

# **Do loss profiles on the mortgage market resonate with changes in macro economic prospects, business cycle movements or policy measures?**

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## **Abstract**

Over the years we see that mortgages with less risk of loss, due to more asset accumulation, have become more popular. We examine if this popularity resonates with macroeconomic features, business cycle movements and policy measures. Using detailed data from an important player in the Dutch mortgage market, covering 1990 to 2012, we seek to elicit the time series patterns of the loss profiles of customers. Over time we indeed find changes in loss profiles. The theoretical perspective used to situate this change in profile is prospect theory. Key findings of prospect theory are: interaction between framing of a decision, the attitude towards loss, and loss-averse behavior. Next, we find only very limited impact of changes in the macro economic situation on the loss profiles, that is, business cycle movements on the housing markets do not matter, nor do general business cycle movements. In contrast, we find that some changes in loss profiles are related to tax policy measures. Hence, we conclude that if policy makers want to stimulate loss-averse behavior through asset accumulation, they should actively encourage it.

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# 1. Introduction

Underwater mortgages can be considered as collateral damage resulting from the financial crisis. In contrast to persistent expectations, in recent years housing prices did not keep on rising (Shiller 2005, Shiller 1990), and loans were not sufficiently reduced to cover up for the decline in current real estate value. Investment-wise, houses did not turn out as safe as houses were assumed to be (Ferguson 2009). Consequently the *loan to value ratio* rose above 1.

There is consensus that a declining housing market combined with an increasing household debt has a serious consequence, which basically is that a decline of housing values limits economic growth (IMF October 2008). Declining house values have a negative impact upon opportunities for borrowing, using housing collateral, as well as have possible welfare effects (IMF October 2008), that is, household debt can constrain economic activity (IMF April 2012). Housing values bubble bursts, preceded by increases in household debt, tend to be followed by large and long-lasting declines in household consumption (IMF April 2012, Kosuke, Proudman and Vlieghe 2004). After the 2007 subprime mortgage market the housing market faced a hard time to recover (Reinhart and Rogoff 2009). Overall, when households accumulate more debt during a boom, the subsequent burst features an even more severe contraction in economic activity (IMF WOE 2012, p.95). Considering the severe consequences of such a burst, reluctance towards accumulation of debt is to be expected.

In this paper we will not exclusively pay attention to the accumulation of debt and to the rise and fall of the housing prices, but also to mortgage related accumulation of assets. Adding the asset side to the mortgage story offers a more nuanced view upon the loss profile on the mortgage market. Data will be distracted from the Dutch mortgage market. The Dutch mortgage market has a variety of mortgages, including mortgages that allow for an accumulation of capital by combining debt with financial assets. Next to pay-off mortgages and interest-only mortgages, mortgages that combine loans with savings, investments and insurances play a substantial role as well. If capital accumulation is directly related to debt, mortgagors reduce their dependency upon current value on the housing market. Debts can be paid off using the accumulated assets. Consequently if housing prices go up, the accumulated assets offer additional financial benefits, if housing prices go down the assets form a financial buffer. These mortgages are contra-cyclical. Adding the asset side broadens the perspective on mortgages and allows gaining a more detailed insight in behavior related to potential

losses. Therefore the question we address in this article is: When do mortgagors choose mortgages that reduce the risk of a potential loss?

Several reasons can be provided for choosing the Dutch market. From a loan-to-value perspective the Dutch housing and mortgage market takes a special position. In 2010 the International Monetary Fund (IMF) noticed two major vulnerabilities within the Dutch economy. The first is related to external factors, while the other is related to high indebtedness of Dutch households. The IMF reports: "[...] The domestic risks from high indebtedness in the housing sector continue to require close scrutiny, though mitigating factors appear to offer reassurance. Nevertheless, the high loan-to-value (LTV) ratio, as well as elevated bankruptcies flag the vulnerability and need for continued vigilance." (IMF December 2010). So, there is an international concern and interest for this market. Adding the asset side to this story, might put this statement as well as the concerns in a different perspective.

Furthermore, the Dutch mortgage market offers a variety of mortgages. This creates the opportunity to contribute to existing research that mainly focuses on the loan to value ratio. Understandably, the *value* side of the “story” received much attention (Reinhart and Rogoff 2009). A long lasting bubble in the housing prices preceded the financial crisis (Reinhart and Rogoff 2009). The decline in housing prices is remarkable, as prices have been rising for decades. An indexed decline of housing prices in the USA shows its peak in the second quarter of 2006 (189.93) and its preliminary low at the end of 2011 (124). At the end of 2012 21.5% of all residential properties with a mortgage in the United States were still in negative equity (Corelogic 2012).

While the gradients are less extreme in the Dutch housing market, there seems to be a similar trend. In the Netherlands the housing market price index peaked in August 2008 (113.8) to drop to a low at the end of 2012 (94.7). Between 2008 and 2013 the number of underwater mortgages almost doubled, from 13% to 25%. So, for 4.2 million houses in the Netherlands, in 1 million cases the loan exceeds the current value (CBS 2012).

Next to the value side of the story, the loan side of the story is a returning topic in ongoing academic and societal discussion on the housing market (Acharya and Richardson 2009, Diamond and Rajan 2009, Taylor 2009, Genesove and Mayer 2001, Case and Shiller 2003, Case and Shiller 1988). This debate additionally covers the relationship between mortgage expansion and securitization of subprime mortgages (Mian and Sufi 2009, Agnello and Schuknecht 2011). Substantial attention has been given to how the monetary policy by the Federal Reserve could possibly have contributed to a bubble in housing prices in the

United States (Bernanke 2010) and the relationship between housing prices, inflation and interest rate (Reinhart and Rogoff 2009, Taylor 2009, Titman 1982, Schwab 1982, Gatzlaff 1994, Summers 1980, Case and Shiller 1989).

