Why Do Borrowers Choose Adjustable-Rate Mortgages over Fixed-Rate Mortgages? : A Behavioral Investigation

Masaki Mori
Graduate School of International Management, International University of Japan, 777 Kokusai-cho, Minami Uonuma-shi, Niigata, 949-7277 Japan; Tel: +81 25-779-1418; Email: mori@iuj.ac.jp

Julian Diaz III
Department of Real Estate, J. Mack Robinson College of Business, Georgia State University, P.O. Box 3989, Atlanta, GA 30302 U.S.A.; Tel: 404-413-7723; Email: jdiaz@gsu.edu

Alan J. Ziobrowski
Department of Real Estate, J. Mack Robinson College of Business, Georgia State University, P.O. Box 4020, Atlanta, GA 30302 U.S.A.; Tel404-413-7726; Email: aziobrowski@gsu.edu

A considerable number of U.S. borrowers still choose adjustable rate mortgages (ARMs) over fixed rate mortgages (FRMs) even when interest rates are historically very low. This study examines the psychological reasons for the popularity of ARMs by testing the Prospect theory's reflection hypothesis. Experiments are conducted using business professionals. The results suggest that psychological factors may explain why ARM borrowers tend to ignore the associated risk factors, focusing heavily upon pricing factors when choosing mortgage type. The results also indicate that borrowers may be viewing mortgage selection as part of a positive choice; namely, acquiring a home.

Keywords

Adjustable-rate mortgage; Fixed-rate mortgage; Prospect theory; Reflection hypothesis; Experiment

1.   Introduction

The choice of a residential mortgage is one of the most significant decisions that people make in terms of household risk management. At the end of the third quarter of 2007, the value of outstanding U.S. residential mortgages was $10 trillion, which was 74% of the GDP (Federal Reserve Board of Governors, 2007). U.S. residential mortgages can be classified into two broad categories: fixed rate mortgages (FRMs) and adjustable rate mortgages (ARMs). A FRM specifies an interest rate that stays fixed for the life of the mortgage (typically 15 or 30 years) regardless of market conditions. An ARM, which was first introduced during the 1980s, is a mortgage in which the interest rate is not fixed, but tied to an index (market interest rate) and periodically adjusted (typically once a year) as the rate index moves up or down. In recent years, lenders offer ARMs with initial lock-in periods of 3, 5, 7, or 10 years so that the first payment adjustment is postponed into the future. Existence of the well-developed secondary mortgage market is an important feature of the U.S. residential mortgage market. In the secondary mortgage market, existing mortgages are bought and sold, and purchased mortgages are repackaged into various types of mortgage-related securities mainly via government sponsored enterprises, such as the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Corporation (Freddie Mac). Thus, the secondary mortgage market separates functions of originating, funding and servicing. For example, approximately 65% of the residential mortgage loans originated in the primary market were sold to Fannie Mae and Freddie Mac in 2001 (Dennis & Pinkowish, 2004). Being large financial institutions with the capacity to sell their loans in a secondary mortgage market, lenders in the U.S. primary market often behave as if they were *risk-neutral* (Brueckner, 1993). Therefore, the borrowers' choice between the FRMs and ARMs has major implications with respect to interest rate risk-sharing between borrowers and lenders. During some time periods, ARMs have accounted for nearly 70% of conventional residential mortgage loans in the U.S. Figure 1 shows that many U.S. borrowers still choose ARMs over FRMs, even when interest rates are low. During 2004-2005, while interest rates remained at 30-year lows, ARMs accounted for approximately one-third of all conventional mortgage originations. Note that the ARM share shown in Figure 1 is conservative. Over the past 20 years, the average ARM loan was 1.3 times larger than the average FRM loan. Therefore, the ARM share, based on value weights, would be even larger.

Figure 1   Historical Mortgage Rates and ARM Share in the U.S
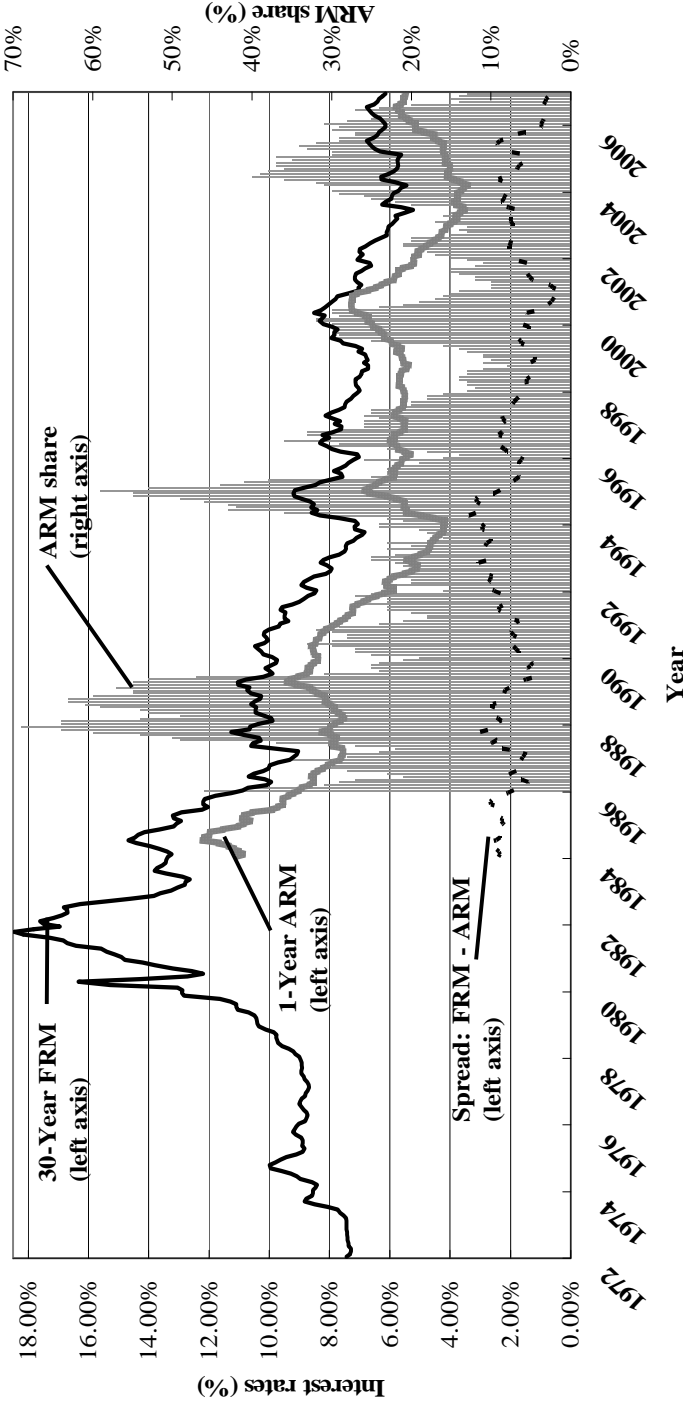
Note: The observed periods for FRM rate, ARM rate, and ARM share are from January 1972 to December 2006, from January 1984 to December 2006, and from January 1986 to December 2006, respectively. All rates are from Freddie Mac. The estimate of ARM share is based upon the number of conventional loans closed for purchase, and taken from The Federal Housing Finance Board.

