Gender is our basic variable of interest. Race is one of the most examined factors.<sup>4</sup> Since interest rates change over time, the year when the loan is originated is directly associated with the loan rates. Specifically, we estimate

$$Rate = \alpha + \beta_1 Gender + \beta_2 Race + \beta_3 Year + \varepsilon \quad (1)$$

where *Rate* is the interest rate (in basis points) on mortgage originated by a certain household. *Gender* is a dummy variable to indicate male or female borrower. *Race* is a class variable to indicate White, Black, Hispanics, and other ethnic groups. *Year* is a vector of categorical variables ranging from 2000 to 2004 to indicate the year of mortgage origination.

The regression results are displayed under the column Model 1 in Table 4. As expected, the estimated coefficient of Gender indicates that women on average pay 18.4 basis points more on mortgages than men of the same race who obtained mortgages in the same year. The gap is significant at 0.0001 as indicated by its t-stat (5.25). *Race* is also significant. The estimated coefficients of *Race* indicate that, on average, mortgage rates for Whites are 26.2 basis points lower than Hispanics, but the rates for Blacks are 23.5 basis points higher than Hispanics, suggesting the gap between Blacks and Whites is about 49.7 basis points within the same gender and year of origination. Note that “Hispanics” is the omitted class of race variable. Notably, the results also indicate that the “Other” ethnic groups (e.g. Asians, etc)

<sup>4</sup> See, for example, Munnell et al. (1996) and Charles and Hurst (2002).

**Table 4** Analysis of shopping behavior and gender disparity in mortgage rates

Variables	Category/value	Model 1		Model 2		Model 3		Model 4	
		Coeff.	<i>t</i> -Stat.	Coeff.	<i>t</i> -Stat.	Coeff.	<i>t</i> -Stat.	Coeff.	<i>t</i> -Stat.
Intercept		599.6	93.88	550.1	68.68	587.7	55.44	596.3	56.22
Gender	<b>Women</b>	<b>18.4</b>	<b>5.25</b>	<b>15.4</b>	<b>4.52</b>	<b>8.0</b>	<b>2.41</b>	<b>3.5</b>	<b>1.05</b>
Race	White	-26.2	-4.99	-21.3	-4.19	-12.9	-1.62	-4.1	-0.83
	Black	23.5	3.42	16.4	2.46	15.8	2.46	14.4	2.25
	Others	-40.0	-4.70	-32.0	-3.88	-3.7	-0.74	-11.6	-1.47
Year ( <i>of loan origination</i> )	2000	92.1	15.29	97.6	16.67	85.9	15.14	84.5	14.99
	2001	50.5	10.48	49.8	10.63	47.0	10.46	45.7	10.22
	2002	28.3	6.98	30.3	7.67	31.6	8.34	30.1	8.00
	2003	1.2	0.33	0.9	0.27	0.8	0.25	-0.4	-0.12
ARM	Yes			-59.3	-16.28	-60.0	-17.13	-60.4	-17.35
Term	15 years			-24.2	-6.10	-13.7	-3.58	-13.8	-3.63
	30 years			24.1	7.14	26.9	8.27	25.8	7.95
LTV	<=80%			-40.7	-8.02	-22.3	-4.51	-20.6	-4.19
	80 – 95%			-13.2	-2.39	-1.8	-0.34	-0.5	-0.09
Refi.	Yes			-17.3	-4.73	-7.2	-2.01	-6.5	-1.83
Income						-0.4	-5.27	-0.4	-5.38
Saving	Yes					-11.9	-4.57	-11.9	-4.63
Checking	Yes					-41.6	-5.33	-42.3	-5.41
Bkrupt	Yes					28.5	6.82	28.4	6.84
Rejection	No					-48.0	-8.92	-45.4	-8.48
	Yes					-0.7	-0.12	-0.3	-0.05
Edu	Below high School					32.7	10.83	29.7	9.81
	High School					16.9	5.49	15.2	4.96
Shopping	By recommend							-3.9	-1.27
	By search							-28.2	-9.48
R <sup>2</sup>		7.5%		13.7%		21.2%		22.3%	
Number of Observations		1,511		1,511		1,511		1,511	

1. Data Source: Survey of Consumer Finances

2. The base (omitted) class of some of the multi-class categorical variables are: “male” in Gender, “2004” in Year, “other” in Term, “other” in LTV, “never applied” in Credit Rejection, “college” in Education, “other” in Shopping