Finally, our research also broadens the discussion on risk perception of buyers (Case and Shiller 1988, Kolbe and Zagst 2010) as well as upon the present value of receipts from selling a house (Poterba 1984) and the repayment of mortgages (Green and Shoven 1986). By considering a period that includes both a boom and a bust, loss profiles throughout these periods can be examined and compared. If homeowners have persistent expectations on price increases, it is understandable that they do not worry about repayment of their mortgage. They apparently expect that the loan-to-value ratio will decrease below 1 due to an increase in value. This behaviour is in accordance with the principle of the greatest fool: “there will always be a buyer willing to pay more for the house than I did”. Taking a mortgage wherein capital is accumulated next to the debt goes against this principle, at least in part. The greatest fool principle is replaced by a more prudent principle, that is, “maybe there is someone who wants to buy the house, but there is a chance that the price this person is willing to pay does not cover up for the current debt”.

Based on detailed data from the Dutch mortgage market, covering the period from 1990 to 2012, we examine if and how people considered various mortgage types and thereby anticipating on a potential loss. We examine if mortgage structures match price development, that is, are they pro-cyclical or contra-cyclical? The presence of underwater mortgages shows that the match between loan and value has not been sufficient to match a price decline. Apparently pro-cyclical mortgages dominated contra-cyclical mortgages.

The theoretical perspective of this paper is aligned with prospect theory. One of the key findings of prospect theory is interaction between ‘framing of a decision’ and ‘making of a decision’. Kahneman and Tversky have convincingly shown that people act loss averse and that perception of loss is dependent upon the framing of the decision (Kahneman and Tversky 1984, Kahneman and Tversky 1979, Kahneman 1992, Tversky and Kahneman 1991, Paraschiv and Chenavaz 2011). In our study we examine the interaction between framing and loss-averse behavior on the mortgage market. We question whether and when mortgagors anticipate upon possible losses. In line with prospect theory we should expect people to be reluctant to take risks that can lead to potential losses, thus act contra-cyclical, but at first sight the presence of underwater mortgages seems to point to the opposite direction. Instead of being loss-averse, house owners effectively seem to have speculated on increasing prices. However, in this explanation the assets that can compensate for losses are not included. By

adding the asset side of the story, we can further develop this story line. Focus of debate will be the interaction between frame and loss profiles: Within which frame do mortgagors show loss-averse, that is, contra-cyclical, behavior?

A key difference between the work of Kahneman and Tversky and our study is that their research and findings are based upon outcomes of strictly defined and designed experiments. The frames are clearly defined, and the behavior can be directly observed. In contrast, we do not base our findings on experiments but on real life data obtained from one of the largest mortgage providers within the Netherlands. By doing this we want to contribute to the discussion of the use of prospect theory findings, and the importance of framing, outside experimental economics.

The outline of this paper is as follows. We start with an introduction of prospect theory with a special focus on the interaction between frame and loss profile. Based upon Minsky (1992) different debts structures and corresponding loss profiles are presented. We make a distinction between speculative mortgages that are pro-cyclical, hedging mortgages, that are contra-cyclical, and hybrid mortgages that combine pro and contra-cyclical patterns. The section ends with relating Minsky's debt structures to mortgages available on the Dutch market. Subsequently our key hypothesis is formulated. The third section contains an introduction on three frames that might matter on the mortgage market. Based upon the relevant literature we distinguish macro economic features (first frame), business cycle movements upon the housing and market and within the economy (second frame), and policy measures taken on the Dutch market (third frame). The fourth section covers data and methodology. We will situate the data within this context and use the so-called attraction model for analysis (Fok, Franses and Paap 2002) as we will deal with market shares. The fifth section contains the results. We find that tax policy measures taken between the 1990 and the 2012 do have an influence on the loss profile of the mortgage market. Next to that there is only a minor influence of macro economic features. Dynamics on the housing markets – fluctuations in price – do not have a significant influence. The influence of growth within the economic upon behaviour on the housing market is limited. The sixth and final section contains conclusion and discussion. This section contains a reflection upon theoretical assumptions as well as on consequences and further research is presented.

Our overall conclusion is that frames can have an influence, but that the incorporation of frames is not self evident. Some frames seem to work, others do not. Additionally, it is not always unambiguous whether the frames encourage pro-cyclical or contra-cyclical behaviour. We also conclude that prospect theory is not only a descriptive theory, as its founding fathers

position the theory, but it can also play a normative role within economic policy. Sometimes loss aversion is desirable from an economic-societal perspective. In situation where that does not happen by itself, policy measures can contribute to this.

## **2. Framing, loss aversion and mortgages**

This research examines changes in loss profiles on the mortgage market. Prospect theory offers a theoretical framework to situate this research. Based on experiments, Kahneman and Tversky criticized Expected Utility theory. Their work shows that people do not act in accordance with rational expectations. Instead of equally weighting gains and losses, people act with more loss aversion. Furthermore, individuals are risk seeking when potential losses are at stake and risk avoiding when it comes to gains. Whether a deviation from a status quo is perceived as a gain or a loss is dependent upon the way this change is framed. In this section we start with an elaboration of some key concepts of Kahneman and Tversky and we use this to formulate hypotheses on the loss profile on mortgages. Work of Minsky is used to distinguish different loss profiles related to mortgages.

### **2.1 Decision making according to prospect theory**

A returning example to illustrate prospect theory is the Asian disease example (Tversky and Kahneman 1986). It contains all key elements of prospect theory, which are framing, loss aversion, risk seeking when a potential loss shows up, and a reluctance to take risks when a potential gain shows up. The decision to be made is about a government program to combat an Asian disease. The experiment starts with a clear problem statement:

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows:

When the program to combat the disease is framed as is done below, a majority (percentages votes in parentheses) chooses alternative A.

If program A is adopted, 200 will be saved. (72%)

If problem B is adopted, there is  $\frac{1}{3}$  probability that 600 people will be saved and a two-thirds probability that nobody will be saved. (28%)

On the contrary, if the program is defined as is done below, the majority chooses program D.

