

Part V

**Heuristics and Experiments
in Finance**

Chapter 10

Heuristics and Biases in the Israeli Mortgage Market

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Abstract

This research examines the three seminal heuristics that are employed in decision-making under uncertainty: availability; representativeness; and anchoring and adjustment; and their appearance in the Israeli mortgage market. We argue that the standard economic criteria are sometimes inadequate to explain household's choices, which may be motivated by heuristic principles which reduce the complex task of choosing a mortgage. More specifically, we focus on the households' choice between fixed rate mortgages (FRM) and adjustable rate mortgages (ARM). We empirically examine the effect of these heuristics on the decision between ARM and FRM using a unique data provided to us by the Bank of Israel, which contains detailed information on the household's decision between fixed and adjustable rate mortgage contracts in Israel in the past decade. The results of our analysis demonstrate a significant effect of availability and representativeness heuristics on households' decision. In addition, we show that regulatory provisions regarding the loan division between FRM and ARM may serve as a possible anchor to the borrowers.

Keywords: Heuristics and biases, mortgage decision making, household finance, adjustable and fixed rate mortgages

JEL Classification: D10, D14, G21, R2

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1. Introduction

This paper examines the three seminal heuristics that are employed in decision making under uncertainty described in Tversky and Kahneman (1974) and their appearance in the Israeli mortgage market. The three heuristics are: (i) representativeness, which is usually employed when decision makers are asked to judge that an event belongs to class of events; (ii) availability, which is often employed when decision makers are asked to assess the plausibility of a particular development; and (iii) anchoring and adjustment, which is usually employed when an initial value to some aspects of the decision is available.

Since, housing is the most important asset in the portfolio of most households, the effect of each individual heuristic may lead decision makers to systematic errors which, in turn, can cause a substantive loss of economic value. A better understanding of the effect of these heuristics on mortgage borrowers' decisions can improve the design of market reforms in this area in order to maximize market efficiency and to minimize households' economic loss.

There is mounting of theoretical literature focusing on determining what factors contribute to the optimal choice in housing finance. Most of them examining the decision between Fixed Rate Mortgages (FRM) and Adjustable Rate Mortgages (ARM). Researchers have found that the relative attractiveness of a specific type of contract should depend on individual circumstances, such as the borrower's income, borrowing constraints, the probability of pre-paying the loans, and on macro-economic measures such as inflation of housing prices (Baesel and Biger, 1980; Statman, 1982; Alm and Follain, 1984; Stanton and Wallace, 1999; and Koijen *et al.*, 2009).

Despite it, there is little empirical evidence about the optimality of mortgage decision making. Campbell and Cocco (2003) show that mortgage borrowers sub-optimally choose between ARM and FRM contracts. Campbell (2006) use the American Housing Survey to show evidence that mortgage borrowers make several mistakes that leads to important implications for equilibrium in the mortgage market. Agarwal, Rosen and Yao (2012) show that mortgage borrowers sub-optimally refinance their mortgage and Agarwal, Ben-David and Yao (2014) show that mortgage borrowers exhibit the sunk cost fallacy.

In this paper we focus on the behavioral aspects of housing finance decisions. Understanding the mechanism through which these decisions are made is very significant in terms of housing in general and mortgage market implications in particular.

More specifically, we focus on the decision of homeowners to choose between fixed rate mortgages (FRM) and adjustable rate mortgages (ARM). Making the decision between FRM and ARM is difficult for most homeowners, many of whom lack formal economic education or knowledge and are not sophisticated finance decision makers or mortgage borrowers.

Decisions about housing finance are based on beliefs concerning uncertain events which are employed to assess probabilities and to predict values. Tversky and Kahneman's (1974) seminal paper found that decision makers rely on a limited number of heuristic principles which reduce the complex task of assessing probabilities and predicting values to simpler judgmental operations. In general, these heuristics are useful, but can also lead to systematic errors. In our setting, an implication of these heuristics on making the decision between FRM and ARM can explain our empirical findings.

When faced with the difficult task of choosing between FRM and ARM (usually not having previous experience, and relevant knowledge), individuals employ a limited number of heuristics to simplify this decision. We hypothesize that decision makers are bounded by the *availability* of information the market provides through its general media and judging this information by its *representativeness*. Moreover they may be influenced by *anchoring and adjustment* taking into account regulation provisions limiting the ARM/FRM share out of the entire loan.

We tested the effect of these three heuristics using unique data provided to us by the Bank of Israel (Israel's central bank) which contains information on the choices households made between fixed and adjustable rate mortgage contracts in Israel during the past decade.¹ Overall, our analysis the

¹At the single household level it could be either an FRM or ARM contract or some combinations between them. The Israeli market still has a strict distinction in FRM-ARM products. Moreover, while in most other markets switching (refinancing) is not so expensive; a key feature of the Israeli market is that the initial choice is essentially definitive. In order to switch FRM to ARM, an interest rate differential (IRD) of the entire remaining mortgage balance must be paid. This IRD represents the present value of interest differentials, which

results of our analysis demonstrate a significant effect of availability and representativeness heuristics on households' decision. In addition, we show that regulatory provisions regarding the loan division between FRM and ARM may serve as a possible anchor to the borrowers.

The paper proceeds as follows: Section 2 describes the data. Section 3 describes the tested heuristics. Section 4 provides the design. Section 5 presents our results, and finally, Section 6 discusses the findings and conclusions.