After the rise of ARMs during the 1980s, a number of studies on the choice of mortgage have been published.[1] Theoretical studies, such as Brueckner (1993), and Campbell and Cocco (2003), provide normative reasons for borrowers' choice of ARMs by developing models of optimum mortgage choice. Brueckner (1993) presents a two-period model of optimum mortgage choice and the comparative static of the model indicates that when borrowers are more impatient than lenders and have a strong desire for current consumption, they are likely to choose the lower payment streams of ARMs at the expense of interest rate risk exposure. Borrowers would also be expected to choose ARMs over FRMs when interest rate variance decreases, borrowers become less risk-averse, the general level of interest rates rises, or the term structure of interest rates becomes steeper (i.e., the spread between FRM and ARM interest rates widens). Campbell and Cocco (2003) develop a dynamic (life-cycle) model describing optimal consumption and mortgage choices. Numerical simulation shows that borrowers, who have relatively small mortgages, stable income, low default costs, and high moving probabilities, should choose ARMs over FRMs.

Normative implications are important guidelines for borrowers to make rational mortgage choice decisions, and can be used as specifications for the choice of mortgage equations in empirical studies. Empirical studies, such as Phillips and VanderHoff (1991, 1994), and Jones, Miller, and Riddiough (1995), test normative implications measuring the relative significance of potential factors that affect mortgage choices of borrowers. Utilizing mortgage transaction data from the National Association of Realtors and a large national lending institution, Phillips and VanderHoff (1991, 1994) show that pricing variables, such as teaser discounts of ARMs and points on ARMs and FRMs, play a dominant role in deciding which mortgage is chosen. When ARMs are cheap relative to FRMs, borrowers will choose ARMs. In general, borrower characteristics, such as age, income and mobility, are found to have only a weak influence on mortgage choices. Jones, Miller, and Riddiough (1995) estimate a time series model of ARM market shares over 7 years (1986-1992) and show that the ARM market share increases when mortgage rates are above historical averages, and decreases when mortgage rates are below historical averages. The survey by Lino (1992) illustrates that many borrowers are unable to determine correctly which type of mortgage has the higher expected cost. In addition, the results imply that borrowers adjust their expectations of future expenses, income, and mortgage payments to justify their choice of mortgage type. Bucks and Pence (2005) find that households often have trouble understanding the details of ARMs: 42% of people with ARMs underestimate interest rate caps compared to lender-reported data and ARM borrowers frequently misreport the index to which rate changes are tied.

Some studies have reported that ARMs expose borrowers to a great deal of interest rate risk. VanderHoff (1996) compares the probabilities of prepayment and default for FRMs and ARMs and finds that ARMs defaulted more often than FRMs. These

---

[1] Leece (2004) provides an extensive literature review on the choice of mortgage.

defaults are not the result of rational wealth maximizing decisions to exercise options imbedded in mortgages. Rather, the defaults are the result of rising monthly payment levels. Ambrose, LaCour-Little, and Huszar (2005) examine the performance and associated risk of 3/27 hybrid ARMs and show that their default risk is relatively high, especially around month 36 when the hybrid mortgage converts from a FRM to an ARM, thus emphasizing the riskiness of ARMs.

Campbell and Cocco's (2003) theoretical model of mortgage choice suggests that borrowers' choice of ARMs may be an attempt to reduce short term costs if borrowers know that they are highly likely to move in the near future, especially when housing prices are expected to increase in the short run. However, VanderHoff (1996) finds evidence that, in actuality, ARM holders are less mobile than FRM holders, which implies that ARM holders often end up exposing themselves to ARM interest rate risks for a longer period than they originally anticipated. This is especially when housing prices stop rising. In such cases, shortsighted ARM holders may not be able to escape their risky loans by selling or refinancing, which is the situation for many borrowers in the current U.S. home mortgage market. The gap between normative borrower behavior and empirical evidence is the focus of the current study. We examine the psychological reasons that underlie observable behaviors of borrowers resulting in the popularity of ARMs in the U.S. (e.g., choosing a mortgage with a lower initial rate to purchase a home). This behavioral investigation contributes to the existing literature on the choice of mortgage by incorporating psychological traits to examine attitudes of borrowers towards interest rate risk in residential mortgages.

Behavioral investigation is descriptive, attempting to describe what people do, focusing on behaviors themselves, rather than upon their consequences. In the area of real estate, behavioral investigations have been extensively conducted to examine the actual valuation processes of appraisers (valuers) both in the U.S and U.K. For example, inspired by Tversky and Kahneman's (1974) work in heuristic problem solving, Gallimore (1994, 1996), Diaz and Hansz (1997), and Diaz and Wolverton (1998) seek evidence of biases in valuation judgment using controlled experiments. Gallimore (1994) finds evidence of two psychological effects, *anchoring* and *recency,* suggesting that valuers in the U.K. tend to inappropriately overweigh information received most recently. Seeking evidence of *confirmation bias,* Gallimore (1996) investigates whether expert valuers in the U.K. seek only information in support of preliminary opinions made by themselves earlier and the presence of confirmation bias is not proven in valuation judgment. Diaz and Hansz (1997) find that expert appraisers in the U.S. operating in geographically unfamiliar markets are influenced by anonymous expert opinions, which shows the evidence of anchoring in the valuation process. Diaz and Wolverton (1998) uncover the behavior of appraisers who use their own previous value judgments as anchoring reference points. Although a number of studies focused on the actual behavior of valuation experts testing psychological effects have emerged, the behavior of other types of participants in real estate is still unexplored.

We test the Prospect theory's reflection hypothesis (Kahneman & Tversky, 1979) as a contributing factor in a borrower's choice of mortgage type. Specifically, we test the research hypothesis that *people, who exhibit a risk-averse preference for a fixed rate bond (FRB) over a variable rate bond (VRB) when choosing a bond type, tend to demonstrate a risk-seeking preference for an ARM over a FRM, when choosing a mortgage type.* Experiments were conducted using business professionals. We find that risk-averse people tend to become more risk-seeking when choosing a mortgage type, leaning more toward ARMs, which may be the psychological reason for its observed popularity. We also find evidence that borrowers behave differently depending on their propensity for current consumption (i.e., consumption-oriented versus investment oriented) and the ways that they frame the mortgage-choice decision.

