How Homeowners Choose between Fixed and Adjustable Rate Mortgages?

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Abstract

Housing is the most important asset in the portfolio of most households. Understanding the households' decision on housing finance has important implications from a policy perspective, due to the effects it may have on the housing prices, on the housing market stability and on household welfare. The theoretical literature on housing finance focused on figuring out the optimal choice between Fixed Rate Mortgages (FRM) and Adjustable Rate Mortgages (ARM). We argue that the standard economic criteria are sometimes inadequate to explain household's choices, which may be motivated by psychological factors. In other words, we claim that household's choice depends only partially on the findings of the theoretical literature. We examine the effect of changes in the short term market interest rate on the households' choice between fixed rate mortgages (FRM) and adjustable rate mortgages (ARM). We test this effect 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 association between FRM preference and short term interest rate reduction. Moreover, we find that the change in the short term interest rate is more salient to the borrowers in periods of a high interest rate environment. We attribute these findings to Tversky and Kahneman (1974) availability and representativeness heuristics.

Keywords: Mortgage decision making, household finance, adjustable and fixed rate mortgages, cognitive biases

JEL classification: D10, D14, G21, R2

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1. Introduction

Housing is the most important asset in the portfolio of most households. In addition to the important decision to purchase a house, decisions about how to finance it must be made. Understanding the decision making process of home owners has important implications from a policy perspective, due to the effects it may have on housing prices, on housing market stability, and on household welfare.

For more than three decades the theoretical literature on housing finance has focused on determining what factors contribute to the optimal choice 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), Campbell and Cocco (2003) and Koijen et al. (2009).

Baesel and Biger (1980) analyzed the considerations of mortgage lenders and borrowers in choosing between fixed versus index-linked mortgages. They found that from the borrowers' perspective, the choice between fixed and index-linked mortgages depends on the relationship between future income and inflation. More specifically, according to their model, a borrower's preference depends on the difference in interest rates between the fixed and index-linked mortgages, and on the covariance between the borrower's income and the rate of inflation. They conclude that coexistence of the two types of mortgage loans is possible.

The uniqueness of Statman's (1982) model lies in the inclusion of the value of the house in the terminal wealth of the borrower. This inclusion leads to differences between this model and the Baesel and Biger (1980) model in the identification of the cases where borrowers will prefer fixed or index-linked mortgages. Statman (1982) found that borrower's preferences for fixed rate or index-linked mortgages depend on the relationship between the rate of changes in income and the rate of inflation, as well as on the relationship between changes in the net value of houses and the rate of inflation. Moreover, the model suggests that no statement about borrower preference can be made unless at least the signs of these two relationships are known.

Alm and Follain (1984) addressed two issues: the first is the impact of inflation upon consumers' housing decisions when the household must use the Standard Fixed Payment Mortgage (SFPM). The second is the impact of Alternative Mortgage Instruments (AMI) on the housing

demand. The results of their simulation indicated that low rates of inflation increase the housing demand by reducing the after-tax user cost of housing, but higher rates of inflation decrease the demand, as liquidity problems in the mortgage market dominate. In addition, AMIs were found to reduce the severity of these mortgage market imperfections and therefore to increase the housing demand. The impact of AMIs is generally quite large, particularly for the Price-Level Adjusted Mortgage (PLAM). Because of the magnitude of their impact, AMIs offer enormous opportunities to households, opportunities for which households are willing to pay substantial amounts.

Stanton and Wallace (1999) discussed the interest-rate risk of ARM. They analyzed the interest-rate sensitivity of ARM based on the four most commonly used indices, and compared the properties of ARM based on these indices. They found that the interest-rate sensitivity of an ARM depends significantly on its contract terms, on the dynamics of the index underlying the mortgage, and on the prepayment behavior of the mortgage holders. They did not take into consideration, however, the role of risky income and borrowing constraints.