2. Data

Our main body of data comes from the Israeli Central Bank data on mortgage loans between the years 2002–2011. The Israeli mortgage market has undergone numerous changes in recent years due to the decline in inflation rates and structural reforms. As a result of the continuing decrease in inflation, the short interest rates of the Bank of Israel² have dropped in the last decade from two-digit settings to a “stable” low rate, as seen in Figure 1 (presents monthly commercial banks short term interest rates from November 2002 to April 2011).

The magnitude of the market for housing finance of households in Israel (see Figure 2, which shows monthly mortgage volumes from July 2003 to April 2011) and in most developed countries has risen substantially over the past decade.

In recent years, we have witnessed a significant increase in housing prices, which were already considered to be high even in historical perspective. Between 2008 and 2010, prices rose by 41% in real terms, significantly faster than the 1.5% increase in real terms starting in 1973, as displayed in Figure 3.

Most of the price increase, up to the last quarter of 2010, is attributed to interest rates dropping in response to the global economic crisis in

could be significant. A household has an option to switch FRM to ARM (this option can be phrased as a put option), while the option cost of this decision is already incorporated in the FRM terms.

²The short interest rate of the Bank of Israel is publicized once a month, on the last Monday of each month, for the upcoming month; this decision is widely discussed throughout the media.

Figure 1: Commercial Banks Prime Interest Rates (November 2002–April 2011, monthly figures)

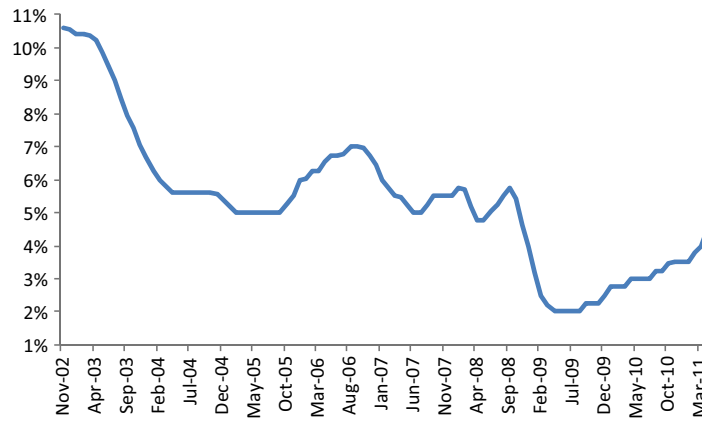
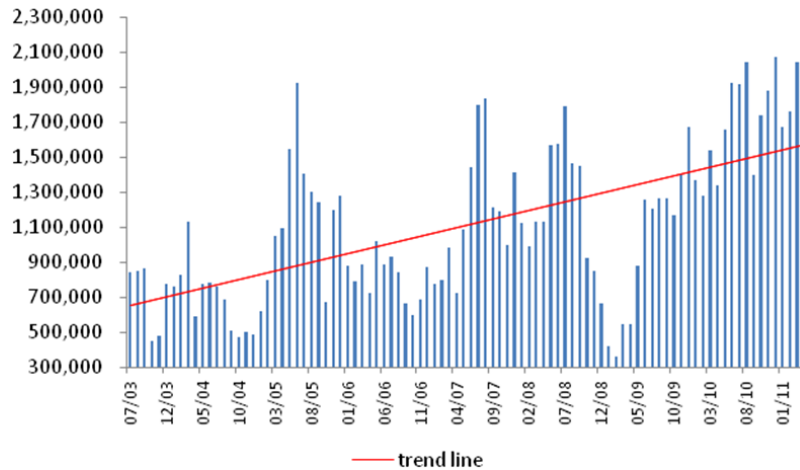


Figure 2: Mortgage volumes (Thousands NIS) (July 2003–April 2011, monthly figures)

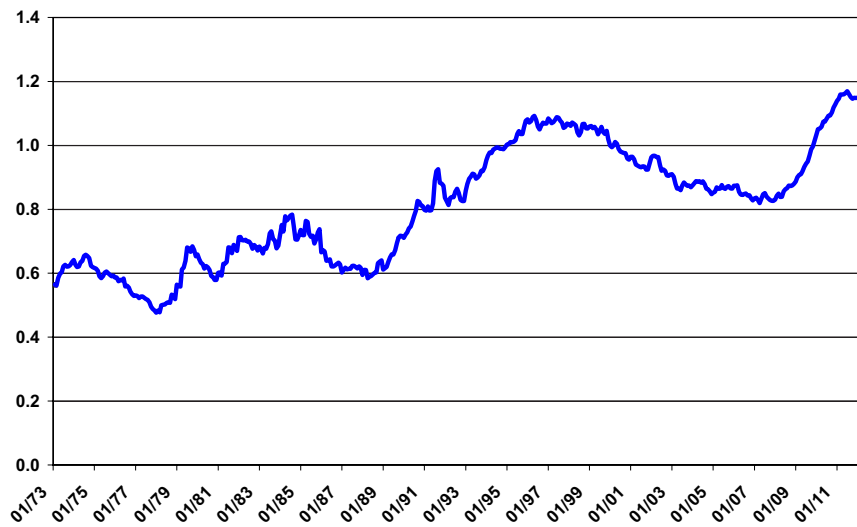


2008–2009. The reduction of interest rates also triggered a climb in inflation expectations, which subsequently increased housing acquisitions as a protective measure against inflation.

Moreover, changes in housing pricing are part of long-term price cycles, originating in previous price changes. In fact, from the mid-1990s to early 2008, real housing prices declined continuously, with an aggregate drop in

Figure 3: The Real House pricing (in comparison with the Consumer Price Index) (January 1973–January 2012, monthly figures, January 2000 = 1)

Source: bank of Israel



prices of over 20%, therefore implying that recent price changes represent a correction over the price decline of the past decade.