If program C is adopted, 400 people will die (22%)

If program D is adopted, there is a  $\frac{1}{3}$  probability that nobody will die and a  $\frac{2}{3}$  probability that 600 people will die. (78%)

According to the Expected Utility Theory, decision makers would be indifferent between the alternatives A, B, C and D. If all the programs are compared to each other, program A is similar to program C. In both programs 200 will survive for sure and 400 will die for sure. And, program B is similar to program D. In both programs there is  $\frac{1}{3}$  probability that 600 people survive and  $\frac{2}{3}$  probability that they do not. So, the expected outcome is here again 200 people will survive, 400 people will die. That A is preferred over B and that D is preferred over C can be explained by looking at the editing and evaluation phase.

The first aspect is the way the decision is framed, that is, as either a gain or as a loss. Framing takes place in what is called the editing phase. Framing is always possible when dealing with risks and two or multiple sidedness is possible for all risky projects. "Risky prospects are characterized by their possible outcomes and by the probabilities of these outcomes. The same outcome however can be framed or described in different ways" (Kahneman and Tversky 1984). Within the above example the outcomes can either be framed as gains or they can be framed as losses. Prospect theory assumes that people are passive in accepting the frames or problem descriptions offered to them (Thaler, et al. 1997, 651). However, people choose differently when the problem is framed in a different way, better put as "the decision makers are usually unaware of the possibility that their views of a problem might change with a different formulation – for example, that risk aversion could be replaced by risk seeking when the same problems were framed in terms of losses rather than gains" (Kahneman 1992, 305).

Explanations for the decision to differ can be found in the decision process, that is, the evaluation phase that consists of three properties (Kahneman and Tversky 1984, 342). The first is that the value function is defined by gains and losses rather than by total wealth. This is related to the assumption of prospect theory that a change dominates the decision, that is, the carriers of value are changes in wealth or welfare, rather than final states (Kahneman and

Tversky 1979, 277). A point of reference, most of the times a status quo, is taken as starting point to judge the change. The second property is that the value function is concave in the domain of gains and convex in the domain of losses. This is what is called the reflection effect, which says that people are risk averse when it comes to gains and risk seeking when it comes to losses (Kahneman and Tversky 1979, 268). They are not willing to risk a possible gain, but they are willing to risk a possible loss. The third property, which is labelled loss aversion, results from the value function being considerably steeper for gains than for losses. Empirical and experimental research documented that losses are weighted about twice as strongly as gains (Kahneman 1992, Kahneman, Knetsch and Thaler 1990, Tversky and Kahneman 1991).

## **2.2 Loss profiles of mortgages**

When it comes to mortgages, the loan-to-value ratio at the moment of buying the house can be considered as the status quo. In this paper we assume that the loan-to-value ratio at the moment of buying the house equals 1. In that case, the current value of the house covers up for the mortgage. From that moment on, two things can happen when it comes to this ratio: (1) the value can change as housing prices go up or down, or (2) the loan can remain the same or be reduced in case of repayment mortgages. Additionally assets can be accumulated to cover up for potential differences between loan and value. Pro-cyclical mortgages enlarge the difference between loan and value, both in times of prosperity and adversity. Contra-cyclical movements will narrow down a possible gap between loan and value. So, from a prospect theory perspective we expect a preference for contra-cyclical mortgages. We will now categorize mortgages in pro and contra-cyclical mortgages.

Using Minsky's (Minsky 1992) work on debt structures, three types of debt structures can be identified and related to loss profiles of mortgages, these are: hedge, speculative and Ponzi finance units. Debt structures contain the seeds of stability or instability. The first one contributes to stability, the third to instability, while the second profile is most likely to contribute to instability. Equilibrium is the starting point for hedge financing, that is, "hedge financing units are those which can fulfil all of their contractual payment obligations by their cash flows: the greater the weight of the equity financing in the liability structure, the greater the likelihood that the unit is a hedge financing unit" (Minsky 1992). In the end the total debt is repaid by the cash flows. McCulley (2009) relates this type to the repayment mortgages. Every month the rate is paid and a part of the principle sum is repaid. Monthly the loan is



reduced and this reduction can cover up for – at least – a part of an eventual decline in housing prices. At first sight this debt structure will be preferred by mortgagors aiming at the reduction of a potential loss. The hedge structure is in accordance with loss-averse behaviour as it is contra-cyclical, it maintains the status quo.

Speculative finance units are units that can meet their payment commitments on “income account” on their liabilities, even as they cannot repay the principle sum out of income cash flows. Such units need to “roll over” their liabilities, that is, new debt must be issued to meet commitments (Minsky 1992). McCulley (2009) relates this to interest-only mortgages. Mortgagors taking this kind of mortgage can take larger mortgages as their monthly payments are lower compared to those of hedge mortgagors. Based upon prospect theory the expectations are that loss-averse decision makers will be reluctant when it comes to taking these kinds of mortgages, unless the chance that housing prices rise convincingly outnumbers the chance that the prices will decline. So, at first sight speculative debt structures are not in line with loss-averse behaviour.

Finally, there are Ponzi units. For this type the cash flows from operations are not sufficient to fulfil either the repayment of the principle sum or the interest due on outstanding debts by their cash flows from operations (Minsky 1992). Subprime mortgages fall within this third category (McCulley 2009). Consequently Ponzi debt structures are not in line with loss-averse behaviour either. Both Ponzi and speculative debt structures are not based on the equilibrium assumption, but upon the assumption of the “greatest fool”. Both categories of mortgages are pro-cyclical.

Speculative and especially Ponzi mortgages can destabilize the financial system. As a consequence they are not only unlikely to appear from a prospect theory perspective, but also undesirable from a macroeconomic perspective.