Campbell and Cocco (2003) argued that the form of the mortgage contract can have significant effects on household welfare and asked how a household should make the choice between FRM and ARM. In general, a numerical solution of their life-cycle model showed that homeowners with smaller houses relative to income, more stable income, lower risk aversion, more lenient treatment in bankruptcy, and a higher probability of moving should find ARMs more attractive.

In a recent paper, Koijen et al. (2009) studied the relationship between the term structure of interest rates and both individual and aggregate mortgage choice. They developed a theoretical model which showed that the long-term nominal bond risk premium is the crucial determinant of the relative attractiveness of an ARM versus an FRM. Thinking of FRM as a short position in long-term bonds and of ARM as rolling over a short position in short-term bonds implies that FRM holders are paying a nominal bond risk premium. A higher bond risk premium, leads to a more expensive FRM, and a higher ARM share. They also found that in aggregate time-series data, that the long-term bond risk premium is strongly related to the ARM share.

Few papers have empirically examined the choice between fixed-rate and adjustable-rate mortgages, some of them studying the US mortgages market (Brueckner (1986), Dhillon et al (1987), Brueckner and Follain (1988), Cunningham and Charles (1990), Sa-Aadu and Sirmans (1995)), and some of them studying other markets as the UK market (Coles (1993), Leece (2000)).

For instance, Dhillon et al (1987) examined micro data on mortgage borrowing and estimated a reduced form of an econometric model of mortgage choice. Their results indicated that pricing variables play a dominant role in the choice decision. Moreover, households with co-borrowers, married couples, and limited expected housing tenures were found to have the greatest probability of taking out ARM. In general, they found that borrower characteristics do not significantly influence the choice.

In a recent paper, Campbell (2013) explores the causes and consequences of cross-country variation in mortgage market structure. However, one of the important arguments emanating from the paper is that the US mortgages market has much to learn from mortgage finance in other countries. One contribution of our paper is that it is empirically examining and exploring the Israeli mortgage finance market, at first, to the best of our knowledge.

Despite the vast amount of literature dealing with housing finance, there are few papers which focus on the *behavioral* aspects of housing decisions. 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. For example, he finds that the decision to refinance FRM is challenging for many households, particularly poorer and less educated ones, and therefore they pay higher mortgage rates than necessary.

Brunnermeier and Julliard (2008) found that households suffer from money illusion ("the inability to properly distinguish changes in nominal values due to changes in real fundamentals from changes due to inflation") when they decide whether to rent or buy a house. A reduction in inflation can generate a substantial increase in housing prices, and, therefore, can create inefficiency in the housing market. They identified an empirical proxy for mispricing in the housing market and show that it is largely explained by movements in inflation. However, their paper focused on the decision to buy a house and not on how to finance the transaction.

Paiella and Pozollo (2007) examined whether or not households can accurately gauge their circumstances in terms of (non-mortgage related) risk exposure and make an appropriate choice of either FRM or ARM. They showed that most household characteristics proxying for exposure to other non-mortgage related risks and for individual risk aversion are irrelevant for the choice. The choice depends, to a great extent, on the relative price of the mortgages and on whether the household faces liquidity constraints. Liquidity constrained households find ARMs particularly attractive because their initial payments are generally lowest; they tend to overlook the overall cost

of the mortgage, and (as evidence suggests) ARM holders do not fully take into account the risk of a rise of the reference interest rates. On the other hand, lenders price this risk too high and borrowers end up paying a high price for the benefit of low initial payments.

Two recent papers show that mortgage borrowers make few systematic mistakes. Agarwal, Rosen and Yao (2012) find that over 40% of mortgage borrowers sub-optimally refinance their mortgages. Agarwal, Ben-David and Yao (2014) find evidence that borrowers exhibit the sunk cost fallacy: borrowers who paid an upfront cost in the past are 8.4% less likely to refinance their mortgage every month as compared to borrowers who do not pay the upfront cost. However, both papers find that financial sophistication helps explaining the suboptimal decision making by borrowers.