Another part of that increase is due to investors' activity, which was enhanced by housing loans financed by high leverage rates. Real mortgage interest rates declined, due to the drop in interest rates, generated investors' activity which led to housing price increases well beyond housing rental prices in the same period³ (a 41% increase in real housing in 2008–2010, compared to a 15.8% real price increase in rent). In view of the fact that both the prices of purchasing housing and rental prices decreased in 2002–2007, the rapid increase in housing prices since 2008 strongly supports the claim of a correction over the real price decline of the past decade.

In light of these changes and in view of the inherent risk of housing loans with high leverage rates, the Bank of Israel adopted stabilizing measures in 2011 and in 2013. This policy limited leverage rates, including

³Theoretically, housing and rent are substitute products, and consequently should be correlated with price changes. However, since housing rentals do not grant ownership, they cannot produce capital gains for investors.

restraints on the ARM share of the total mortgage, parallel to government measures, especially implementing higher limitations for investors' activity. These limitations emphasize the importance of the FRM-ARM decision in the Israel mortgage market, and the crucial role Israeli regulators attribute to this decision. So, additional information regarding FRM-ARM decisions was collected from January 2012 to June 2015, around the major regulatory restriction of September 2013 — restricting a housing loan ARM share to 66.7% (two-thirds) of the total, applying to all durations.

3. Heuristics

Decisions about housing finance are based on beliefs concerning uncertain events which are employed to assess probabilities and to predict values. Tversky and Kahneman's (1974) seminal paper found that decision makers rely on a limited number of heuristic principles which reduce the complex task of assessing probabilities and predicting values to simpler judgmental operations. These heuristics can be useful, but can also lead to systematic errors. However, the implication of these heuristics on making the decision between FRM and ARM can explain our empirical findings.

(i) Availability

The *availability* heuristic uses strength of association as a basis for the judgment of frequency (Tversky and Kahneman, 1973). If the availability heuristic is applied, unrelated factors will affect the perceived frequency of classes and the subjective probability of events. Consequently, the use of the availability heuristic leads to systematic errors. Change in the short term interest rate occurs frequently and is therefore, highly available. Mortgage borrowers, find this frequent event easier to recall and to imagine, and it affects their long term interest rate decision embedded in choosing the mortgage type.

While a tremendous amount of research in social cognition is dealing with the availability heuristic (see Sherman and Corty, 1984; Schwatz *et al.*, 1991 for reviews), a few papers examine the influence of the availability heuristic in financial decision making. Shiller (1998) finds that investors' attention to different types of investment alternatives (as stocks, bonds, real estate, etc.) may be affected by the availability of these types of investment alternatives to the public attention. Barber and Odean (2008) find that when

choosing which stock to buy, investors prefer the stock that has been recently available to them. Kliger and Kudryavtsev (2010) test the availability effect on investors' reactions to analysts' recommendation revisions and find a significant effect.

(ii) Representativeness

According to the *representativeness* heuristic, probabilities are evaluated by the degree to which A is representative of B. In other words, when judging the probability of an event by representativeness, one compares the essential features of the event to those of the structure form which it originates (Kahneman and Tversky, 1972). Therefore, by this heuristic, one estimates probability by assessing similarity or connotative distance. This approach, leads to serious errors, because similarity, or representativeness, is not influenced by several factors that should affect the judgment.

Representativeness in financial markets suggests that investors will infer past prices trends naively (Daniel, Hirshleifer and Teoh (2002)). In other words, investors use past performance as an indicator of future performance in managed funds and stock purchase decisions. For example, Sirri and Tufano (1998) find that purchase decisions in mutual funds are concentrated among the funds which have had high performance. This decision is in contrast with the empirical evidence that shows that there is no persistence in performance (Grinblatt *et al.*, 1995; Carhart, 1997). In another type of financial decision, Benartzi (2001) finds that employees allocate 401(K) retirement savings to investment in their own firm's stock based on how well that stock has done over the last 10 years. Here, as in the mutual funds context, these allocations do not predict future performance.

(iii) Anchoring and Adjustment

The anchoring effect is one of the most examined and tested behavioral heuristics. The anchoring effect is a highly robust heuristic, and in addition, carries a variety of implications to financial decision making as well as to non-financial decision making. The anchoring and adjustment heuristics, first introduced by Tversky and Kahneman (1974) seminal paper. As they explain, decision makers make estimates by starting from an initial value that is adjusted to yield the final answer, but the adjustments are typically insufficient. In their words "different starting points yield different estimates, which are biased toward the initial values".

As Furnham and Boo (2011) review, following Tversky and Kahneman's study, a significant number of studies have illustrated the prevalence of anchoring heuristic in human decision making processes (Plous, 1989; Chapman and Johnson, 1999; Epley and Gilovich, 2001; Mussweiler and Englich, 2005; McElroy and Dowd, 2007; and more). Most of the studies were conducted with university students in laboratory settings and a list of questions that the students may not have naturally used for decision making. Fewer studies faced the subjects with real life situations (such as Ariely *et al.*, 2003; Englich *et al.*, 2005; Critcher and Gilovich, 2008). However, these studies have shown the heuristic to be a robust one.