3. Significance of critical *t*-stats : at 1%, *t*=2.57; at 5%, *t*=1.96; at 10%, *t*=1.67

tend to receive even less interest rate than Whites (-40 basis points versus -26.2 basis points). However, the “Other” group only counts 4.1% of the entire sample. Although the model indicates there are significant gaps between mortgages rates across racial groups, it is premature to conclude on the issue as more controlled variables have yet been included. Finally, the regression coefficients for *Year* closely trace the market condition of the mortgage rates during the same period. According

to the data reported by Freddie Mac, the national average interest rates on 30-year fixed-rate mortgages for the period of 2000–2004 are 8.06%, 6.97%, 6.54%, 5.82%, and 5.84%, respectively. The same downward trend is apparent in the regression coefficients for these years in Model 1.

### Model 2 — Control for Mortgage Characteristics

Next, we add additional controls for mortgage characteristics to Model 1, and estimate

$$\begin{aligned} \text{Rate} = & \alpha + \beta_1 \text{Gender} + \beta_2 \text{Race} + \beta_3 \text{Year} + \beta_4 \text{ARM} + \beta_5 \text{Term} + \beta_6 \text{LTV} \\ & + \beta_7 \text{refi} + \eta \end{aligned} \quad (2)$$

where *ARM* is a dummy variable which equals to 1 if the loan is an adjustable rate mortgage and zero otherwise. *Term* refers to the maturity of the loan, which indicates whether the loan is for 15 years, 30 years, or other maturity. *LTV* is the loan-to-value ratio of the mortgage, which is computed based on the loan amount of primary mortgage and the purchase price. This is consistent with the fact that the survey reports mortgage rates on the primary mortgages. *refi* indicates whether the loan is a refinancing or purchase. Other variables are as defined in previous Model 1.

As shown under Model 2 in Table 4, the gender gap is reduced moderately once the types of the mortgages are controlled. Other things being equal, women on average pay 15.4 basis points higher than men on similar mortgages. The gap remains to be statistically significant at 0.001 with *t*-stat of 4.52. Therefore, controlling for mortgage characteristics explains away some of the gender gap in mortgage rates but not all of it, nor does it significantly narrow the racial gaps of interest rates. On average, Blacks still pay about 37.7 basis points more than Whites on similar mortgages, other things being equal. As expected, interest rates on ARMs are about 59.3 basis points lower than fixed rate mortgages, and rate gap between 30-year and 15-year loans is about 48.3 basis points. The regression coefficients of all right-hand side variables are highly significant and have the correct signs.

### Model 3 — Control for Borrower Characteristics

We further explore the gender gap of mortgage rates by adding more variables to control for the borrower characteristics. We attempt to capture three aspects — income, credit and education. Specifically, we estimate

$$\begin{aligned} \text{Rate} = & \alpha + \beta_1 \text{Gender} + \beta_2 \text{Race} + \beta_3 \text{Year} + \beta_4 \text{ARM} + \beta_5 \text{Term} + \beta_6 \text{LTV} + \beta_7 \text{refi} \\ & \beta_8 \text{Income} + \beta_9 \text{Checking} + \beta_{10} \text{Saving} + \beta_{11} \text{rejection} + \beta_{12} \text{Bkrupt} \\ & + \beta_{13} \text{Edu} + \xi \end{aligned} \quad (3)$$

where *Income* is a categorical variable that indicates the level (or brackets) of borrower's annual household income (less than \$10 K, 10–20 K, 20–30 K, 30–40 K, etc.). Here we do not use the amount of actual income because slight variation of income is unlikely to result in changes on mortgage rates, as lenders typically

consider borrowers' income that falls into the same bracket as being at the same level. The income brackets are progressively numbered as 1, 2, 3, ..., which are taken as the values for variable *Income*.<sup>5</sup>

*Checking* and *Saving* are two dummy variables which indicate if the borrower owns either of these accounts. *Rejection* indicates if the borrower has ever been rejected any credit application in the past 5 years prior to the survey or has no previous application record. *Bkrupt* is another dummy variable which indicates if the borrower ever filed bankruptcy before. While *Checking* and *Saving* are indications of income (or wealth) to some degree, they can also be considered as reflecting some aspect of the borrower's credit quality, in addition to the more direct measure of credit by *rejection* and *Bkrupt*. Similar measures are used by Charles et al. (2008) to capture borrowers' credit worthiness in a study on racial disparity in automobile financing rates. Finally, *Edu* indicates the borrower's highest education level, which is college, high school, or below high school. Education level is used to proximate the financial literacy of the borrower, as Lusardi and Mitchell (2006, 2008) suggests that financial literacy has strong impact on individual's financial decision such as retirement planning.