In our paper we examine the effect of changes in the short term market interest rate 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 home owners many of whom lack formal economic education or knowledge and are not sophisticated finance decision makers or mortgage borrowers.

Therefore, when faced with the difficult task of choosing between FRM and ARM, individuals employ a limited number of heuristics to simplify this decision. Decision makers are bounded by the *availability* of information the market provides through its general media and judging this information by its *representativeness*. From that perspective, the change in short term interest rates is available for mortgage borrowers and can be representative of the FRM-ARM decision.

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.

When individuals faced with choosing between FRM and ARM, they are bounded by heuristics of *availability* of market information, which they evaluate by its *representativeness*.

From that point of view, the short term interest rate changes are available for mortgage borrowers and can be representative for the FRM-ARM decision.

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.

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 compare 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.

We tested the effect of these two 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]

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 Israel[2] have dropped in the last decade from two-digit settings to a "stable" low rate, as seen in Figure 1 (presents monthly commercial banks prime interest rates from November 2002 to April 2011).

[1] At 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 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.

[2] The 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]

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.

[Figure 2]

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 percent in real terms, significantly faster than the 1.5 percent increase in real terms starting in 1973, as displayed in figure 3.

[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 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 1990's to early 2008, real housing prices declined continuously, with an aggregate drop in prices of over 20 percent, 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 period[3] (a 41 percent increase in real housing in 2008-2010, compared to a 15.8 percent 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 2012. This policy limited leverage rates, including restraints on the ARM share of the total mortgage, parallel to

[3] Theoretically, 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.

government measures**,** especially implementing higher limitations for investors' activity, compared to other purchasers. 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.

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.

The paper proceeds as follows: Section 2 provides the design. Section 3 presents our results. Section 4 discusses our findings and conclusions.

2. Design

In order to examine the mechanism that reflects the criteria by which home owners choose between FRM and ARM, we use unique data provided by the Bank of Israel, which contains detailed information on the decision households made between fixed and adjustable rate mortgage contracts[4] in Israel on a monthly basis during the period of November 2002 thru April 2011. The choice between FRM and ARM is estimated using the following linear model of the monthly differences ($t\text{-}t_{-1}$):

$$Slvi_t = \alpha + F(P_t, RW_t, RHpi_t, RBpi_t, (Lfi - Lvi)_t, Einf_t, Ld_t) + \varepsilon_t$$

$Slvi_t$ 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,…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]

[4] For 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.

[5] Although 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.

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.

3. Results

We estimated three regressions, with regard to the above equation, 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 year fixed effects into the equation, while in column (4) we subtracted prime interest changes from the full equation, including year fixed effects.

[Table 1]

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, which even strongly 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 not related to other variables or year fixed effects.

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.

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.

Consequently, one would expect the described association between FRM preference and prime rates reduction to have been more dominant in the early part of the last decade.

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.

[Table 2]

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.

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

In order to decide whether the described association between FRM preferences is attributed to availability, or to 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 quite striking. 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.

[Table 3]

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 4, 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 capacity of households did not change (see Figure 5 that demonstrates the ratio of the average home price to the average annual wage).

[Figure 4], [Figure 5]

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.[8] This may partially explain the influence in recent years, but does not suggest an explanation for initial FRM preference.

[7] We 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.

[8] In 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.

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.[9]

This data is divided into 16 term spreads,[10] where each of those has its own calculated interest rate differential. Accordingly, in order to test each 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 6 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.

[Figure 6]

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

[10] Mortgages 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 to2 years 6) of 2 to3 years 7) of 3 to 4 years 8) of 4 to5 years 9) of 5 to7 years 10) of 7 to10 years 11) of 10 to12 years 12) of 12 to15 years 13) of 15 to17 years 14) of 17 to20 years 15) of 20 to25 years 16) of more than 25 years.

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.

[Table 4]

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

Although our explanations focus on the demand-side, the concerns that selection mechanisms on the lenders-side drive the observed results cannot, however, be ignored. Lenders might have certain borrowers in a FRM contract and others in an ARM contract on a risk-adjusted base. Regarding this concern, we conducted a set of face-to-face in-depth meetings with mortgage banks' deputies. These meetings don't seem to point out on such mortgage bank preferences.