Moreover, regarding to the volume of the anchoring heuristics, the literature shows that the higher the ambiguity, the lower the familiarity, relevance or personal involvement with the problem, the stronger the anchoring effect (Van Exel *et al.*, 2006). In addition, the literature shows that informational relevance of values may play a role in affecting decision makers' susceptibility to the anchoring effect (Hastie *et al.*, 1999; Marti and Wissler, 2000; Englich *et al.*, 2005). More specifically, Strack and Mussweiler (1997) show that anchor values similar or identical in judgmental dimensions to the estimates, yield significant effect on the volume of anchoring.

4. Design

In order to examine the effect of representativeness and availability heuristics on the mechanism that reflects the criteria by which home owners choose between FRM and ARM, we use detailed information on the decision households made between fixed and adjustable rate mortgage contracts⁴ in Israel on a monthly basis during the period of November 2002 through April 2011.

The choice between FRM and ARM is estimated using the following linear model of the monthly differences ($t-t_{-1}$):

$$(1) \quad \Delta s_{lvi}_t = \alpha + F(P_t, RW_t, RHpi_t, RBpi_t, (Lfi - Lvi)_t, Einf_t, Ld_t) + \varepsilon_t$$

⁴For decades, most of the mortgage loans taken by households in Israel consisted of mortgages linked to consumer price index, while unlinked mortgages only began to expand in recent years.

$Slvi_t$ denotes the dependent variable, representing the change of the share of adjustable (variable) rate linked mortgages contracts amount signed in period t ($t = 1, 2, \dots, 101$ — representing months), out of the total amount of linked mortgages contracts signed in that period. In other words, this variable represents the change in ratio of ARM/(ARM+FRM) of linked mortgages.

The independent variables are:⁵

P_t	Denote the change of Israel commercial banks' prime interest rate in period t
RW_t	Denote the change of average real wage per employee per month in period t (deducted of market inflation influence)
$RHpi_t$	Denote the change of housing price index in period t , deducted of market inflation influence
$RBpi_t$	Denote the change of building construction price index in period t , deducted of market inflation influence
$(Lfi - Lvi)_t$	Denote the change of the difference between reference rates for fixed and adjustable rate linked mortgages, as reported by Israeli central bank
$Einf_t$	Denote the change of the expected yearly inflation rate for the next 12 months, derived out of capital market expectations
Ld_t	Denote the change of the duration of linked FRM mortgages, as reported by Israeli central bank

Our main concern is the P_t coefficient, capturing the change of the short term interest rate influence. Since the latest change in the short-term interest rate should not influence long term loan decision, it can serve as proxy to the effect of heuristics and biases on the mortgage decision.

⁵Although the difference between FRM and ARM rates $(Lfi - Lvi)_t$ could be prone to selection bias: one does only observe the outcome-rate (either ARM or FRM) and not the alternative offered (and non-chosen) one. We test this possible issue by applying a yield curve approach, since it has a similar effect to that of the interest rate differential. Our analyses indicate similar results with the use of each of the two variables.

In order to examine the effect of anchoring and adjustment heuristic on the mechanism that reflects the criteria by which home owners choose between FRM and ARM, we use detailed information on the decision households made between fixed and adjustable rate mortgage contracts in Israel on a monthly basis during the period of January 2012 through June 2015. We chose this specific period since the major regulatory amendment dealing with the choice between FRM and ARM, took place at September 2013. We examine whether the regulatory restriction serve as an anchor to mortgage borrowers, and if so we further test the adjustment process.

5. Results

First, we estimate three regressions, with regard to the equation (1), marked as columns (1)–(3) in Table 1. Column (1) demonstrates the change of ARM share as a function of prime interest changes, while column (2) includes the full equation with the described controls. In column (3) we add yearly fixed effects into the equation, while in column (4) we subtracted prime interest changes from the full equation, including year fixed effects.

Column (1) of Table 1 illustrates a significant association between FRM preference and prime rates reduction, while column (2) demonstrates almost the same association between FRM preference and prime rates reduction, even after adding controls. As seen in column (3) results, year fixed effects added had no apparent influence in comparison to column (2). Column (4) illustrates that after taking out prime rate changes from the equation, none of the controls, which are commonly used in the literature, explains FRM preference. This supports our findings concerning FRM preference with prime rates reduction. The results of these four tests firmly demonstrate a significant association between FRM preference and prime rates reduction in the described period, above the beyond the other variables and yearly fixed effects.

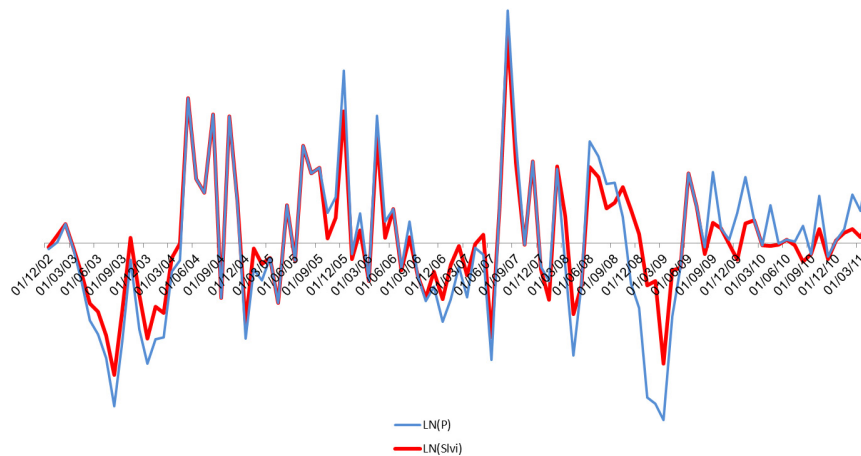
Decision makers find the change in short term interest rates representative of the absolute level of interest rates. More precisely, a recent increase in short term interest rates is representative of a high level of interest rates and therefore, home owners prefer choosing ARM in this case. Accordingly, a recent decrease in short term interest rates is representative of a low level of interest rates and therefore, mortgage borrowers prefer FRM in this case. Figure 4 visually illustrates the results.