2.   Prospect Theory

The Nobel Prize winning[2] Prospect theory's reflection hypothesis (Kahneman & Tversky, 1979) states that people tend to be more risk-averse in positive decision situations, while they tend to be more risk-seeking in negative choice situations. Taking out a mortgage means people will have negative cash flows (compared to having no mortgage payments) over time, which are fixed with FRMs and tied to market interest rates with ARMs. Thus, the choice between ARMs and FRMs can be framed as a choice between two types of negative prospects (loss situations) associated with uncertainty. When people invest in a bond, they receive coupon income over time, which is fixed with FRBs and tied to a market interest rate with VRBs. Thus, the choice between FRBs and VRBs can be framed as the choice between two types of positive prospects (gain situation) under conditions of uncertainty.

One could argue that the borrowers' choice between ARMs and FRMs may be framed as a choice between whether or not to purchase insurance against the interest rate risk of ARMs by viewing the negative certain payments of FRMs as costs rather than a choice between the two types of losses. In such a case, borrowers should tend to choose FRMs over ARMs, because they will be less averse to the sure negative payments of FRMs according to Kahneman and Tversky (1984). In fact, not all borrowers necessarily frame the choice of mortgage in the same way. Some borrowers may frame it as the choice of buying insurance, with most of them choosing FRMs over ARMs; whereas others may frame it as the choice between two types of negative prospects, with most of them choosing ARMs over FRMs. Since the focus of the current study is the rationale for the seemingly risk-ignoring behavior of ARM borrowers, we primarily assess the behavior of borrowers who frame the choice of mortgage as a choice between two types of negative prospects, by enforcing this hypothesized decision frame upon study participants. The

---

[2] Awarded for Economics in 2002.

behaviors of the participants in no-framing control situations are also examined to gain insights regarding future research on framing.

Therefore, the Prospect theory's reflection hypothesis, in combination with the already hypothesized decision frames, provides the research hypothesis of the current study: people, who exhibit a risk-averse preference for a FRB over a VRB when choosing a bond type, tend to demonstrate a risk-seeking preference for an ARM over a FRM, when choosing a mortgage type.

3.   Methodology

The testing of the research hypothesis essentially involves a test of the causal relationship between the sign of the cash flow and decision-maker risk preferences. Controlled experiments are powerful tools for collecting evidence of causality (internal validity) because they offer an opportunity for the researcher to isolate the impact of key explanatory variables and control for any influence of exogenous factors, and thus, they have been the most popular tool among behaviorists studying real estate experts. Therefore, instead of testing many potential factors at the same time, we exercised the experimental method, controlling for potential confounding factors in order to explicitly test the research hypothesis. Regardless of such advantages of controlled experiments, the approach is often criticized as being unrealistic; behaviors observed in a "laboratory" without real money at stake may be apart from those in a real world. In fact, reviewing 74 experiments with no, low, or high financial incentives, Camerer and Hogarth (1999) find that financial incentives actually affect the behaviors in effort-responsive tasks, such as recalling items from memory. However, the authors find no effect of financial incentives on average behaviors in non-effort-responsive tasks, such as games, auctions, and risky choices, although variance of behavior is usually reduced by higher financial incentives. More recently, Dohmen, Falk, Huffman, Schupp, Sunde, and Wagner (2006) examine the possibility of any differences in risky choice (lottery choice) decisions between those without real money at stake and those with real money at stake (€300) using 450 randomly selected participants from all over Germany. They find that the risk taking behavior observed in a laboratory-like environment without real money at stake is a good predictor of actual risk-taking behavior. Therefore, our study is designed purposefully to enhance internal validity as a study at the very earliest stage of behavioral research in home mortgage choice. It serves as a significant foundation to gain insights about actual risk-taking behaviors of borrowers. Nevertheless, future research should replicate the current experiment with different people in different settings to pursue a higher degree of external validity.

We provide two decision tasks (mortgage task and bond task) to participants to measure their preference for an ARM (VRB) or a FRM (FRB). Note that in order to test the Prospect theory's reflection effect on a borrowers' choice of mortgage type, it is necessary to prepare a gain decision situation in which test subjects can be screened to identify individuals who behave in a risk-averse fashion as suggested

both by the Prospect theory and traditional expected utility theory since the reflection hypothesis only predicts the behavior of risk-averse people in loss situations. The mortgage decision task is a choice between an ARM and a FRM. The bond decision task is a choice between a VRB and FRB. A copy of experiment cases is included in Appendices A and B. The cases simplify mortgage and bond decision problems to isolate a cause-effect relationship between borrower risk preferences and the sign of cash flow by controlling for alternative explanations, while maintaining enough reality so that participants can perceive cases as mortgage and bond decision tasks. In other words, the cases were prepared to test the Prospect theory's reflection hypothesis with high internal validity under the mortgage decision context, which entails a greater degree of uncertainty than lottery choice problems used by Kahneman and Tversky (1979).

A 5-year holding period was specified in the mortgage case based on the median tenure period of American homeowners to control for a potential confounding factor; mobility. The bond case states that participants are planning to hold a bond until its maturity, which is also 5 years. Table 1 summarizes the parameters in both the mortgage and bond instruments, maintaining consistency except for the sign of cash flows.

Table 1   Summary of Mortgage and Bond Instruments in Cases

MORTGAGES	ARM	FRM
Loan amount	$150,000	$150,000
Initial rate	8%	8%
Payoff period	30 years	30 years
Payment frequency	Monthly	Monthly
Interest rate adjustment period	1 year	-
Periodic and lifetime cap	No	-
BONDS	VRB	FRB
Issue Price	$150,000	$150,000
Initial Coupon rate	8%	8%
Maturity	5 years	5 years
Coupon frequency	Monthly	Monthly
Coupon rate adjustment period	1 year	-

Prior studies show that people tend to choose ARMs when interest rates are above the historical average and FRMs when interest rates are below average. To try to avoid any bias caused by perceptions of participants on interest rate levels, the historical average rate for FRMs (8%) was used as the initial rates for all instruments. This also controls for the anchoring effect by the   teaser rate of ARMs, i.e., if we introduce a realistic rate differential between an ARM and a FRM in the mortgage case, it would be impossible to judge if the choice of ARMs is due to the rate differential or the psychological factor that we are testing. The case also states that the   interest rates of ARMs can potentially range from 11% (+3%) to 5% (-3%), which is based on the historical levels of FRM interest rates.