4. Discussion and Conclusion

In this paper we focus on the behavioral aspects of housing finance decisions. More precisely, we examine the effect of changes in the short term market interest rate on the decision of homeowners to choose between fixed rate mortgages (FRM) and adjustable rate mortgages (ARM).

The results of our analysis demonstrate a significant association between FRM preference and prime rates reduction. We attribute it to the availability and representativeness heuristics. Changes in the short term interest rate occur frequently and therefore, are highly available. Moreover, 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.

Additional explanation for our findings – not inconsistent with the previous one –is peer effects. Borrowers tend to compare their mortgage offers to their peers mortgages' terms. When rates went up, the peers were able to secure mortgages at lower rates. In order to avoid loss realization, new borrowers prefer a gamble (ARM) over a fixed rate. After rates go down, the new borrowers will prefer FRM.

Furthermore, we find that 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 the availability

and representativeness heuristics are more influential in a high interest rate environment, in which those heuristics can be obtained more easily.

To summarize, our empirical findings can be viewed as having real life implications for the reliance on judgmental heuristics. As Tversky and Kahneman (1974) determined "…It is not surprising that useful heuristics such as representativeness and availability are retained, even though they occasionally lead to errors in prediction or estimation". 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. Using unique data on the Israeli mortgage market, our paper demonstrates an association between FRM preference and prime rates reduction in the last decade. This result indicates that households had a perception of high risk, which, in retrospect, turned out to be unfounded.

The magnitude of the market for housing finance in Israel and in most developed countries has risen substantially over the past decade. A profound understanding of the decision making process functioning in this market is of increasing importance for its potential effects on housing prices, market stability and public welfare.

The household's decision regarding the mortgage finance is aperiodic affected by experts' advice. However a large number of papers is showing that not only households with no economic expertise may indeed be subject to such psychological effects, but also professional and experts advisors may be subject to the same biases (for example see: Lakonishok, Shleifer and Vishny (1992), Odean (1998), Hirshleifer (2001), Shapira and Venezia (2001), Coval and Shumway (2005), Biais and Weber (2009), Menkhoff and Nikiforow (2009), Ofir and Wiener (2015)).

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 and representativeness.

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.

Our analysis, as a possible direction of the future research, could be performed at the household level, providing more detailed descriptive measures and distinguishing between households of different characteristics.