Table 1: ARM–FRM Share Decision in Linked Mortgages

	The change in ratio of ARM/ (ARM+FRM) of linked mortgages			
	(1)	(2)	(3)	(4)
Change of prime interest rate in period t	0.818*** (0.209)	0.812*** (0.209)	0.803*** (0.240)	
Change of monthly real wage in period t		−0.298 (0.349)	−0.281 (0.359)	−0.491 (0.377)
Change of real housing price index in period t		1.013 (1.148)	0.258 (1.312)	−0.482 (1.921)
Change of real construction price index in period t		−2.052 (1.658)	−1.328 (1.803)	−1.381 (1.803)
Change of the difference between reference interest rates for FRM and ARM in period t		0.021 (0.021)	0.022 (0.020)	0.033 (0.022)
Change of the expected yearly inflation rate in period t		−0.134** (0.063)	−0.118* (0.071)	−0.089 (0.075)
Change of linked FRM duration in period t		−0.651 (0.414)	−0.614 (0.431)	−0.493 (0.458)
Constant	0.009 (0.012)	0.004 (0.013)	0.008 (0.122)	0.019 (0.130)
Observations	101	92	92	92
R^2	0.133	0.236	0.320	0.218

Notes: OLS regressions are reported in the panel, where each of the three columns represents an independent regression. The dependent variable includes is in the columns' title. Column (1) demonstrates the change of ARM share as a function of prime interest changes, while column (2) includes the full equation with the described controls. In column (3) we add year fixed effects into the equation, and in column (4) we subtracted prime interest changes variable. Standard errors are in parentheses. *** =Significant at the 1% level. ** =Significant at the 5% level. * =Significant at the 10% level.

Figure 4: Changes in Prime Interest Rates (LN P) and Adjustable Interest Rates Mortgage Share (LN Slvi)(November 2002–April 2011, monthly figures)



In the early part of the last decade, short term interest rates were double digit, followed by consecutive years of high interest rates, a remainder of the hyper-inflationary economy heritage of former years. The association between FRM preference and prime rates reduction may be more prominent in the early part of the last decade, since high interest rate environment is more salient and more available to the borrowers.

To check the influence of the interest rates environment on the FRM-ARM decision, we performed four additional regressions, dividing our sample into two (almost) equal periods.⁶ The first period begins in November 2002 and ends in January 2007; the second period begins in February 2007 and ends in April 2011. The first period represents a high interest rate environment, and the second period represents a low interest rate environment.

The results are presented in Table 2. Column (1) demonstrates the change of ARM mortgages as a function of prime interest, without adding more controls in the first period, while column (2) includes controls and year fixed effects in the equation. Column (3) and column (4) repeat the same tests, as the first two columns, only in the second period.

⁶The first group contains 50 consecutive observations, while the second group contains 51 consecutive observations.

Table 2: ARM-FRM Share Decision in Linked Mortgages, by Time Periods

	The change in ratio of ARM/ (ARM+FRM) of linked mortgages			
	(1)	(2)	(3)	(4)
	Period 1		Period 2	
Change of prime interest rate in period t	3.120*** (0.710)	2.939*** (0.862)	0.525** (0.201)	0.579** (0.213)
Change of monthly real wage in period t		0.136 (0.676)		-0.469 (0.406)
Change of real housing price index in period t		1.125 (2.752)		-0.403 (1.445)
Change of real construction price index in period t		-1.746 (2.702)		-0.991 (2.473)
Change of the difference between reference interest rates for FRM and ARM in period t		0.032 (0.030)		0.006 (0.029)
Change of the expected yearly inflation rate in period t		-0.096 (0.198)		-0.152** (0.074)
Change of linked FRM duration in period t		-0.624 (0.600)		-0.840 (0.684)
Constant	-0.010 (0.128)	-0.018 (0.151)	-0.005 (0.051)	0.063** (0.030)
Observations	50	46	51	46
R ²	0.396	0.404	0.196	0.377

Notes: OLS regressions are reported in the panel, where each of the four columns represents an independent regression. The dependent variable is in the columns' title. Columns (1) and (2) include period 1 observations, while columns (3) and (4) include period 2 observations. Standard errors are in parentheses.

The first period begins in November 2002 and ends in January 2007; the second period begins in February 2007 and ends in April 2011

*** =Significant at the 1% level. ** =Significant at the 5% level. * =Significant at the 10% level.

As Table 2 illustrates, one's initial notion could possibly be justified. The described association between FRM preference and prime rate reduction is more dominant in the early part of the last decade, and weakens in the later period. Dividing our sample into two periods, we found that the magnitude of our general findings is higher in the period which was represented in a high interest rate environment.

In other words, the change in the short term interest rate is more salient to the borrowers in periods of a high interest rate environment. This finding indicates that availability and representativeness are more influential in a high interest rate environment, in which those heuristics can be obtained more easily.

In order to decide whether the described association between FRM preferences is attributed to availability, or to expected prime rate changes, we examined the same test used in Table 2 by using future change of prime rates in observation $t + 1$ instead of observation t , which represents the foreseen change of prime rates rather than available and known prime rates. As Table 3 illustrates, the results are showing a significant difference between the effect of the available recent change to the effect of the expected change. The association between FRM preferences and prime rates is much less substantial in both periods, and only partially statistically significant.⁷ The dramatic change between Table 2 and Table 3 demonstrates the availability influence of prime rate changes, which play an important role, compared to the general tendency of prime rate levels.