### **2.3 Risk loss profiles on the Dutch mortgage market**

To formulate hypotheses we should relate the classification based on Minsky to the Dutch mortgage market. On this market roughly three different types of mortgages can be identified. The first one is the *interest only* mortgage. In this case the mortgagor only pays the interest rate and the principle sum itself is not repaid. So, at the end of the maturity the loan is just as large as it was in the beginning. If the real estate is sold before the end of the maturity the loan is also as large as it was in the beginning. Dependent on whether or not the value of the real estate has risen, the loan to value ratio can be lower or higher than 1. This kind of

speculative mortgages is clearly pro-cyclical. The second type of mortgage is the *repayment* mortgage. Each month a part of the principle is repaid, and at the end of the maturity there is no loan left. When the house is sold before the maturity ends a part of the loan is repaid, and consequently the loan is reduced. This kind of hedge mortgage is contra-cyclical. The third type of mortgages has a *combined* character. They consist of an interest-only loan combined with an investment account, a savings account or a combination of both. The growth or decline of the investment account is dependent upon the concrete investment that is made as well as upon the investment climate. It is likely that in prosperous times the investment account will grow and in less prosperous times that it will shrink. So, combined investment mortgages are pro-cyclical but to a lesser extent than interest only mortgages. Mortgages combined with savings accounts have different loss profiles, and they can be compared with contra-cyclical repayment mortgages. This type of combined mortgages guarantee that a substantial part of the mortgage can be repaid at the end of the duration and they offer a financial back up if the house is sold before the end of the maturity. Mortgages combined with investments accounts are more risky and have a different loss profile. Dependent upon the development of the investments the financial back up will be higher or lower.

If the Dutch mortgages are related to Minsky's categorization, then the repayment mortgage as well as the combined saving mortgage classify as contra-cyclical hedge finance products. At the end of the duration either the principle sum is either fully repaid, or the mortgagor saved the money to repay, a part of, the mortgage. The interest-only mortgage as well as the hybrid investment mortgage can be classified as speculative financial products. The latter to a lesser extent than the former, but both are pro-cyclical. Finally there are mortgages that combine insurance and investment. They will be classified as hybrid mortgages as they contain characteristics of both contra and pro-cyclicity.

Figure 1 displays the developments on the mortgage market in the Netherlands where we plot monthly data for 1990-2012. The contra-cyclical products consist of repayment mortgages as well as combined saving mortgages, whereas the pro-cyclical finance product consists of interest-only mortgages, hybrid mortgages represent combined investment mortgages. We see that the number of contra-cyclical – hedge – mortgages started to decline in the beginning of the nineties and rose again in 2006. The development of the pro-cyclical products is the mirror image of the hedge finance products.

## 2.4 Hypotheses

The formulation of hypotheses concerns an application of prospect theory upon the mortgage market. For this, the editing phase as well as the evaluation phase can be linked to the mortgage market. The basic question is why the mortgage market shows fluctuations, see Figure 1. That is, which frame(s) explain(s) that in certain times pro-cyclical mortgages are dominant, while in other times mortgage with a contra-cyclical nature dominate the mortgage market? Indeed, why is the loss aversion not constant over time?

We examine the relationship between this frame and the decisions that have been taken. To describe the fluctuations in the economy, we will consider indicators as inflation, interest rate, growth, numbers of houses sold and housing prices. Within the current literature these indicators are usually suggested to influence the decision process. Besides the aforementioned macroeconomic frames and the business cycle movements we will examine the potential effects of Dutch policy measures upon the preferences for certain types of mortgage. For all the policy measures in the time span of the analysis we will examine the relationship between the specific policy measure and the proportion of either hedge or speculative mortgages.

Our null hypothesis is that there should be no relationship between economic indicators and changes in the numbers of pro-cyclical or contra-cyclical mortgages, that is, the loss profile of mortgagor is not dependent upon macroeconomic features, business cycle movements or policy measures. The alternative hypotheses are (1) that framing does matter, and (2) that mortgagors prefer loss aversion within each frame.

As a point of reference, status quo, we take the loan-to-value ratio of 1. Indeed, the moment the house is bought the loan should reflect the current value. In line with prospect theory it can be expected that a loan-to-value ratio of 1 or below 1 is preferred to a loan-to-value ratio above 1. In the latter case the loan exceeds the current value and the house owner runs the risk to get under water. A contra-cyclical hedge finance instrument is in line with this loss-averse preference. In case of pro-cyclical speculative financial products, however, the loan is not reduced and it is not certain whether that investment will produce the expected profit. Hybrid mortgages play an ambiguous role. So, from the perspective of the prospect theory we would expect that a contra-cyclical finance unit is always preferred. Looking at the data (Figure 1) we already can see that this is not the case. From the second part of 1997 until the second part of 2008 speculative finance units were preferred over hedge units. Based upon the analysis that will be performed below, we will reflect on this in the conclusion of

this paper. Can the preference for speculative finance units be seen as a violation of prospect theory (that is, in times of booms people do not act in accordance with the decision process of prospect theory) or do the results associate with framing (that is, within the frame of a booming housing market, this behaviour can be seen as behaviour in accordance with the prospect theory)? In the next section we elaborate on the frames for the Dutch housing market.

### **3. Frames for the Dutch mortgage market**

In this section we discuss cascading frames that can leave their mark on the risk-loss profile of the mortgage market. Based upon prospect theory we expect that people act loss averse in general. We first consider macroeconomic frames that could be of influence. These frames are relevant for the economy as a whole, but are also relevant for the housing market. Next to that we discuss the business cycle. We pay attention to the business cycle on housing markets, where these dynamics create a special mind set for mortgagors on the housing market, as well as to fluctuations in economic growth. These fluctuations are illustrated with numbers of the Dutch housing market. Finally, we discuss relevant policy measures. In all cases we formulate how we expect that these frames will influence decision making.

#### **3.1 Macroeconomic frames**

A link is often established between monetary policy and developments on the housing market. Much academic debate has been concerned with the link between housing prices, inflation and interest-rate policy (Reinhart and Rogoff 2009, Taylor 2009, Titman 1982, Schwab 1982, Gatzlaff 1994, Summers 1980, Case and Shiller 1989). Movements on the mortgage market will thus be related to inflation as well as to interest rate policy.