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

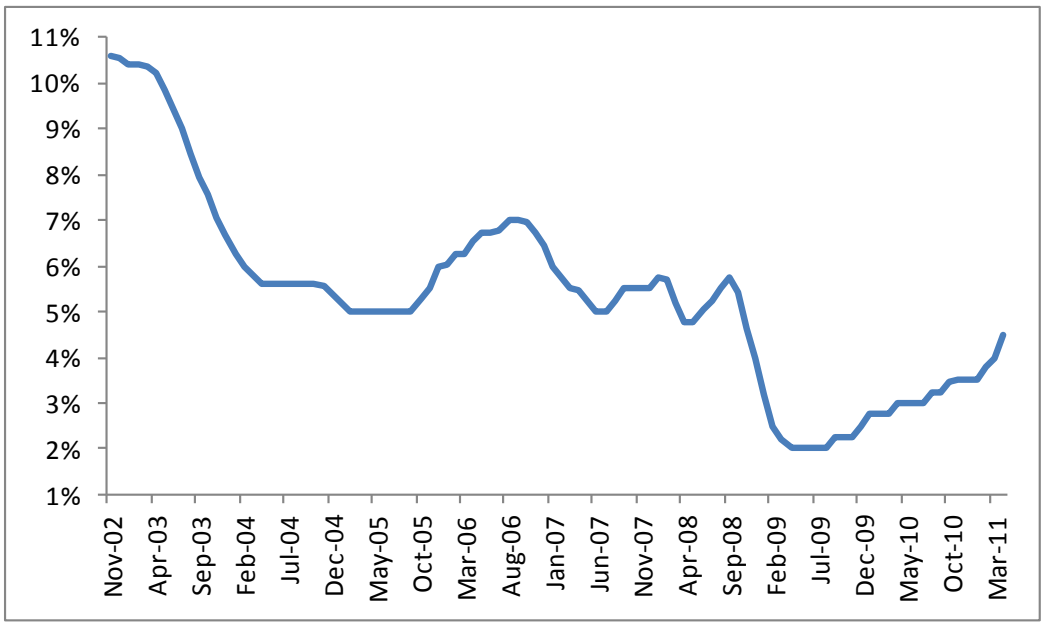


Figure 2 –Mortgage volumes (Thousands NIS)
(July 2003 - April 2011, monthly figures)