An alternative explanation for FRM preferences could refer to the mortgage leverage ratio. If an increase in the mortgage leverage ratio occurs, mortgages become riskier. This could induce favoring FRM. Hence, if this argument is valid, we would expect it to be more prevalent in the early part of the last decade (period 1), where FRM preference was more dominant. As seen in Figure 5, however, mortgage leverage ratio in the early part of the last decade was fairly constant, and, therefore, could not have created such an influence. In fact, mortgage leverage ratio actually increased in recent years, where FRM preferences were less dominant, while the repayment

⁷We also tested the use of prime rates in observation $t + 2$ instead of observation t ; the association between FRM preferences and prime rates was even less substantial than with $t + 1$.

Table 3: ARM-FRM Share Decision in Linked Mortgages, in sequential time observation (T+1), by time periods

	The change in ratio of ARM/ (ARM+FRM) of linked mortgages			
	(1)	(2)	(3)	(4)
	Period 1		Period 2	
Change of prime interest rate in period t+1	1.640** (0.809)	1.530* (0.850)	0.208 (0.201)	0.482* (0.244)
Change of monthly real wage in period t		-0.133 (0.748)		-0.570 (0.433)
Change of real housing price index in period t		0.790 (3.050)		-0.698 (1.519)
Change of real construction price index in period t		-2.243 (2.994)		0.603 (2.621)
Change of the difference between reference interest rates for FRM and ARM in period t		0.038 (0.034)		0.016 (0.031)
Change of the expected yearly inflation rate in period t		-0.138 (0.220)		-0.192** (0.086)
Change of linked FRM duration in period t		-0.616 (0.671)		-0.746 (0.724)
Constant	0.023 (0.148)	0.025 (0.167)	0.003 (0.064)	-0.016 (0.061)
Observations	50	46	50	45
R ²	0.202	0.267	0.093	0.321

Notes: OLS regressions are reported in the panel, where each of the four columns represents an independent regression. The dependent variable is in the columns' title. Columns (1) and (2) include period 1 observations, while columns (3) and (4) include period 2 observations. Standard errors are in parentheses.

The first period begins in November 2002 and ends in January 2007; the second period begins in February 2007 and ends in April 2011

*** =Significant at the 1% level. ** =Significant at the 5% level. * =Significant at the 10% level.

Figure 5: Mortgage Leverage Ratio in Housing Loans⁸ (Q1 2003–Q2 2010, quarterly figures)

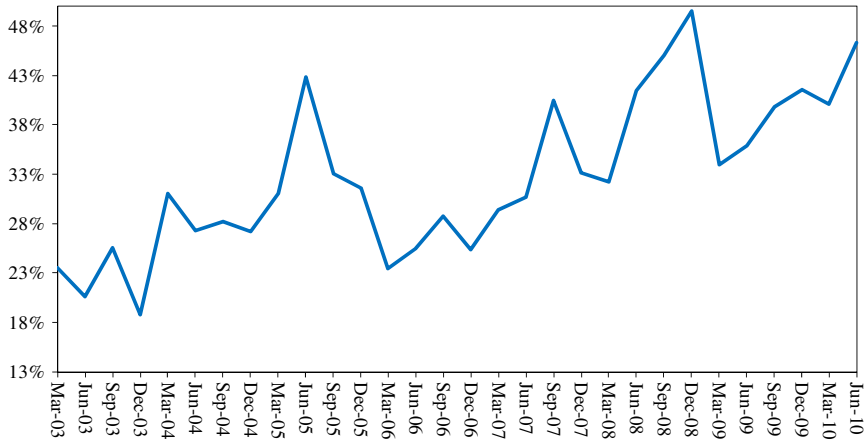
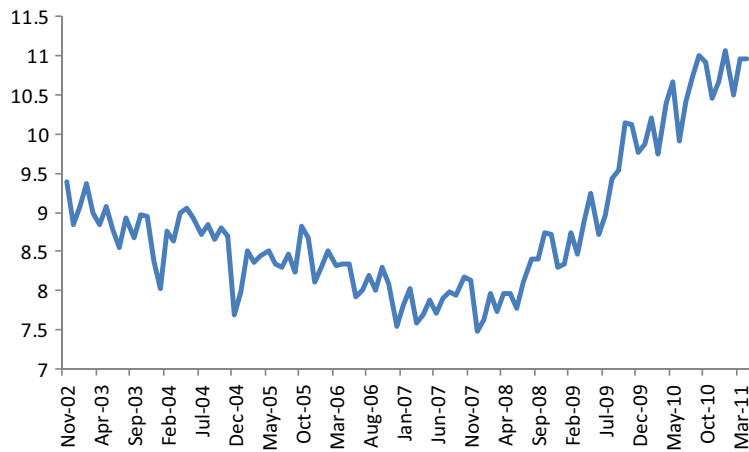


Figure 6: The Ratio of the Average House pricing to the Average Annual Wage (November 2002–April 2011, monthly figures)



capacity of households did not change (see Figure 6 that demonstrates the ratio of the average home price to the average annual wage).

⁸The leverage rate is calculated as the ratio of total mortgages granted to the value of the homes purchased. The value of the homes is calculated as the product of the average transaction value by the number of transactions during the period (source: Bank of Israel).