In addition, the cases present expectations regarding inflation rates, participant income, and house price. Again, to try to avoid any bias caused by expectations of participants, a neutral scenario was prepared in which income and house price are expected to increase at the same rate as inflation. Finally, the cases provide 6-point scales with which the preferences of participants for an ARM (VRB) or a FRM (FRB) were measured. Since the 6-point scale does not have a mid-point, participants were forced to show their preference toward one of two instruments, which mimics a mortgage decision in real life. A score of 1 represents the strongest preference for variable-rate products, while a score of 6 represents the strongest preference for fixed-rate products. Some demographic questions were also asked.[3]

Both tasks were conducted using a web-application developed for the present study. *The within-subjects design* (repeated measures analysis) was used for the main treatment (sign of cash flow) in which each participant conducted both the mortgage and bond cases because this type of analysis usually allows for a more powerful estimation of effects than between-subjects designs. *Counterbalancing* is used in which approximately half of the participants (Group A) conducted the mortgage case first and the bond case second while the other half of the participants (Group B) conducted the bond case first and the mortgage case second. Participants were randomly assigned to one of the two experimental groups. Therefore, the experimental design to test the hypothesis is a 2 x 2 counterbalanced design. The within-subjects factor is the sign of cash flow fixed at two levels: bond (positive cash flow) and mortgage (negative cash flow). The between-subjects factor is the counterbalancing sequence fixed at two levels: mortgage-bond sequence and bond-mortgage sequence. The design is summarized in Table 2.

Table 2   Summary of Experimental Design

		Sign of Cash Flow (within-subjects)	
		Mortgage (negative)	Bond (positive)
Counterbalancing Sequence (between-subjects)	Mortgage-Bond Sequence	**I**	**II**
	Bond-Mortgage Sequence	**III**	**IV**

Within the 2 x 2 counterbalanced design, the initial task that the participants undertook was expected to enforce the hypothesized decision frames within their second task. This was to be achieved by sensitizing participants toward the sign of cash flow, which mimics decision-making in real life, so that they frame their second task as a choice between the two types of positive prospects under risk for the bond case, or as a choice between the two types of negative prospects under risk for the

---

[3] Demographic questions are available from the authors upon request.

mortgage case. Thus, the main focus in testing the research hypotheses is on decisions under the framing control situation. The decision results of participants under situations that have no framing control are separately analyzed as an exploratory analysis, primarily to gain implications for further study on the topic.

As not all borrowers necessarily frame the choice of mortgage in the same way, not all borrowers necessarily make their decisions in the same fashion. We hypothesized that when choosing a mortgage type, people, who show risk-averse (RA) preferences when choosing a bond type, may behave differently from people, who show risk-seeking (RS) preferences when choosing a bond type. Since testing behaviors of both RA and RS participants at the same time could mask important implications, we separately examined the behaviors of the participants based on their risk preferences in a bond choice. We defined RA people as participants with preference scores of 4, 5, or 6 and RS people as those with preference scores of 1, 2, or 3 when choosing a bond type.

Thus, we defined four groups for our analyses; 1) RA-framing control, 2) RA-no framing control, 3) RS-framing control, and 4) RS-no framing control. The direct test of the research hypothesis is an independent two-sample T test, which tests the difference in preference score, focusing on the RA-framing control group between participants in Cell II versus Cell III in Table 2.

We used business professionals as experiment participants, since these participants are likely to have already made home mortgage decisions in the past or will make such decisions in the near future. In fact, the post-experiment survey found that more than 80% of experiment participants have borrowed home mortgage loans to purchase their personal residences at least once and 17% of them have experienced mortgage choice more than twice. Thus, this group of participants is a good representative of entry-level homebuyers in the U.S. Also, these participants have relatively homogeneous characteristics, such as age, income, education level, and work experience, which are potential confounding factors in this study.

Ninety-two business professionals participated in the study. Among the 92 participants, 7 were excluded from the analysis because they reported that they had taken some real estate courses and showed significantly different behaviors (strongly risk-averse, leaning toward FRMs) from the remaining participants, $t(90) = -2.40$, $p < .05$ (two-tailed). Thus, the usable sample consists of 85 participants. Table 3 provides an overview of important characteristics of the experimental sample. Among the 85 participants, 68 are U.S. nationals and 17 are foreigners. All subjects are combined into one group of U.S. homebuyers, since there are no significant differences in mortgage and bond risk preference scores between these two groups ($t[83] = -0.83$, $p > .10$; and $t[83] = 1.41$, $p > .10$, respectively). The average age of the 85 participants is 32 with a mode of 33. According to the National Association of Realtors (National Association of Realtors, 2006), the median age of entry-level U.S. homebuyers was 32 in 2005. Therefore, this group of experiment participants is reasonably representative of entry-level homebuyers in the U.S. Fifty-five percent of

the participants are married, which is very close to the married couples' share (61%) of the U.S. housing market, further supporting the validity of the sample.

As shown in Table 3, 60% of the participants have a household income of greater than $75,000, which is a group with relatively high income. Admittedly, further investigations with lower income groups should be conducted to allow for any confidence generalizing beyond the currently-studied samples. Still, findings of this study are significant since empirical studies both in the U.S. and U.K found that income level has a negligible effect on mortgage choice (Dhillon, Shilling, & Sirmans, 1987; Phillips & VanderHoff, 1994; Leece, 2001). Table 3 generally demonstrates a high degree of homogeneity of household income, work experience, and education level. Several statistical tests found no significant effects of these demographic factors on preference scores.[4] Thus, the sample of 85 U.S. participants can be treated statistically as one homogeneous group.

Table 3   Summary of Participant Profiles

Item	Category	Number	Percentage
Gender	Male	47	55.3%
	Female	38	44.7%
Nationality	U.S.	68	80.0%
	Non-U.S.	17	20.0%
Marital Status	Married	47	55.3%
	Single	38	44.7%
Household Income	Under $20,000	5	5.9%
	$20,000 - $34,999	1	1.2%
	$35,000 - $49,999	7	8.2%
	$50,000 - $74,999	18	21.2%
	$75,000 - $99,999	17	20.0%
	$100,000 or more	34	40.0%
	Not Answered	3	3.5%
Work Experience	2 years or less	8	9.4%
	3 to 5 years	17	20.0%
	6 to 10 years	34	40.0%
	11 to 15 years	14	16.5%
	16 to 20 years	6	7.1%
	21 or more years	6	7.1%
Education (Degree obtained)	Bachelor Degree	62	73.0%
	Master Degree	22	25.9%
	Doctoral Degree	1	1.2%

---

[4] Test results are available from the authors upon request.