The effect of adding these borrower characteristics controls can be seen under Model 3 in Table 4. First, the gender gap of mortgage rates is almost reduced by half to 8.0 from 15.4 in Model 2, and remains significant at 0.01. Second, the only racial indicator that remains significant is Blacks. The rate gap between Blacks and Whites is reduced by about 10 basis points, but the differences between Whites, Hispanics, and other groups are no longer significant. Third, all mortgage features remain significant and have the correct signs. The majority of the regression coefficients show only minor changes in their magnitudes, except for those coefficients of LTV, which become noticeably smaller than in model 2, but still maintain the same correct signs. Fourth, all the borrower characteristics variables newly added into Model 3 exhibit statistical significances.<sup>6</sup> Other things being equal, higher borrower income is associated with lower interest rates. Borrowers who have either checking or saving account on average pay 41.6 or 11.9 basis points, respectively, less than those who do not have any banking account. On the other hand, borrowers with previous bankruptcy record pay 28.5 basis points more than those without. In addition, people who did not experience credit applications rejections in the previous 5 years on average enjoy 48.0 basis points lower rates than those who either had application rejections or had no previous application record.<sup>7</sup> Finally, level of education seems to have a strong relationship with mortgage rates. As the results show, borrowers with only high school degree on average pay 16.9 basis points more than those with college degrees, and the gap is 32.7 basis points for borrowers without high school degrees. Since the level of education is generally positively correlated with the borrower's financial literacy, the sign of this variable is expected. However,

<sup>5</sup> Alternatively, we assign dummy variables for each income bracket and regress on these dummies. We find that the two alternatives produced virtually identical regression coefficients for other variables in the model, so we choose to report the results of the original approach for its easier interpretation — the estimated coefficient is the drop of basis points when borrower's income moves up to the next bracket.

<sup>6</sup> The borrower's age does not enter the model because our analysis indicates that the impact of age on mortgage rates is statistically insignificant.

<sup>7</sup> Here the coefficient of  $-0.7$  for having credit application rejected is statistically indistinguishable from zero (never applied for credit before).

despite strong explanatory power of all these control variables, they are still not enough to fully explain the gender disparity in mortgage rates.

#### Model 4 — Examine the Effect of “Shopping Behavior”

So far, the traditional explanatory variables can only partially explain the gender disparity in mortgage rates. So we turn our attention to the shopping behavior of borrowers when they select their lenders. As displayed in Table 1, women and men apparently take very different approaches to decide which lender to choose for their mortgage needs. Whereas 42.1% of men select their lenders based on who offers the lowest rates, an equal portion of the women simply deal with lenders recommended to them by other people. This suggests that men may be financially and/or technically more savvy than women, and their search effort should be rewarded by the market. To examine the impact of “shopping” behavior of men and women on mortgage rates, we add this control variable to the previous model. Specifically, we estimate:

$$\begin{aligned} \text{Rate} = & \alpha + \beta_1 \text{Gender} + \beta_2 \text{Race} + \beta_3 \text{Year} + \beta_4 \text{ARM} + \beta_5 \text{Term} + \beta_6 \text{LTV} + \beta_7 \text{refi} \\ & \beta_8 \text{Income} + \beta_9 \text{Checking} + \beta_{10} \text{Saving} + \beta_{11} \text{rejection} + \beta_{12} \text{Bkrupt} \\ & + \beta_{13} \text{Edu} + \beta_{14} \text{Shopping} + \zeta \end{aligned} \quad (4)$$

where *Shopping* is a dummy variable which indicates if the borrower’s lender choice is based on search for the lowest rate, or based on recommendation by others, or based on other reasons. These other reasons may include convenient lending office location, multiple services under-one-roof, previous business relationship, low service fees, perception of easy-to-qualify, or no-choice (assumption of existing mortgage or financing through builders who have contracted lenders), etc.