A possible justification for the increased leverage ratio in recent years can account for a growing trend of investors' activity, exploiting low interest rate loans for short term profit, motivating high leverage ratio, and minimizing private capital exposure.⁹ This may partially explain the influence in recent years, but does not suggest an explanation for initial FRM preference.

Similar to mortgage leverage ratio rationalization, a change in homeowners' repayment capacity can also potentially have an impact on the ARM–FRM decision. A decrease in the repayment capacity of homeowners could occur, which would encourage favoring FRM. Such a decrease may derive from an increase in real housing pricing, or, less likely, from a change in real wages. Thus, if this argument is valid, it would have been more prevalent in the early part of the last decade (period 1), where FRM preference was more dominant. However, as seen in Figure 5, repayment capacity in the early part of the last decades lightly improved. Real housing price increases only occurred in the second period, where favoring FRM was less dominant. As a result, neither leverage ratio nor repayment capacity can explain FRM preferences.

As shown in Table 1 and Table 2, neither does interest rate differential explain FRM preference. It is still possible, however, that our findings are partially influenced by the variety of mortgages of different maturities included in our sample. Consequently, we obtained additional data provided by the Bank of Israel, in which ARM–FRM share and the interest rate differential are calculated separately for each term.¹⁰

This data is divided into 16 term spreads,¹¹ where each of those has its own (calculated) interest rate differential. Accordingly, in order to test each

⁹In view of the inherent risk of housing loans with high leverage rates, the Bank of Israel adopted stabilizing measures in 2011 and in 2012 that take into accounts the mortgage characteristics and needs: rent unit housing enhancers and investors, halting massive hazardous housing loans. The Bank of Israel has limited leverage rates, including restraint on ARM share of total mortgage.

¹⁰The data is only available starting in July 2003, thus eliminating 8 observations (November 2002–June 2003) from our original sample.

¹¹Mortgages with maturities as follows: (1) of up to one month, (2) of 1–3 months, (3) of 3–6 months (4) of 6–12 months (5) of 1 to 2 years (6) of 2 to 3 years (7) of 3 to 4 years (8) of 4 to 5 years (9) of 5 to 7 years (10) of 7 to 10 years (11) of 10 to 12 years (12) of 12 to 15 years (13) of 15 to 17 years (14) of 17 to 20 years (15) of 20 to 25 years (16) of more than 25 years.

period separately, we calculated the new dependent variable $Slvi$ and the new independent variable $Lfi - Lvi$ for each term spread.

We performed two separate regressions for each of the maturity terms — the first regression demonstrates the change of ARM share as a function of prime interest changes, while the second includes the full equation with the described controls and year fixed effects. Most of the term spreads do not obtain sufficient observations due to maturity distribution, which, incidentally, has remained fairly constant during the entire period. Figure 7 illustrates the scope of ARM and FRM lending volumes by maturity spread, in the entire period. Since ARM lending with a maturity greater than 15 years is rare, we concentrated on three term spreads, where sufficient data was found: 7–10 years of term maturity, 10–12 years of term maturity and 12–15 term maturity.

Consistent with the previous findings, the results shown in Table 4 illustrate a significant association between FRM preference and prime rates reduction. This association was found in each of the time periods.

That is, the availability and representativeness are more influential in a high interest rate environment, in which these heuristics can be obtained more easily.

For testing the anchoring and the adjustment effect we take the September's 2013 ARM share regulatory amendment and look closely on this share before and after the regulatory shock. In order to do so, we examine the data regarding the ARM share in the short period before the regulatory amendment (January 2012 to September 2013) and in short period after the regulatory amendment (September 2013 to June 2015). Longer period examination may be noisy and bear additional explanations to the borrowers' behavior, such as different interest rate environments or different regulatory amendments.

Before the regulator intervention, the ARM share remained stable for more than a year and a half (around 75%). As a respond to the September 2013 change, ARM share dropped to the new level, fluctuating between 56–58% for the following year.

Starting September 2014, as a possible result of the media campaign concerning the potential risk of the adjustable rate, ARM share began shrinking to the new 45% level as for mid-2015. The campaign was highly available throughout the media, as a part of the public discussion

Table 4: FRM-ARM Decision in Linked Mortgages for Various Terms, by Time Periods

	The change in ratio of ARM/ (ARM+FRM) of linked mortgages	
	(1)	(2)
Change of prime interest rate in period t, in mortgages with term of 7 to 10 years	1.767*** (0.473) [0.133] {93}	1.651*** (0.587) [0.278] {87}
Change of prime interest rate in period t, in mortgages with term of 10 to 12 years	2.419*** (0.921) [0.071] {93}	3.185*** (1.185) [0.130] {87}
Change of prime interest rate in period t, in mortgages with term of 12 to 15 years	2.202*** (0.798) [0.077] {93}	1.796* (1.046) [0.134] {85}

Notes: OLS regressions are reported in the panel, where each cell represents an independent regression. The dependent variable is in the columns' title. Column (1) demonstrates the change of ARM share as a function of prime interest changes, in different maturities, while column (2) includes the full equation with the described controls and year fixed effects. Standard errors are in parentheses. R-squared is in square brackets. The number of observations is in braces.

*** =Significant at the 1% level. ** =Significant at the 5% level. * =Significant at the 10% level.

on the mortgage guarantee bill¹² first introduced to the Knesset (Israeli parliament). Figure 8 illustrates the results.

The immediate drop in the ARM share can be the effect of anchor caused by the regulatory new restrictions. The fluctuations in the ARM share in the following period may be a result of an adjustment process, influenced the households' decisions.