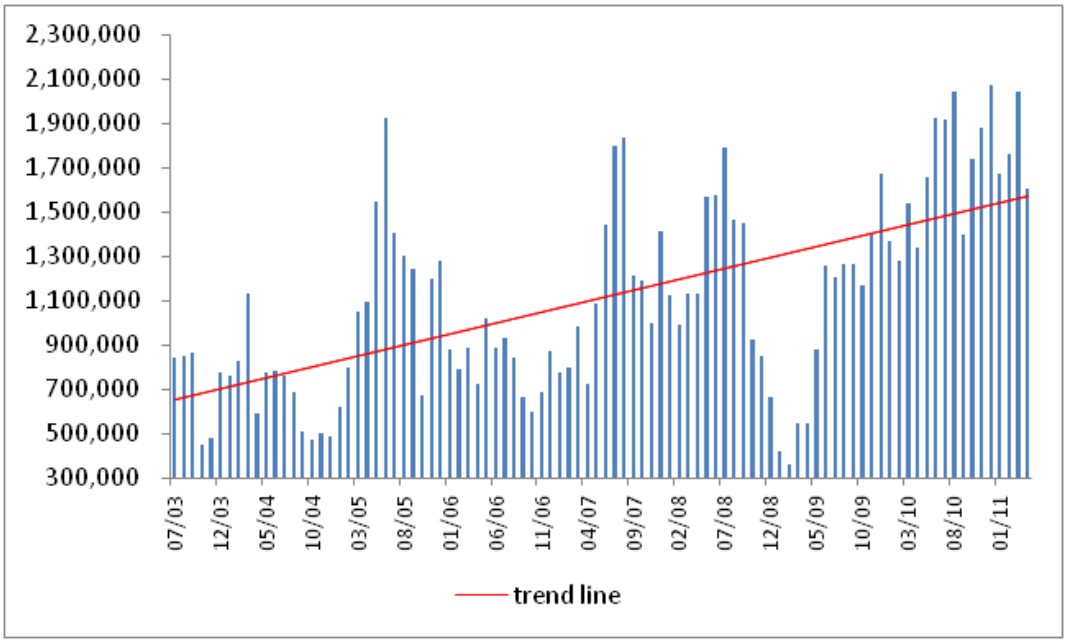
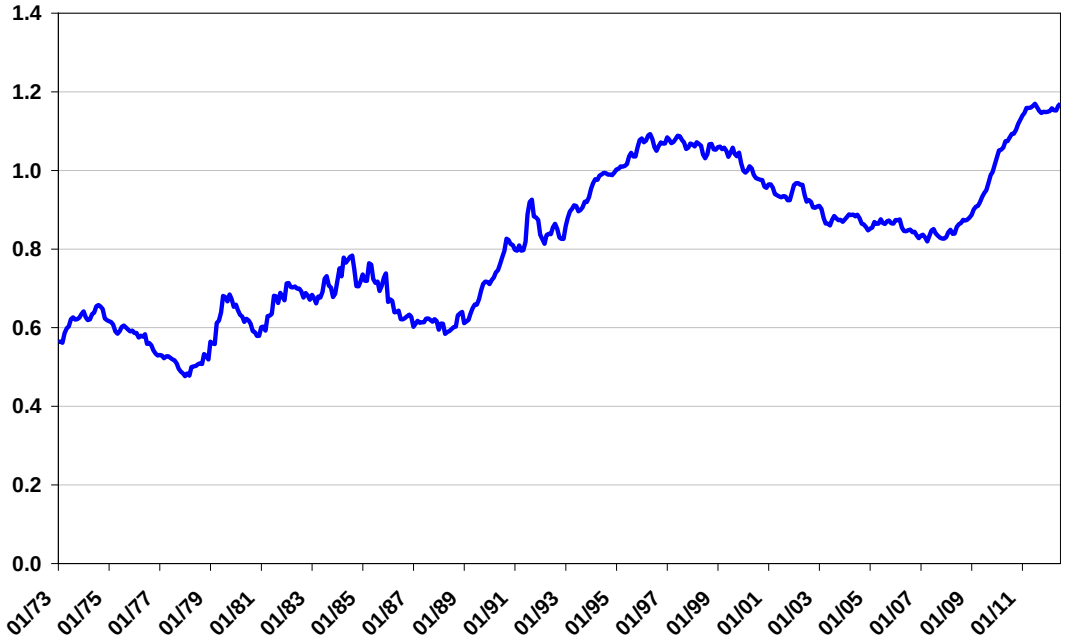
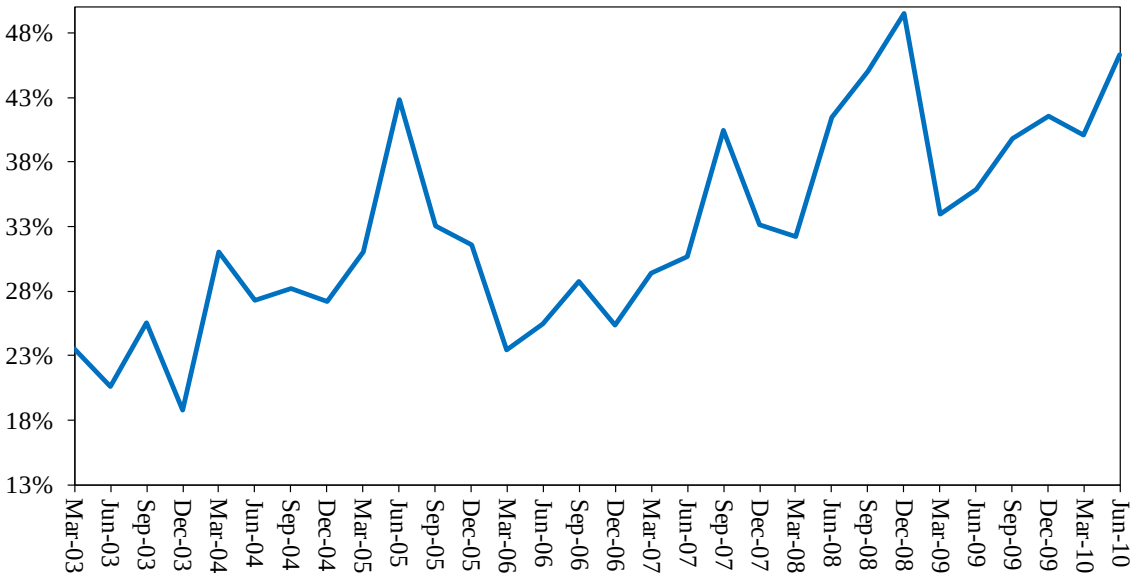


Figure 3 – The Real House pricing (in comparison with the Consumer Price Index)
(January 1973- January 2012, monthly figures, January 2000 = 1)



Source: bank of Israel

Figure 4 - Mortgage Leverage Ratio in Housing Loans[11]
(Q1 2003- Q2 2010, quarterly figures)



[11]The 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).