4.   Results

Among the 85 participants, 52 (61%) have exhibited risk-averse preferences when choosing a bond type. Since the Prospect theory's reflection hypothesis predicts that risk-averse people show the preference reversal in loss situations, these risk-averse participants become the main focus of our research hypothesis and are labeled *RA*. The remaining 33 participants demonstrate risk-seeking preferences when choosing a bond type, so they are labeled *RS* and analyzed separately as an exploratory analysis.

Figure 2 summarizes the behavior of the participants who demonstrated a risk-averse preference (preference score of 4, 5 or 6) when choosing a bond type. The left pane shows scores under framing control situations (i.e., scores collected during the second tasks of the participants) and the right pane shows those under no-framing control situations (i.e., scores collected during the first tasks of the participants). The research hypothesis was tested directly by comparing risk preference between the bond choice and mortgage choice under the hypothesized decision frames focusing on the RA-framing control group (left pane of Figure 2). The null hypothesis tested was that the mean for the mortgage case (negative cash flow) is equal to or larger (more risk-averse) than the mean for the bond case (positive cash flow). An independent two-sample T test assuming unequal variances rejected the null hypothesis, $t(25) = 1.68$, one-tailed $p < .05$. Thus, the research hypothesis, which is essentially, the Prospect theory's reflection hypothesis, is supported; that is, people, who demonstrate a risk-averse preference for a FRB over a VRB when choosing a bond type, significantly change their risk preferences when choosing a mortgage type, leaning more toward ARMs under the hypothesized decision frames. Note that both the mortgage and bond cases were designed to be consistent except for the sign of cash flows. Thus, the preference reversal observed with RA participants is likely due to the effect proposed by the Prospect theory's reflection hypothesis. This psychological factor may underlie the mortgage choice decisions of people who tend to choose ARMs.[5]

For overall RA participants, a two-way mixed ANOVA reveals that the main between-subjects effect of the counterbalancing sequence is almost significant and the interaction effect between the sign of cash flow and counterbalancing sequence is strongly significant ($F[1,50] = 3.99$, two-tailed $p = .051$ and $F[1,50] = 9.20$, two-tailed $p < .01$, respectively). The significant interaction effect suggests different behaviors between participants with different framing control conditions. As shown in the right pane in Figure 2, participants do not significantly change their risk preferences between the mortgage choice and bond choice under the no framing control situation, favoring both fixed rate bonds and mortgages. The findings suggest that a deeper understanding about the ways that borrowers frame mortgage choices is required. At this point, we suspect that when participants conducted the mortgage case as their first task, they might not have recognized a mortgage as a loss situation as hypothesized. Arguably, participants with no-framing control could have framed

---

[5]   Descriptive statistics of risk preference scores is available from the authors upon request.

their mortgage choice in two ways. First, they could have framed the choice between ARMs and FRMs as the choice of buying or not buying insurance against the interest rate risk of ARMs. Kahneman and Tversky (1984) imply that they should tend to choose FRMs over ARMs in such a case, because they are less averse to the certain negative payments of FRMs than when they frame the choice between ARMs and FRMs as a choice between two types of losses. This behavior, seen with cost framing, is consistent with the results under a no framing control situation. Secondly, without the framing control, participants might think of the mortgage as a gain situation associated with getting a house. When given the bond choice first, participants recognized the mortgage as a loss situation and became more risk-seeking, as suggested by the Prospect theory's reflection hypothesis. Thus, future investigations into the situations and conditions wherein borrowers frame mortgage choices will be of importance to gain insights into the risks of ARM borrowers.

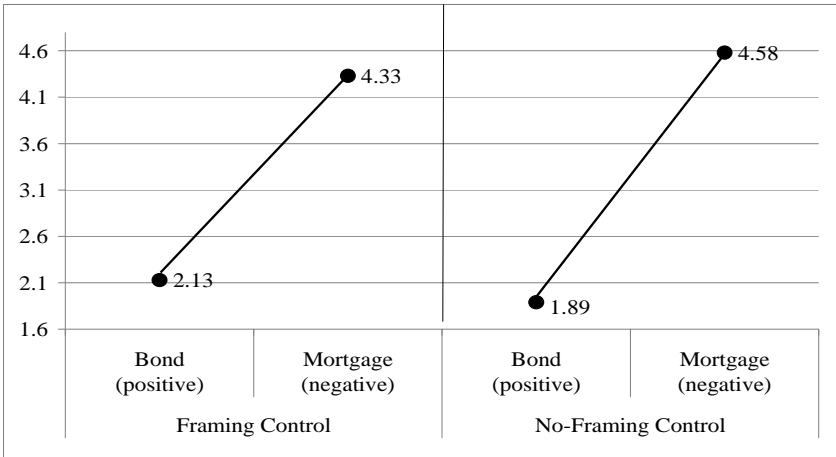**Figure 2   Summary of Risk Preferences of RA participants**
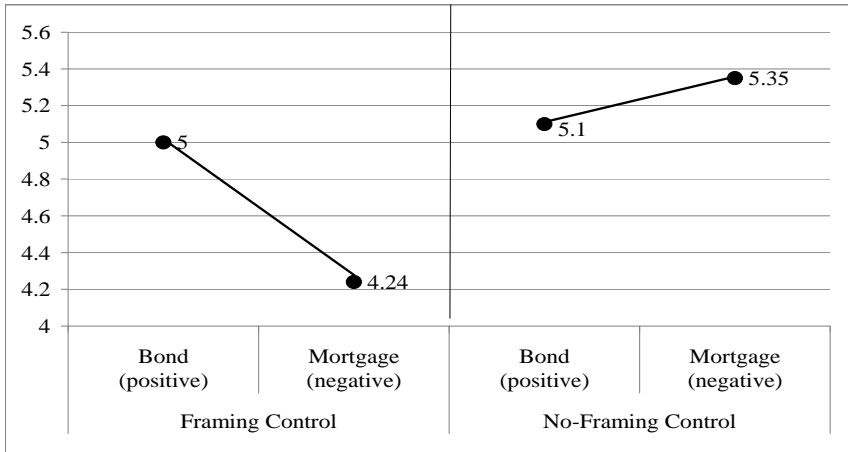
Note: RA participants are the 52 individuals who exhibit risk-averse preferences when choosing a bond type. The left pane shows the results under a framing control situation and the right pane shows the results under a no-framing control situation.