¹²The bill, if passed as a law, enables first-time apartment purchasers to receive a mortgage loan of up to 90% loan-to-value (LTV), by allowing the state to become a third party guarantee on mortgage loans taken by eligible citizens.

Figure 7: FRM and ARM Mortgage volumes (Thousands NIS), by Maturity (in years) (July 2003–April 2011, Average of monthly figures)

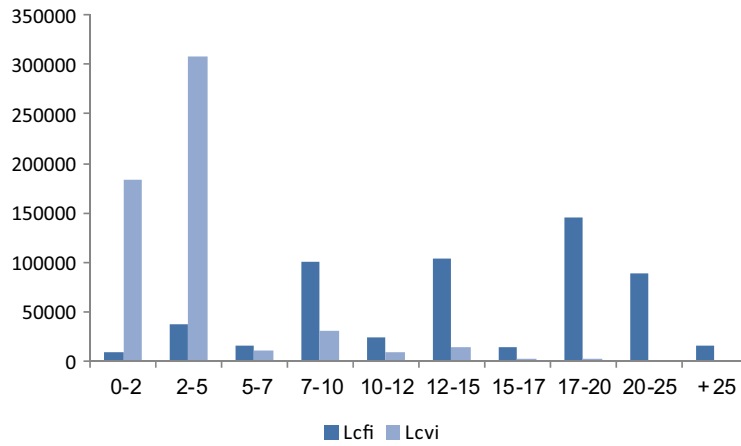
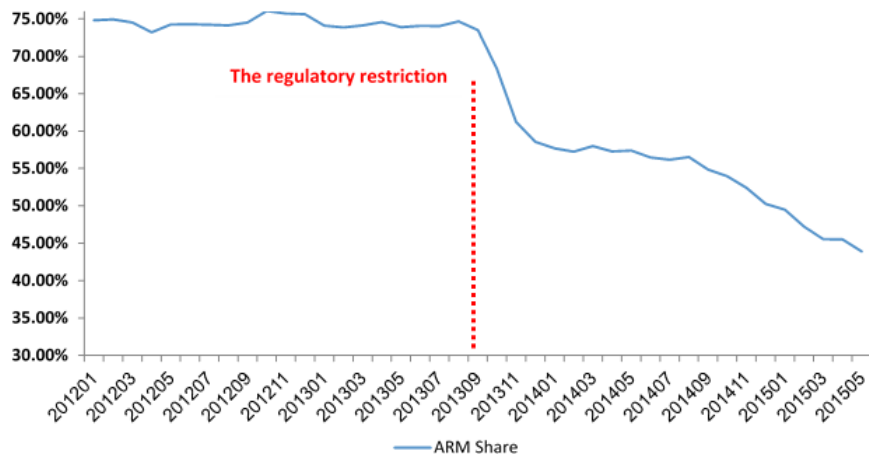


Figure 8: ARM share (January 2012–May 2015, monthly figures)



6. Discussion and Conclusion

This paper examines the three seminal heuristics that are employed in decision making under uncertainty: availability; representativeness; and anchoring and adjustment; and their appearance in the Israeli mortgage market. We focus on the households’ choice between fixed rate mortgages

(FRM) and adjustable rate mortgages (ARM) and on the ARM share fluctuations out of the entire loan.

We empirically examine the effect of these heuristics on the decision between ARM and FRM using a unique data provided to us by the Bank of Israel, which contains detailed information on the household's decision between fixed and adjustable rate mortgage contracts in Israel in the past decade. The results of our analysis demonstrate a significant effect of availability and representativeness heuristics on households' decision. In addition, we show that regulatory provisions regarding the loan division between FRM and ARM may serve as a possible anchor to the borrowers and may lead to a further adjustment process.

We find that changes in the short-term interest rate occur frequently and therefore, are highly available for mortgage borrowers. In addition, decision makers find the recent change in short term interest rates representative of the absolute level of interest rates. In other words, a recent increase in short-term interest rates is representative of an absolute high level of interest rates and therefore, mortgage borrowers prefer ARM. Accordingly, a recent decrease in short-term interest rates is representative of an absolute low level of interest rates and therefore, mortgage borrowers prefer FRM.

Furthermore, we find that the recent changes in the short-term interest rate is more salient to the borrowers in periods of a high interest rate environment than in periods of low interest rate environment. This finding can be attributed to the phenomenon that the availability and representativeness heuristics are more influential in a high interest rate environment, because the interest rate levels are more salient in this environment to the borrowers.

In addition, we examine whether a regulatory restriction of the ARM share serve as an anchor to the blend choice between ARM and FRM. We do find a significant drop in the ARM share as a result of the regulatory restriction and a fluctuation in the share in the following year. These changes may be due to the effect of the anchoring and adjustment heuristic.

To conclude, our empirical analysis of the decision between FRM and ARM is an example of a possible implication of cognitive bias theory on the housing finance decisions. We suggest that common economic principles are sometimes inadequate to explain homeowner's choices. We

show that this choice is motivated by psychological factors. Campbell (2013) argues that to understand mortgage markets we need a much broader perspective that integrates insights from across disciplines. Our paper contributes to our understanding of how the decision making process functions by demonstrating the linkage between FRM and ARM decisions and behavioral aspects such as availability, representativeness, anchoring and adjustment.

Examining the influence of regulatory restriction on decision makers' behavior, we believe that our paper can contribute significantly to the understanding of market functioning in *practice* beyond the theoretical predictions. Our findings concerning this functioning should be further investigated, especially in light of the implications of the recent stabilizing measures adopted by the Bank of Israel.

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