Figure 5 – The Ratio of the Average House pricing to the Average Annual Wage (November 2002- April 2011, monthly figures)

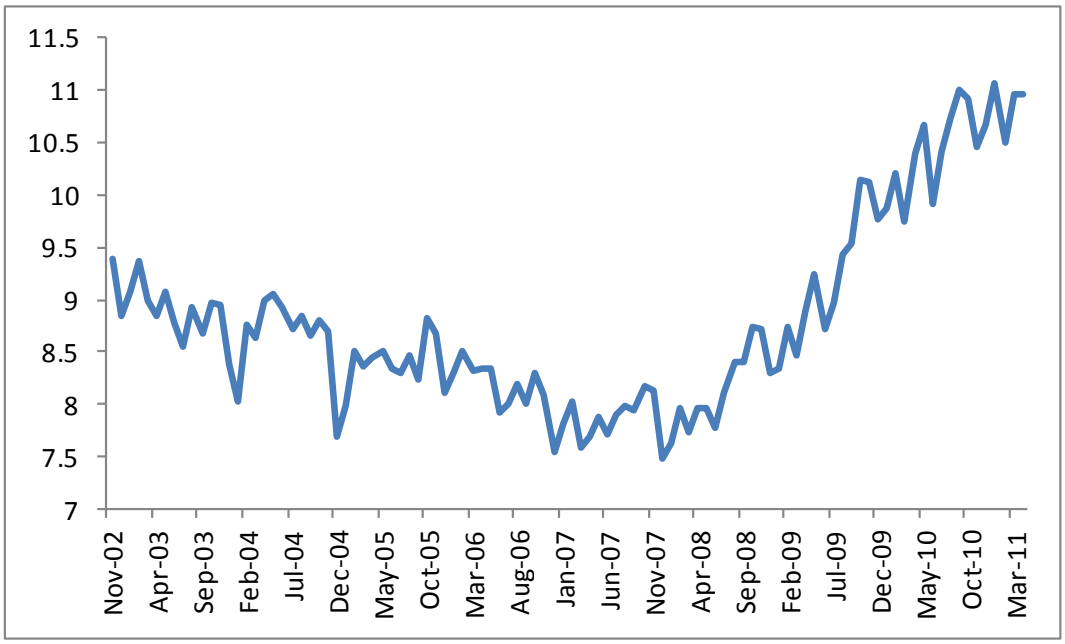


Figure 6 – FRM and ARM Mortgage volumes (Thousands NIS), by Maturity (in years) (July 2003 - April 2011, Average of monthly figures)