The effect of shopping behavior difference is immediately noticeable under Model 4 in Table 4. For the first time, gender disparity becomes insignificant. Although on average women still pay 3.5 basis points higher than men, such gap is statistically indistinguishable from zero. As the variable *Shopping* indicates, borrowers who search for lowest rates on average pay about 24.3 basis points less than the borrowers who rely on other people’s recommendations. As for the rest of the variables in the model, there are no significant changes in the magnitudes of their regression coefficients from Model 3, and none of the variables has shifted sign.

The evidence revealed by Model 4 suggests that the apparent gender disparity on mortgage rates, which is documented in the CFA report and confirmed by our data, can be explained by the distinct shopping behaviors of women and men. Our finding suggests that the conventional wisdom of shopping around does apply to the mortgage market, and expanded search effort is likely to bring lower rates to the borrowers.

This result supports our hypothesis that search is correlated with lower mortgage rates. Some readers may be curious as to why selecting lenders based on recommendations from other people tends to cause the borrowers to pay more. After all, people tend to only accept advice from those they trust to be more knowledgeable than themselves, and the people who make recommendations could very well have searched for the lowest rates for their own mortgages. We conjecture there are at least two reasons: First, borrowers who deal with lenders recommended to them by people

whom they trust are likely to be less suspicious of the lender's proposal and thus negotiate less aggressively, not to mention that many borrowers are not even aware of the fact that mortgage rates are negotiable. Their pre-injected trust toward the lender may cause them to be more inclined to "take the lender's word". Second, the mortgage market is not efficient in the sense that each mortgage is a unique financial security underwritten based on the unique preferences and characteristics of the lender and the borrower. Given that no two borrowers are identical in every way, and different lenders (and their underwriting programs) may assess different risk to different borrower characteristics, one borrower getting a low rate is no guarantee for another borrower getting the same.

Needless to say, some women may, by some random luck, actually get good deals without search effort. But they are also likely to get poor deals as well. So the variance in rates for women may be greater for men (who try to narrow down their selection to the best rates available). Put differently, shopping behavior may also explain the variance in rates. Certainly, this issue may deserve separate and more nuanced inquiry in the future.<sup>8</sup>

#### Model 5 — Cross Effect of Borrowing Behavior and Mortgage Products

To expand on the notion that the mortgage market is inefficient due to the heterogeneity of people and products, we reason that good search effort may be more beneficial for some mortgage products than for others. Given the limitation of our data, we focus on examining the effect on adjustable rate mortgages versus fixed rate mortgages. The hypothesis is that the effect of shopping behavior is more pronounced for ARMs than for fixed rate mortgages. To test, we include a cross-effect control to the previous model and estimate the following:

$$\begin{aligned} \text{Rate} = & \alpha + \beta_1 \text{Gender} + \beta_2 \text{Race} + \beta_3 \text{Year} + \beta_4 \text{Term} + \beta_5 \text{LTV} + \beta_6 \text{refi} \\ & \beta_7 \text{Income} + \beta_8 \text{Checking} + \beta_9 \text{Saving} + \beta_{10} \text{rejection} + \beta_{11} \text{Bkrupt} \\ & + \beta_{12} \text{Edu} + \beta_{13} \text{shopARM} + \psi \end{aligned} \quad (5)$$

where *shopARM* is a categorical variable that is the product of two variables — *Shopping* and *ARM*, which indicates six scenarios — ARM by search, ARM by recommendation, ARM by other reason, fixed-rate mortgage (FRM) by search, FRM by recommendation, and FRM by other reason. Because of the interaction variable, the individual variable *ARM* and *Shopping* in Model 4 are removed. The regression results are reported under Model 5 in Table 5.

As the results show, compared to ARM by other reason, borrowers who select ARM based on their search can expect to pay 58.8 basis points less on the loans. On the other hand, borrowers who take ARM from recommended lenders are likely to pay 27 basis points more. The difference between these two shopping behaviors is an astonishing 85.8 basis points! This is a huge interest rate gap by any measure of the debt market. In comparison, for fixed-rate mortgages (FRM), borrowers who search for the lowest rates

<sup>8</sup> This is a point brought up by an anonymous referee, which we believe is interesting and worthy of further inquiry.