Although we have proposed no hypothesis for risk-seeking individuals, as an exploratory exercise, we examined the behaviors of the 33 RS participants who exhibited a risk-seeking preference (preference scores of 1, 2, or 3) when choosing a bond type. As summarized in Figure 3, ANOVA reveals a strongly significant main effect of sign of cash flow, $F(1,31) = 67.57$, one-tailed $p < .01$. There are no significant effects of the counterbalancing sequence or any significant interaction between the sign of cash flow and counterbalancing sequence ($F[1,31] = .001$, two-tailed $p > .10$; and $F[1,31] = .38$, two-tailed $p > .01$, respectively). Thus, RS participants change their risk preferences significantly to the more risk-averse

preference of a FRM when choosing a mortgage type, regardless of task sequence (i.e., framing control condition). Although the behavior of RS participants should be investigated further with formal research hypotheses, we argue that RS participants may have a myopic view with a strong propensity for current consumption. When people invest in a bond, they must put their money into it, which represents negative cash flow at the present moment. Therefore, myopic individuals may view bond investment selection as part of a loss situation, resulting in risk-seeking behavior despite a future income stream. On the other hand, when people take out a mortgage, they obtain a lump sum of money for a home purchase, which is positive cash flow at the present moment. Therefore, myopic people may view mortgage selection as part of a gain situation, resulting in risk-averse behavior despite future payments.

Figure 3   Summary of Risk Preferences of RS Participants

Note: RS participants are the 33 individuals who exhibit risk-seeking preferences when choosing a bond type. The left pane shows the results under a framing control situation and the right pane shows the results under a no-framing control situation.

5.   Discussions and Conclusions

This research tests the Prospect Theory's reflection hypothesis as a contributing factor in a borrower's choice of mortgage type. The following two decision frames are enforced in the within-subjects design: 1) the choice between ARMs and FRMs as a choice between two types of negative prospects (loss situation) under conditions of uncertainty; and 2) the choice between FRBs and VRBs as a choice between two types of positive prospects (gain situation) under conditions of uncertainty. Under these hypothesized decision frames, we have tested the research hypothesis that people who exhibit a risk-averse preference for a FRB over a VRB when choosing a

bond type, tend to demonstrate a risk-seeking preference for an ARM over a FRM. Experiments are conducted using business professionals.

The analysis supports the research hypothesis, suggesting that risk-averse people tend to become more risk-seeking when choosing a mortgage type, leaning more toward ARMs when they frame the mortgage choice problem as part of a loss situation. Psychological factors may explain why ARM borrowers tend to ignore the risk factors associated with ARMs, focusing heavily upon pricing factors when choosing mortgage type.
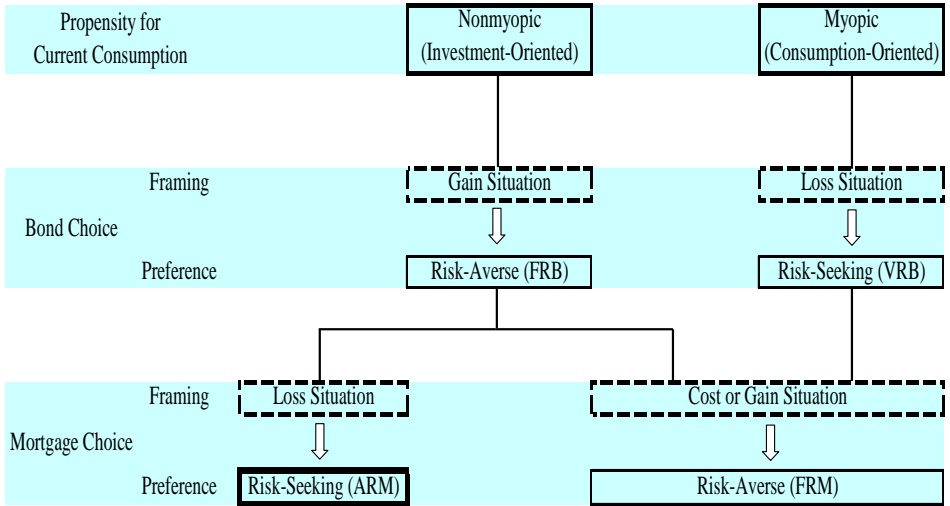
In addition, other behaviors are identified that help generate research hypotheses for future research. Figure 4 summarizes the behaviors of the participants, revealed and implied by the current study. The analysis separates the overall sample into two groups: RA participants, who demonstrate a risk-averse preference when choosing a bond type; and RS participants, who demonstrate a risk-seeking preference when choosing a bond type. It can be argued that RS participants may be myopic, harboring a strong propensity for current consumption and viewing bond investment selection as part of a loss situation. As a result, they behave in a risk-seeking manner when choosing a bond type, even given the prospect of future income. On the other hand, RA participants may be investment-oriented, and have a propensity for asset accumulation, viewing bond investment selection as part of a gain situation, resulting in risk-averse behavior.

RA participants could have framed the mortgage choice problem in three potential ways. First, when participants conduct the mortgage case as their second task, with the positive bond choice first, participants clearly appear to view mortgage selection as a choice between two types of negative prospects (loss situation) associated with uncertainty. In such a case, risk-averse individuals tend to become more risk-seeking when choosing a mortgage type, which implies that risk factors are less important for them. Therefore, they tend to focus more on pricing factors when choosing a mortgage type, as suggested by previous empirical studies. Secondly, RA participants could have framed the choice between ARMs and FRMs as the choice of purchasing or not purchasing insurance against the interest rate risk of ARMs. In such a case, they choose a FRM over an ARM, because they are less averse to the certain negative payments of a FRM than when they frame mortgage choice as two types of losses, as suggested by Kahneman and Tversky (1984). Finally, RA participants might think that a mortgage is a gain situation, associated with attaining a house, again resulting in a risk-averse preference for a FRM for the future payment stream, perhaps to secure the gain (home) at the present moment.

RS participants, who have behaved in a risk-seeking fashion in positive choice situations and choose a variable rate bond over a fixed rate bond, tend to avoid risk, with a FRM as their mortgage choice. This result suggests that myopic individuals may view bond investment selection as part of a negative (loss) choice, resulting in risk-seeking behavior, while they view mortgage selection as part of a positive (gain) choice, resulting in risk-averse behavior. The behavior of RS participants is totally

independent of the counterbalancing sequence, which implies that all RS participants framed the mortgage choice decision in the same way.