The frames we discuss in this setting are not specific for the Dutch housing markets, but are returning topics in the discussion on mortgages (Acharya and Richardson 2009, Diamond and Rajan 2009, Taylor 2009, Genesove and Mayer 2001, Case and Schiller 2003, Case and Shiller 1988). This debate also covers the relationship between mortgage expansion and securitization of subprime mortgages (Mian and Sufi 2009). Substantial attention has been given to how the monetary policy by the Federal Reserve could possibly have contributed to a bubble in housing prices in the United States (Bernanke 2010) and the

relationship between housing prices and inflation and interest rate (Reinhart and Rogoff 2009, Taylor 2009, Titman 1982, Schwab 1982, Gatzlaff 1994, Summers 1980, Case and Shiller 1989). In our analysis we will examine the relationship between inflation, interest rate and loss profile on the mortgage market.

The expectation is that a rise in inflation positively influences the loan-to-value rate by an increase in value. The higher the inflation, the higher is the actual value of the house, the lower the loan-to-value ratio, thus implying “same loan, higher value”. The chance to lose is reduced in this case, and as such this frame reduces the necessity to hedge. However it is questionable whether inflation would be sufficient to convince a loss-averse mortgagor, especially in the European Union where inflation remained low during the last decade.

The interest rate is also expected to be of influence. In case of a low interest rate the loan becomes less expensive and, consequently more attractive. The interest rate might reframe the decision, although it will not be of influence upon the loan-to-value ratio. A low interest rate reduces the monthly expenses, however long term consequences – in this case being able to repay the loan – become less apparent. A low interest rate may not make less visible the importance of hedging to avoid losses, while it neither reduces the loan nor is it a guarantee that the value of the real estate will rise. From a prospect theory perspective the question is whether this reduced visibility is enough for the loss-averse mortgagor to – indeed – reduce hedging.

During the years of our available data we saw first a decrease and after that a flattening of the inflation rate, which would increase the need to hedge. Next, there was a decrease in interest rate, which would make the importance of hedging less visible, however not less needed. See Figure 3 for an overview on the movements of the interest rate and inflation. However, is this enough for mortgagors who are more affected by losing than by gaining?

### **3.2 Business cycle: housing market and GDP**

When it comes to the business cycle internal dynamics can be addressed, that is, the business cycle movement on the housing market, as well as external dynamics, that is, business cycle movements of the economy in general. In the Dutch housing market we have seen price developments that point into the direction of a boom, but also during economic growth various fluctuations can be traced. We first take a look at the housing market and its indicators for business cycle movements.

A booming or busting pattern on the market is related to general shared beliefs, either by a layman who bought a house, and/or also by economists and policy makers (Case and Schiller 2003). Price developments at the beginning of the 20<sup>th</sup> century in the US housing market resemble such a pattern (Cohen, Coughlin and Lopez 2012). Adaptive expectations played a leading role, such that trends in values of certain variables were assumed to persist in the future (Kindleberger and Aliber, 2005, p. 33). When values increased, the shared expectation was that they will keep on rising in the future. This created a follow-the-leader process where firms and households witnessed that others are profiting from speculative purchases (Kindleberger and Aliber, 2005, p. 25). The expectations that dominated the frame were the profits made by others. When price increases go higher and more frequent, people changed their investment strategies and started taking risks they previously were not taking (Earl, Peng, and Potts, 2007, p. 351). At times when aggregate success is larger than usual, confidence will be higher (Gervais and Odean, 2001, p. 19), and in turn this overconfidence can promote herding as has happened before in the securities market (Hirschleifer, Subrahmanyam and Titman 1994).

In the end, a boom is “a non-sustainable pattern of financial behaviour” (Kindleberger and Aliber, 2005). According to these authors, the non-sustainable pattern involves the purchase of an asset, like real estate or a security, not because of the rate of return on the investment but in anticipation that the asset or security can be sold to someone else at an even higher price. If you buy something it is possible to sell it with profit. The term “the greatest fool” has been used to suggest that the last buyer was always counting on finding someone else to whom his assets could be sold. However there will come a point in time without “a greatest fool”, and that is where the boom turns into a bust.

When taking a look at the value side of the Dutch housing market we see a movement that is comparable, although less extreme, to the value movement in the United States. From January 1995 until August 2008 the price index kept on rising. Starting with an index value of 36.5 in January 1995, it rose to 106.9 in August 2008 (CBS 2012). In this period the average value almost tripled, that is, from Euro 88991 in January 1995 to Euro 261948 in August 2008. These numbers clearly point towards a boom on the Dutch housing market. A point of view that is supported by the amount of houses sold (CBS 2012). In the same period the sales increased from 8793 to 15469 units, where the sales peaked in December 2003 (24651 units).

To examine whether this dynamics is of influence upon the loss profile, we study the relationship between the amount of houses sold, the rise in price and a changing loss profile.

Based upon these developments a rise in speculative mortgages is expected until 2008, after that the ‘greatest fool’ seems to disappear from the stage. So it becomes less likely that real estate is sold for a higher price and hedging mortgages become more attractive.

Next to the business cycle patterns within the housing market we examined the estimated monthly growth of GDP (for details, see section 4 below). The expectation is that an increase in growth will have a positive influence on the mind set and upon the willingness to close speculative mortgages. In these circumstances the investments are expected to rise. Additionally, a decreasing growth should make the loss-averse mortgagors increasingly keen on hedging.

### **3.3 Policy measures**

Finally, Dutch tax policy measures on mortgages, taken between the 1990s and 2012, will be examined as well. Tax deductibility of mortgages has a long history within the Netherlands. For decades the gross wages are reduced by the annually paid mortgage interest before the final tax is calculated. Initially, this policy was meant to stimulate private ownership on the housing market. Within the period of our research additional policy measures have been taken to adjust, in fact to reduce, the amount of tax benefit. The deductibility of the interest rate has become very expensive and many economists believe that it distorts the Dutch housing market. This discussion is however not at stake in this paper. We will only look how six policy measures are of influence to the loss profile of chosen mortgages.