**Table 5** Effect of search behavior on mortgage types and loan purpose

Variables	Category/value	Model 5		Model 6	
		Coefficient	<i>t</i> -Stat.	Coefficient	<i>t</i> -Stat.
Intercept		595.3	52.91	598.5	44.74
Gender	<b>Women</b>	<b>3.0</b>	<b>0.91</b>	<b>2.8</b>	<b>0.83</b>
Race	White	-3.3	-0.68	-3.3	-0.66
	Black	15.1	2.36	14.7	2.30
	Others	-10.8	-1.36	-10.7	-1.35
Year (of loan origination)	2000	85.2	15.18	85.3	15.17
	2001	45.0	10.12	44.5	10.00
	2002	29.9	7.96	29.9	7.98
	2003	-0.2	-0.07	-0.4	-0.13
Term	15 years	-15.2	-4.03	-15.7	-4.13
	30 years	25.2	7.78	24.3	7.47
LTV	<=80%	-20.1	-4.10	-20.8	-4.22
	80 – 95%	-0.6	-0.11	-0.5	-0.10
Refi.	Yes	-7.5	-2.13		
Income		-0.4	-5.29	-0.4	-5.33
Saving	Yes	-11.9	-4.63	-12.1	-4.69
Checking	Yes	-41.3	-5.30	-41.0	-5.24
Bkruptcy	Yes	30.7	7.41	30.7	7.40
Rejection	No	-43.1	-8.05	-43.5	-8.12
	Yes	0.2	0.03	-0.3	-0.05
Edu	Below high School	29.8	9.88	29.4	9.73
	High School	14.8	4.84	14.5	4.74
shopARM	Recommend-ARM	27.0	3.40		
	Search-ARM	-58.8	-7.79		
	Recommend-FRM	49.6	8.45		
	Search-FRM	35.1	6.07		
	Other-FRM	58.5	10.04		
shopARMrefi	Recommend-ARM-purchase			17.6	1.29
	Search-ARM-purchase			-64.5	-5.22
	Recommend-ARM-refi			32.2	3.30
	Search-ARM-refi			-55.1	-5.78
	Recommend-FRM-purchase			48.7	4.78
	Search-FRM-purchase			40.3	3.97
	Other-FRM-purchase			49.8	4.89
	Recommend-FRM-refi			49.8	7.03
	Search-FRM-refi			32.6	4.67
	Other-FRM-refi			62.7	8.90
$R^2$		23.0%		23.1%	
Number of Observations		1,511		1,511	

1. Data Source: Survey of Consumer Finances

2. The base (omitted) class of some of the multi-class categorical variables are: “male” in *Gender*, “2004” in *Year*, “other” in *Term*, “other” in *LTV*, “never applied” in *Rejection*, “college” in *Edu*, “other for ARM” in *shopARM*. There are two base categories in variable *shopARMrefi*, which are “Other-ARM-purchase” and “Other-ARM-refi”

3. Significance of critical *t*-stats : at 1%,  $t=2.57$ ; at 5%,  $t=1.96$ ; at 10%,  $t=1.67$

still pay less than those rely on recommendation. But the difference is only 14.5 basis points, much smaller than the gap for ARMs. These results suggest that searching for the lowest rates is much more beneficial for borrowers who choose adjustable rate mortgages. Once again, this finding supports our hypothesis that the impact of search is greater for more complex mortgage products. This also makes intuitive sense because the ARMs are inherently more complex with a lot more customizable features than the conventional fixed-rate mortgages. It is a general consensus in the consumer behavior research area that the benefit of the shopper's search effort tends to increase with the complexity and value of the goods desired. Our results now provide one more piece of evidence to this general consensus from perhaps the biggest and most complex household goods of all — the home mortgages.

#### Model 6 — Does the Effect of Search Vary by Loan Purpose?

The previous model indicates that borrowers who selected ARM based on their search will pay 85.8 basis points less than borrowers who take ARM from recommended lenders. Now we further ask: Will such benefit of search be different if the borrower's purpose is to refinance as opposed to purchase? To answer this question, we use another variable named *shopARMrefi* to control the cross effect between search behavior, mortgage type (ARM or FRM), and loan purpose (purchase or refinance), and estimate the following model:

$$\begin{aligned} \text{Rate} = & \alpha + \beta_1 \text{Gender} + \beta_2 \text{Race} + \beta_3 \text{Year} + \beta_4 \text{Term} + \beta_5 \text{LTV} + \beta_6 \text{Income} + \beta_7 \text{Checking} \\ & + \beta_8 \text{Saving} + \beta_9 \text{rejection} + \beta_{10} \text{Bkrupt} + \beta_{11} \text{Edu} + \beta_{12} \text{shopARMrefi} + \psi \end{aligned} \quad (6)$$