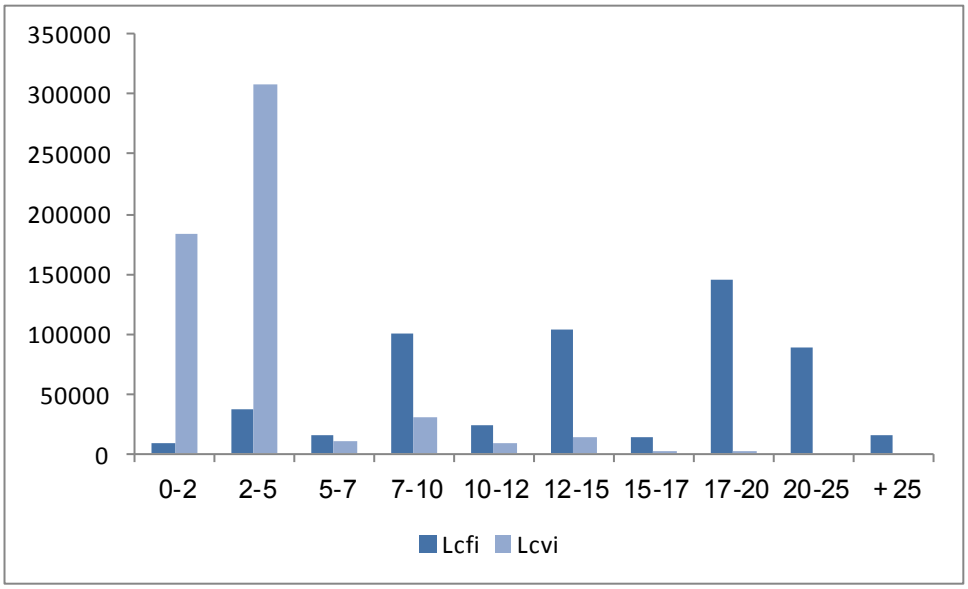


Table 1 – ARM-FRM Share Decision in Linked Mortgages

	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***	0.812***	0.803***	
	(0.209)	(0.209)	(0.240)	
Change of monthly real wage in period t		-0.298	-0.281	-0.491
		(0.349)	(0.359)	(0.377)
Change of real housing price index in period t		1.013	0.258	-0.482
		(1.148)	(1.312)	(1.921)
Change of real construction price index in period t		-2.052	-1.328	-1.381
		(1.658)	(1.803)	(1.803)
Change of the difference between reference interest rates for FRM and ARM in period t		0.021	0.022	0.033
		(0.021)	(0.020)	(0.022)
Change of the expected yearly inflation rate in period t		-0.134**	-0.118*	-0.089
		(0.063)	(0.071)	(0.075)
Change of linked FRM duration in period t		-0.651	-0.614	-0.493
		(0.414)	(0.431)	(0.458)
Constant	0.009	0.004	0.008	0.019
	(0.012)	(0.013)	(0.122)	(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 percent level. **=Significant at the 5 percent level. *=Significant at the 10 percent level.

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***	2.939***	0.525**	0.579**
	(0.710)	(0.862)	(0.201)	(0.213)
Change of monthly real wage in period t		0.136		-0.469
		(0.676)		(0.406)
Change of real housing price index in period t		1.125		-0.403
		(2.752)		(1.445)
Change of real construction price index in period t		-1.746		-0.991
		(2.702)		(2.473)
Change of the difference between reference interest rates for FRM and ARM in period t		0.032		0.006
		(0.030)		(0.029)
Change of the expected yearly inflation rate in period t		-0.096		-0.152**
		(0.198)		(0.074)
Change of linked FRM duration in period t		-0.624		-0.840
		(0.600)		(0.684)
Constant	-0.010	-0.018	-0.005	0.063**
	(0.128)	(0.151)	(0.051)	(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 percent level. **=Significant at the 5 percent level. *=Significant at the 10 percent level.

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**	1.530*	0.208	0.482*
	(0.809)	(0.850)	(0.201)	(0.244)
Change of monthly real wage in period t		-0.133		-0.570
		(0.748)		(0.433)
Change of real housing price index in period t		0.790		-0.698
		(3.050)		(1.519)
Change of real construction price index in period t		-2.243		0.603
		(2.994)		(2.621)
Change of the difference between reference interest rates for FRM and ARM in period t		0.038		0.016
		(0.034)		(0.031)
Change of the expected yearly inflation rate in period t		-0.138		-0.192**
		(0.220)		(0.086)
Change of linked FRM duration in period t		-0.616		-0.746
		(0.671)		(0.724)
Constant	0.023	0.025	0.003	-0.016
	(0.148)	(0.167)	(0.064)	(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 percent level. **=Significant at the 5 percent level. *=Significant at the 10 percent level.

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***	1.651***
	(0.473)	(0.587)
	[0.133]	[0.278]
	{93}	{87}
Change of prime interest rate in period t, in mortgages with term of 10 to 12 years	2.419***	3.185***
	(0.921)	(1.185)
	[0.071]	[0.130]
	{93}	{87}
Change of prime interest rate in period t, in mortgages with term of 12 to 15 years	2.202***	1.796*
	(0.798)	(1.046)
	[0.077]	[0.134]
	{93}	{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 percent level. **=Significant at the 5 percent level. *=Significant at the 10 percent level.