In the midst of the 1980s the capital insurance is introduced. This insurance product can be used to repay a mortgage, although not necessarily. The accumulated assets within these insurance products are based on savings or investments. Since 1992 this insurance is associated with much stricter fiscal requirements, that is, capital insurances are only exempted from tax benefits up to a certain amount. Compared to other capital insurances, the capital insurance to repay a mortgage “kapitaalverzekering eigen woning” (Dutch for capital insurance own house) is less restricted. This measure came into force on January 1, 1992 (1 January 1992 Wet IB 1964). This insurance can be seen as an instrument for hedging, capital is accumulated to repay the mortgage. However this hedging opportunity was also countered by the possibility to refinance the house and use the added value as income for consumption. This could seduce house owners to increase the debt without considering the long term consequences. The question here is whether the mortgagor acts loss averse and increases

hedging, to cover for future expenses, or that he is satisfied with the opportunities that are offered.

From 1997 onwards interest paid for consumer credit was no longer tax deductible. However, interest paid for mortgages remained to be deductible. Refinancing the house by taking out a second mortgage could offer liquidity that could be used for consumption, and that is tax deductible. This measure came into force on January 1, 1997 (Wet IB 1 January 1997). This measure could offer an incentive to increase the loan without hedging it, and real estate can be used as a source of income. Here we leave the question whether or not consumption is preferred above debt. What however can be questioned is whether a mortgagor acts loss averse and consequently finances the debt with hedge products.

Since 2001 mortgage interest only used for purchase, remodeling or maintenance of the house is tax deductible. Other interest is no longer tax deductible, so the shortcut to use mortgage to tax-friendly finance consumption was blocked. The interest is tax-deductible for a maximum of 30 years. This attractive solution is double sided, that is, on the one hand it is attractive to not reduce the mortgage, as in this case the tax deductibility is maximized, and on the other hand, capital insurance is taken to repay the mortgage in 30 years. This measure came into force on January 1, 2001 (Wet IB 1 January 2001). As tax deductibility is no longer possible after 30 years, this measure might encourage mortgagors to increase hedging. After 30 years the costs of their mortgages will increasingly rise. Additionally, this measure makes that the house no longer can be considered as a source of consumer credit. However, the house remains an investment. As long as the housing prices will keep on rising, the expectation is that speculative mortgages are attractive. It can be expected that loans can be repaid because of a rise in value of real estate. Real estate can become an object of private investment, and hedging might seem less needed. When house owners sell their house, they can keep a possible rise in price for consumption. Here again, the question is whether house owners speculate upon a rise in price, or act loss averse and prefer hedging mortgages.

This latter opportunity disappears in 2004. From 2004 on it is fiscally required that money earned with selling the house is used to invest in the new house. This is called the additional loan policy measure “bijleenregeling” (Dutch for rule to additional lend money). This measure might be slightly in favor of less hedging, as the hedging is already partly taken care of by the money earned by selling the house.

From 2008 home mortgage savings (in Dutch: “spaarrekening eigen woning” (SEW)) and investment accounts (in Dutch: “beleggingsrekening eigen woning” (BEW)) can be offered by banks and mortgage providers as alternatives for capital insurance. Capital



insurance could only be offered by insurance companies. This new option offers banks the opportunity to compete with insurance companies. The fiscal requirements for the savings and investment account are equal to those of the capital insurance. This measure came into effect on January 1, 2008. This measure might encourage hedging, however through another way. It changes the way of earning of banks, by making it more attractive to offer mortgages with investments and savings.

Based upon an overview of the policy measures it is not unambiguous which direction the loss profile should change. Although pro-cyclical speculation is not actively encouraged, it is not discouraged as well. The returning question is whether the mortgagors act loss averse by increasing their share in contra-cyclical mortgages, or speculate on prosperity and choose pro-cyclical mortgages.

## **4. Data and methodology**

This section deals with our data in more detail and with the econometric model that we use. As we have data on monetary market shares of preferred mortgage types, which are bounded by 0 and 100%, and also should sum to 100%, we rely on the so-called market share attraction model, which is rather popular in empirical marketing research, see Fok, Franses and Paap (2002).

### **4.1 The data**

Our data are obtained from the largest mortgage intermediary on the Dutch market, branded as “de Hypotheker” (Dutch for “the mortgage man”). The intermediary has a market share of 10%, which implies that it brokers around 10% of the mortgages that are sold at the mortgage market in the Netherlands. In 2012 it issued around 22000 mortgages with an average value of Euro 184,373.84.

Although the data are obtained from one broker, the data show similarities with data for larger players in this market. When looking at the monthly changes in the percentages of pro-cyclical mortgage data, those of the Hypotheker compare very well with data provided to us from another important player on the mortgage market, the Rabobank (not reported). At the same time, the Hypotheker mortgages, for which we have most detailed data for the longest period, have similar patterns as the total Dutch mortgage market. Hence, we believe

that our subsequent analysis on this small-share broker will lead to conclusions that can be generalized for the total market. That is, we are aware of the fact that these data do not cover the complete Dutch mortgage market, but as the pattern of the sold mortgages is comparable to data of the largest financial mortgage provider and the value development of these mortgages are comparable to those of the Dutch mortgage market, we think they provide an accurate image of developments upon the Dutch. Furthermore the data represent a substantial amount of mortgages, and as far as we know, they have never been analyzed before.

The data base contains the monetary market shares of the mortgages that have been issued. The Hypotheker issues nine types of mortgages that we classify as either: pro-cyclical, contra-cyclical or hybrid mortgages. The pro-cyclical category contains the interest only mortgages, while the contra-cyclical category contains repayment mortgages, combined saving mortgages issued by insurance companies and combined saving mortgages issued by banks, and finally, the hybrid category contains combined investment mortgages, ‘life mortgages’, and hybrid mortgages, which are a combination of savings and investments. They are more contra-cyclical than repayment mortgages and combined saving mortgages and they are less pro-cyclical than interest only mortgages. The rest category contains mortgage categories that cannot be classified amongst one of the former three. It contains the credit mortgages – taken to enlarge consumption possibilities –, existing mortgages and mortgages that cannot be classified. Due to policy measures which discourage extra refinancing of the house and improvement in the classification system, this rest category shrinks throughout the years.