As the results under Model 6 in Table 5 show, the coefficients of variables that are already in the previous models remain largely unchanged both in their signs and magnitudes, suggesting the regression results to be stable and robust. But the most interesting results are found in the new variable *shopARMrefi*, which shows that the benefit of search also varies by the purpose of the loan. For example, if an ARM is obtained for purchase, borrowers who search for lowest rates are likely to pay 82.1 basis points less than those who do not search and take ARM from recommended lenders. But if the ARM is obtained for refinancing, borrowers who search are likely to pay 87.3 basis points less than those who do not search. So the benefit of search is greater for refinancing than for purchase, and this is also true for fixed rate mortgages. As the last six scenarios of *shopARMrefi* in Model 6 indicate, for purchase loans, FRM borrowers who search for lowest rates can expect to pay 8.4 basis points less than those who do not search, but the difference is 17.2 basis points if the FRM is for refinancing, much less than that for ARM. These results not only reinforce the previous ARM results (Model 5 in Table 5) in that search matters more for ARM than for FRM, but also reveal a new insight that, given a loan, the benefit of search is greater for refinancing than for purchase.<sup>9</sup> The rationale of these findings may require further investigation. But if one agrees that, to some extent, a refinancing decision

<sup>9</sup> We thank an anonymous referee for suggesting us to pursue this analysis which deepens our understanding of the impact of search.



involves more considerations than a straight purchase decision, then our findings are at least consistent with the notion that search is more beneficial for more complex decisions.

## Conclusions

Despite the sensitive nature of gender disparity in many aspects of social life, the differential mortgage rates between male and female borrowers have remained largely unnoticed until fairly recently. Fishbein and Woodall (2006) present evidence that women are more likely to be subprime mortgage borrowers. Using a different data source, we extend their findings by showing that women are in fact likely to receive higher interest rates on all types of mortgages, and provide a explanation to such gender disparity.

Through a series of empirical analyses, we find that the traditional explanatory variables (mortgage features, borrower characteristics, market conditions, etc.) can only partially explain such gender disparity. While this finding may allude to possible gender discrimination in the mortgage market, we take the analysis one step further to discover that a behavioral variable that captures how men and women differ in searching for mortgages can completely explain the previously significant gender disparity. This finding provides a simple explanation to the apparent gender disparity: men are likely to pay lower rates on mortgages because they tend to search for the lowest rates. Since search is rewarded by the market, the lack of search by women is a plausible reason for them to receive higher mortgage rates.

Our findings are significant in several ways: First, since the gender disparity in mortgage rates can be explained by the behavioral difference between men and women, it implies that the lending system may not be the cause of the disparity. Second, an effective way to eliminate the disparity may simply be to change the borrowers' behavior through education, which improves the financial literacy of women and instills self-confidence for them to face complex tasks of searching for the best mortgage. From a policy perspective, the creation of education programs aimed at improving women's financial skills may be the most socially cost-efficient way to improve the financial well-being for this vital group of households. On the other hand, this study suggests that lending institutions should improve the current disclosure standards and design more user-friendly mortgage products.

As with all empirical research, this study is subject to data limitations. First, as we discussed before, any investigation of possible discrimination in the mortgage market should be conducted from both the lender and borrower perspectives. This study, however, focuses only on the borrower side because our data do not contain enough information on lender behaviors. As several studies on the subject of racial discrimination in lending (e.g. Blackburn and Vermilyea (2006) and Courchane (2007)) have pointed out, disparities among racial groups could be caused by either different practice cross lenders or within lenders.<sup>10</sup> So lender behavior must be controlled in order to properly interpret any detected disparities. While this is certainly an important

<sup>10</sup> Ross and Yinger (2002) provide an excellent survey on earlier work on discrimination in mortgage pricing.

point, it is less of a concern with the current study because the gender disparity in mortgage rates can be fully explained by our models. In other words, the source of the disparity is irrelevant as the disparity does not persist to the end of the analysis.

Second, we should point out that the SCF data only reports interest rates on mortgages but contains no information about discount points. It is well known that there is a trade-off between interest rates and discount points in the mortgage market. Other things being equal, lower interest rates are associated with higher discount points. In other words, interest comparisons among different borrowers should control for the discount points. That said, given the fact that there has been no empirical evidence suggesting that men and women exhibit different preferences with regard to paying discount points, the inclusion of discount points would not likely to alter the findings of this paper.

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