Figure 4   Summary of Participant Behavior

Propensity for Current Consumption	Nonmyopic (Investment-Oriented)		Myopic (Consumption-Oriented)
Bond Choice Framing	Gain Situation		Loss Situation
Preference	Risk-Averse (FRB)		Risk-Seeking (VRB)
Mortgage Choice Framing	Loss Situation		Cost or Gain Situation
Preference	Risk-Seeking (ARM)		Risk-Averse (FRM)

Note: Non-myopic homebuyers are the 52 (61%) RA participants, while myopic homebuyers are the 33 (39%) RS participants. The main focus of the current study is the behavior of the non-myopic investors under the hypothesized decision frame (gain for bond choice and loss for mortgage choice), which results in a risk-seeking preference for an ARM. This finding supports the research hypothesis, which, in turn, had been motivated by the Prospect theory's reflection hypothesis.

Overall, the results suggest that borrowers behave differently depending upon the combination of 1) their propensity for current consumption (i.e. consumption-oriented versus investment oriented); and 2) the ways that they frame the mortgage-choice decision.

In this study, we focus on behaviors of U.S. borrowers. Globally, some cultural factors can also play a role in the choice of mortgage. Hofstede (1991, 2001) suggests that people from different countries evaluate uncertain events in different ways. Thus, comparing risk preferences of borrowers in the choice of mortgage among different cultures should be examined in future research. The findings may be of great importance globally for governments and lenders in developing and introducing new mortgage products in countries with diverse cultures. Based upon the results of the current study, it appears that the behaviors of most borrowers may differ depending upon the ways that they frame a mortgage choice decision. For example, Figure 4 suggests that risk-averse participants view a mortgage choice as part of a loss situation when they are sensitized toward future cash flow. It is

arguable that in the real world, borrowers may be most sensitized toward the future cash flows of a mortgage product when the volatilities of future interest rates, inflation, or their household income are expected to rise. In such situations, borrowers may behave in a risk-seeking fashion, focusing more on pricing factors when choosing a mortgage type. This exposes borrowers to a great amount of unexpected foreclosure risk. Thus, further investigations into the situations and conditions wherein borrowers frame mortgage choices as part of a loss situation will be of importance to gain more insights into the risks of ARM borrowers. The current results are derived under the situation wherein the initial rates are set to be the same for both the ARM and FRM. A hypothetical (controlled) setting is used to ensure the study's high internal validity. Thus, the impact of the ARM-FRM rate differential on borrower behaviors is also of general interest to answer the following questions: How much of the rate differential will make borrowers favor an ARM? Does the size of the impact differ between RA and RS, and among borrowers in different cultures? Finally, some direct investigation into the effect of propensity for current consumption on the choice of mortgage is warranted, since the current study does not measure the propensity for current consumption. It should also be noted that all participants of our experiments are relatively highly educated people. Transferring our results to less educated populations may also influence the results and conclusions.

References

Ambrose, Brent W..LaCour-Little, Michael. and Huszar, Zsuzsa R. (2005). A Note on Hybrid Mortgages. *Real Estate Economics,* **33**, 4, 765-782.

Brueckner, Jan K. (1993). Why Do We Have Arms? *Journal of the American Real Estate and Urban Economics Association,* **21**, 3, 333-345.

Bucks, Brian. and Pence, Karen. (2005). *Measuring Housing Wealth.* Paper Presented at the Wealth Study Conference, Luxembourg.

Camerer, Colin F.. and Hogarth, Robin M. (1999). The Effects of Financial Incentives in Experiments: A Review and Capital-labor-production Framework. *Journal of Risk & Uncertainty,* **19**, 1-3, 7-42.

Campbell, John Y.. and Cocco, Joao F. (2003). Household Risk Management and Optimal Mmortgage Choice. *The Quarterly Journal of Economics,* **4**, 1, 1449-1494.

Dennis, Marshall W.. and Pinkowish, Thomas J. (2004). *Residential Mortgage Lending: Principles and Practices* (5th ed.). Mason, OH: Thomson South-Western.

Dhillon, Upinder S..Shilling, James D.. and Sirmans, C. F. (1987). Choosing between Fixed and Adjustable Rate Mortgages: Note. *Journal of Money, Credit and Banking,* **19**, 2, 260-267.

Diaz, J., III. and Hansz, J. (1997). How Valuers Use the Value Opinions of Others. *Journal of Property Valuation and Investment,* **15**, 3, 256-260.

Diaz, J., III. and Wolverton, M. L. (1998). A Longitudinal Examination of the Appraisal Smoothing Hypothesis. *Real Estate Economics,* **26**, 2, 349-358.

Dohmen, T..Falk, A..Huffman, D..Schupp, J..Sunde, U.. and Wagner, G. (2006). Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-validated Survey, *CEPR Discussion Paper no.* **5517**. London: Centre for Economic Policy Research.

Federal Reserve Board of Governors. (2007). *Flow of Funds Accounts of the United States (June 2007).*

Gallimore, Paul. (1994). Aspects of Information Processing in Valuation Judgement and Choice. *Journal of Property Research,* **11**, 2, 97 - 110.

Gallimore, Paul. (1996). Confirmation Bias in the Valuation Process: a Test for Corroborating Evidence. *Journal of Property Research,* **13**, 4, 261 - 273.

Hofstede, Geert. (1991). *Cultures and Organizations: Software of the Mind.* London: McGraw-Hill.

Hofstede, Geert. (2001). *Culture's Consequences: Comparing Values, Institutions, and Organizations Across Nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Jones, S. T..Miller, N. G.. and Riddiough, T. J. (1995). Residential mortgage Choice: Does the Supply Side Matter? *Journal of Housing Economics,* **4**, 1, 71-90.

Kahneman, Daniel. and Tversky, Amos. (1979). Prospect Theory: An Analysis of Decision Under risk. *Econometrica,* **47**, 2, 263-292.

Kahneman, Daniel. and Tversky, Amos. (1984). Choices, Values, and Frames. *American Psychologist,* **39**, 4, 341-350.

Leece, David. (2001). Regressive Interest Rate Expectations and Mortgage Instrument Choice in the United Kingdom Housing Market. *Real Estate Economics,* **29**, 4, 589-613.

Leece, David. (2004). *Economics of the Mortgage Market: Perspectives on Household Decision Making*. Oxford, UK: Blackwell Publishing Ltd.

Lino, Mark. (1992). Factors Affecting Borrower Choice between Fixed and Adjustable rate Mortgages. *The Journal of Consumer Affairs,* **26**, 2, 262-273.

National Association of Realtors. (2006). More Home Buyers and Sellers Use Internet, Practitioners. Retrieved June 29, 2006, from http://www.realtor.org/RMODaily.nsf/pages/News2006011701?OpenDocument

Phillips, Richard A.. and VanderHoff, James. (1991). Adjustable- Versus Fixed-Rate Mortgage Choice: The Role of Initial Rate Discounts. *The Journal of Real Estate Research,* **6**, 1, 39-51.