## **4.2 Methodology**

We consider the time series patterns of four types of mortgages, for which we have monthly shares data. The data are the percentages of new mortgages issued per month for the sample 1990M01 to 2012M12.

In Figure 1 we present the four types of mortgages that we analyze. It is clear that the patterns are not constant over time. Figure 2 presents the annual growth rate of the real GDP, when estimated using the techniques outlined in Brauning & Koopman (2013). Finally, Figure 3 presents the data on inflation and interest rates.

As our four dependent variables are fractions which sum to 1, and which are in between 0 and 1, we rely on the so-called market share attraction model, see Fok, Franses and Paap (2002). The basic idea of this model is that it assumes (here: 4) latent variables called

attractors (or are attractiveness), and their attractiveness is described by a set of explanatory variables. Next, market shares are defined as functions of the relative degrees of attractiveness. For example, consider the situation where the attractiveness of mortgage  $i$  at time  $t$ , denoted as  $A_{i,t}$ , can be described by one-period lagged market share, two-periods lagged market share  $M_{i,t}$ , and a one-period lagged explanatory variable  $X_{i,t}$ , like

$$A_{i,t} = \exp(\mu_i + \varepsilon_{i,t}) M_{i,t-1}^{\gamma_{1,i}} M_{i,t-2}^{\gamma_{2,i}} X_{i,t-1}^{\beta_i} \quad (1)$$

Taking natural logs on both sides gives

$$\log A_{i,t} = \mu_i + \varepsilon_{i,t} + \gamma_{1,i} \log M_{i,t-1} + \gamma_{2,i} \log M_{i,t-2} + \beta_i \log X_{i,t-1} \quad (2)$$

Subtracting from this equation the equation for the  $I$ -th option (here that would be the rest category), which reads as

$$\log A_{I,t} = \mu_I + \varepsilon_{I,t} + \gamma_{1,I} \log M_{I,t-1} + \gamma_{2,I} \log M_{I,t-2} + \beta_I \log X_{I,t-1} \quad (3)$$

and making use of the definition

$$\log A_{i,t} - \log A_{I,t-1} = \log M_{i,t} - \log M_{I,t-1} \quad (4)$$

while setting some autoregressive parameters equal to each other, we get

$$\begin{aligned} \log M_{i,t} - \log M_{I,t} &= \mu_i^* + \varepsilon_{i,t}^* \\ + \gamma_{1,i} \log M_{i,t-1} - \gamma_{1,I} \log M_{I,t-1} &+ \gamma_{2,i} \log M_{i,t-2} - \gamma_{2,I} \log M_{I,t-2} + \beta_i \log X_{i,t-1} - \beta_I \log X_{I,t-1} \end{aligned}$$

Note that this system contains three equations where each equation contains the same parameters for the benchmark share. In our case, the explanatory variables are the same for all market shares, so we have

$$\begin{aligned} \log M_{i,t} - \log M_{I,t} &= \mu_i^* + \varepsilon_{i,t}^* \\ + \gamma_{1,i} \log M_{i,t-1} - \gamma_{1,I} \log M_{I,t-1} &+ \gamma_{2,i} \log M_{i,t-2} - \gamma_{2,I} \log M_{I,t-2} + \beta_i^* \log X_{i,t-1} \end{aligned} \quad (5)$$

By construction, the error terms are correlated, so the parameters in this three-equation system must be estimated using Seemingly Unrelated Regression.

### 4.3 Results

Table 1 presents the estimation results. The effective sample ranges from 1990M03 to and including 2012M12 which amounts to 274 monthly observations per equation. We started with a model which also included prices of houses sold and numbers of houses sold, for which we had to consider a shorter sample starting in 1995M01 due to data shortage, but these two variables were not significant in any of the three equations. So, a first conclusion is that these business cycle dynamics on the housing market are not of influence upon the loss profile. Hence, we deleted these variables, and now we can use the larger sample for all other variables.

The conclusion from Table 1 is that the business cycle movements, expressed as change in growth rate, have no significant influence upon the loss profile of mortgages. Inflation and interest do not put their mark on the loss profiles either. However, policy measures do matter. Due to the 1992 measures, the monetary share of hybrid mortgages reduces. The 2004 policy measure is in favor of both pro-cyclical and contra-cyclical mortgages, the share of hybrid mortgages decreases. The 2008 measure is also in favor of pro-cyclical and contra-cyclical mortgages.

To check the robustness of these results to data transformations, Table 2 reports the estimation results for the same model where now the levels of the economic situation variables are included. Here we see, again, that economic growth has no impact upon loss profiles of mortgages. However, now macroeconomic features do matter. Inflation has a negative influence on both pro and contra-cyclical mortgages, and a rise in interest rate positively relates to pro-cyclical mortgages. Again policy measures do matter more, and the results are comparable to the ones presented in Table 1. Policy measures in 1992 have a negative impact upon the market share of hybrid mortgages. 2004 policy measures increase market shares of both pro-cyclical and contra-cyclical mortgages, where the market share of hybrid mortgages decreases. 2008 policy measures increase market shares of pro-cyclical and contra-cyclical mortgages.

## 5. Conclusions and discussion

Our initial question was “When do mortgagors choose mortgages that reduce the risk of a potential loss?” Underwater mortgages arise when values on the housing market decrease and their problem becomes more severe if there are no assets to cover the difference between the initial loan and the current value. As such, pro-cyclical mortgages increase the chance on underwater mortgages, while contra-cyclical mortgages decrease the chance. Hybrid mortgages can narrow down the gap between loan and value, but the success of this is dependent upon the business cycle.

From a prospect theory perspective, underwater mortgages are hard to explain. Prospect theory assumes that people behave as loss averse. They prefer not losing to the probability of gaining, and whether or not they consider something as a loss or a gain is dependent upon the framing of the decision. At first sight, loss-averse behaviour on the mortgage market would mean a strong preference for contra-cyclical mortgages. Through hedging mechanisms loan and value are balanced, with or without accumulation of assets. However, we see that the share of contra-cyclical mortgages does not always represent a majority, and, on the contrary, pro-cyclical mortgages play a dominant rule during certain recent time spans. So there are times when people behave more pro-cyclical, and there are times when decision makers behave mainly contra-cyclical. Prospect theory can provide an explanation for that through framing as it might be that the framing of a decision moves people towards more or less pro-cyclical behaviour.