Phillips, Richard A.. and VanderHoff, James. (1994). Alternative Mortgage Instruments, Qualification Constraints and the Demand for Housing: An Empirical Analysis. *Journal of the American Real Estate and Urban Economics Association,* **22**, 3, 453-477.

Tversky, Amos. and Kahneman, Daniel. (1974). Judgment Under Uncertainty: Heuristics and Biases. *Science,* **185**, 1124-31.

VanderHoff, James. (1996). Adjustable and Fixed Rate Mortgage Termination, Option Values and Local Market Conditions: An Empirical Analysis. *Real Estate Economics,* **24**, 3, 379-406.

Appendix A: Mortgage Case

__Instruction__ – Please read this instruction first.
In this task, you will be asked to choose between two types of mortgage loans based on information supplied to you.   Please carefully read all information before making your decision and make your decision under specified situations and assumptions.

__Your current situation__
You are about to take out a $150,000 home mortgage loan to purchase your new personal residence.   You are free to choose between two types of mortgage loans as described below.   You are planning to live in your current house for approximately 5 years.

__Mortgage type__
1) *Adjustable-rate mortgage (ARM)* [6]
The adjustable-rate mortgage available to you is a full-amortization mortgage. Loan terms are provided below:

- Initial rate = 8%
- Payment frequency = monthly
- No periodic cap, No lifetime cap[8]

- Principal is paid off in 30 years
- Interest rate adjustment period[7] = 1 year

2) *Fixed-rate mortgage (FRM)*[9]
The fixed-rate mortgage available to you is also a full-amortization mortgage.   Loan terms are provided below:
- Interest rate = 8%
- Principal is paid off in 30 years
- Payment frequency = monthly

__ARM interest rate expectation__
The ARM initial rate and FRM interest rate of 8% are set at this level based on the historical average rate.   Therefore, you can expect that the average interest rate will be around 8% in the long run.   However, there is no guarantee that the interest rate will be around 8% for the next 5 years.   It is assumed that there is an equal chance that the interest rate will move up to 11% (+ 3%) or down to 5% (− 3%) and you

---

[6] Adjustable-rate mortgage (ARM) is a mortgage in which the interest rate is not fixed but is tied to an index (market interest rate) and is periodically adjusted as the rate index moves up or down.

[7] This ARM changes its rate once a year.

[8] Periodic (Lifetime) cap is a provision of an adjustable rate mortgage limiting how much interest rates may increase in a single adjustment period (during the mortgage term).

[9] Fixed-rate mortgage (FRM) specifies an interest rate that stays fixed for the life of the mortgage regardless of market conditions.

don't know when these changes could happen.   The following table shows your monthly and annual payments based on several interest rates assuming the remaining balance of $150,000 and the remaining loan term of 30 years.

Frequency/Interest Rate	8% (FRM)	11%	5%
Monthly payments	$1,100.65	$1,428.49	$805.23
Annual payments	$13,207.76	$17,141.82	$9,662.79

Note that if you choose the FRM, your monthly and annual payments will be fixed at $1,100.65 and $13,207.76, respectively.

Expectations of inflation, your income, and your house price
Based on the historical inflation rate, the annual inflation rate is expected to be 3% for 5 years.   Your income and house price are assumed to increase at the same rate as inflation.

Decision
After taking out a mortgage, you will have payments for the next 5 years, which are fixed with the FRM and tied to a market interest rate with the ARM.   This task is the choice between two types of payments in the future.   There is no right or wrong answer for this task.

Under the situations and assumptions supplied to you, please rate your preference for the ARM or FRM using below scale.

1	2	3	4	5	6
	Preference for				
Preference for					
	ARM				
FRM					

Appendix B: Bond Case

Instruction – Please read this instruction first.
In this task, you will be asked to choose between two types of bond investments based on information supplied to you.   Please carefully read all information before making your decision and make your decision under specified situations and assumptions.

Your current situation
You are about to invest $150,000 in a bond.   You are free to choose between two types of bond investments as described below.   You are planning to hold the bond until the maturity.

Bond type
1)   Variable-rate bond (VRB)[10]
The variable-rate bond available to you is a coupon bond issued by the U.S. government, with which you will receive coupon payments until maturity, when you receive the full principal.   Default risk does not exist.   Other bond terms are provided below:

- ➢   Initial coupon rate = 8%
- ➢   Coupon frequency = monthly
- ➢   Issue price = $150,000

- ➢   Maturity = 5 years
- ➢   Coupon rate adjustment period[11] = 1 year

2)   Fixed-rate bond (FRB)[12]
The fixed-rate bond available to you is also a coupon bond issued by the U.S. government.   Default risk does not exist.   Other bond terms are provided below:

- ➢   Coupon rate = 8%
- ➢   Coupon frequency = monthly

- ➢   Maturity = 5 years
- ➢   Issue price = $150,000

VRB coupon rate expectation
The VRB initial coupon rate and FRB coupon rate of 8% are set at this level based on the historical average rate.   Therefore, you can expect that the average coupon rate will be around 8% in the long run.   However, there is no guarantee that the coupon rate will be around 8% for the next 5 years.   It is assumed that there is an equal chance that the coupon rate will move up to 11% (+ 3%) or down to 5% (– 3%) and you don't know when these changes could happen.   The following table shows your monthly and annual coupon receipts based on several coupon rates.

---

[10]   Variable-rate bond (VRB) is a bond in which the coupon rate is not fixed but is tied to an index (market interest rate) and is periodically adjusted as the rate index moves up or down.

[11]   This VRB changes its coupon rate once a year.

[12]   Fixed-rate bond (FRB) specifies a coupon rate that stays fixed for the life of the bond regardless of market conditions.

Frequency/Coupon Rate	8% (FRB)	11%	5%
Monthly receipts	$1,000.00	$1,375.00	$625.00
Annual receipts	$12,000.00	$16,500.00	$7,500.00

Note that if you choose the FRB, your monthly and annual coupon receipts will be fixed at $1,000.00 and $12,000.00, respectively.

Expectations of inflation and your income
Based on the historical inflation rate, the annual inflation rate is expected to be 3% for 5 years.   Your income is assumed to increase at the same rate as inflation.

Decision
After investing in a bond, you will receive income for the next 5 years, which are fixed with the FRB and tied to a market interest rate with the VRB.   This task is the choice between two types of income in the future.   There is no right or wrong answer for this task.

Under the situations and assumptions supplied to you, please rate your preference for the VRB or FRB using below scale.

1	2	3	4	5	6
	Preference for				
Preference for					
	VRB				
FRB					