Based upon the literature several frames were expected to be of influence. This however turned out to be different when looking at actual data. Dynamics in the housing market and business cycle movements do not have a significant influence upon the choice for mortgages, not as much do interest rates and inflation. When there are effects, the signs are inconclusive. For example, a rise in inflation makes the share of both pro-cyclical and contra-cyclical mortgages go down. So, it is hard to conclude whether or not people behave more loss averse. A rise in interest rate means a rise in pro-cyclical mortgages. This could be because the costs on the short term rise, and an interest-only mortgage has the lowest cost in the short term. Our results are ambiguous on the influence of policy measures upon the loss profile. They do have influence, but on both pro-cyclical and contra-cyclical movements. So, if we relate these findings to prospect theory, our conclusion is that framing does work,

however it is not clear beforehand which frames do work. Additionally, frames do not always point behaviour into the loss-averse direction.

A possible explanation for the limited presence of loss-averse behaviour is the complexity of the decision. While we distinguished different frames in our study, a decision maker has to incorporate all frames simultaneously.

The findings of this article do not contest conclusions of prospect theory, but they do ask for more ‘real life’ experiments to see whether the findings of experimental research do also match complex real life. A related question resulting from this research concerns the impact of frames. Within an experimental research the frame is given, as was discussed in the Asian disease example, but in real life people have to deal with multiple, more or less visible frames. While some frames might lead them to more loss-averse behaviour, others might encourage speculation. Further research would require not only a focus on the interaction between framing and decision making, but also on the interaction between multiple frames and decision making.

What certainly could be concluded from our study is that policy measures are more dominant frames as compared to macro economic features and business cycle movements. Diving a bit deeper into the effectiveness of policy measures brings us to another issue for further research. The 2008 policy measure has a significant influence on the leading types of mortgages. However, it is also mentioned that financial institutions could benefit from this measure as the savings are no longer exclusively offered by insurance companies, but also by banks. This could have provided the banks with extra financial incentives to offer these kinds of mortgages. Further research is needed here.

A final remark can be made about the status of prospect theory. While prospect theory has profiled itself as a descriptive theory, it also has the potential of becoming normative. Within the housing market, loss-averse behaviour is desirable. This behaviour does not rise automatically, neither is it apparently enforced by macroeconomic features or business cycle movements. If framed in an appropriate way, policy measures might encourage contra-cyclical behaviour. So, if we think loss aversion is beneficial, and if we want to reduce underwater mortgages in the future, we should nudge ourselves to this kind of behaviour. Policy measures seem to be most fruitful nudges so far.

## Tables

Table 1: SUR Estimation results for the three equations in (5). Estimated standard errors are in parentheses. 5% significant parameters are presented in italic and boldface. The variables concern the percentage market share in terms of monetary value.

Dependent variable (Logs of market shares minus log of benchmark market shares)					
Variable	Pro-cyclical		Contra-cyclical		Hybrid
Intercept	<b>2.097</b>	<b>(0.201)</b>	<b>2.228</b>	<b>(0.167)</b>	-0.182 (0.208)
Lag 1 of (log) own share	<b>0.739</b>	<b>(0.076)</b>	<b>0.731</b>	<b>(0.153)</b>	0.038 (0.103)
Lag 2 of (log) own share	<b>0.231</b>	<b>(0.075)</b>	0.211 (0.148)		0.093 (0.100)
Lag 1 of (log) benchmark share	<b>-0.151</b>	<b>(0.033)</b>	<b>-0.151</b>	<b>(0.033)</b>	<b>-0.151</b> <b>(0.033)</b>
Lag 2 of (log) benchmark share	<b>-0.145</b>	<b>(0.033)</b>	<b>-0.145</b>	<b>(0.033)</b>	<b>-0.145</b> <b>(0.033)</b>
Change in growth rate GDP	0.022 (0.079)		0.014 (0.078)		-0.004 (0.063)
Change in inflation	0.042 (0.155)		0.071 (0.153)		0.0166 (0.123)
Change in interest	0.344 (0.241)		0.278 (0.237)		-0.186 (0.191)
Policy measures (dummies)					
1992	-0.075 (0.172)		-0.213 (0.164)		<b>-0.554</b> <b>(0.135)</b>
1997	-0.023 (0.136)		-0.116 (0.137)		-0.123 (0.149)
2001	0.056 (0.144)		0.066 (0.143)		-0.118 (0.115)
2004	<b>1.536</b> <b>(0.158)</b>		<b>1.520</b> <b>(0.156)</b>		<b>-0.811</b> <b>(0.133)</b>
2008	<b>0.420</b> <b>(0.129)</b>		<b>0.540</b> <b>(0.136)</b>		0.065 (0.138)
R-squared	0.910		0.814		0.028

Table 2: SUR Estimation results for the three equations in (5). Estimated standard errors are in parentheses. 5% significant parameters are presented in italic and boldface. The variables concern the percentage market share in terms of monetary value.

Dependent variable (Logs of market shares minus log of benchmark market shares)

Variable	Pro-cyclical		Contra-cyclical		Hybrid	
Intercept	<i><b>1.969</b></i>	<i>(0.316)</i>	<i><b>1.741</b></i>	<i>(0.291)</i>	0.325	(0.239)
Lag 1 of (log) own share	<i><b>0.804</b></i>	<i>(0.103)</i>	<i><b>0.777</b></i>	<i>(0.211)</i>	0.040	(0.090)
Lag 2 of (log) own share	<i><b>0.268</b></i>	<i>(0.101)</i>	0.140	(0.208)	0.121	(0.089)
Lag 1 of (log) benchmark share	<i><b>-0.127</b></i>	<i>(0.031)</i>	<i><b>-0.652</b></i>	<i>(0.065)</i>	<i><b>-0.652</b></i>	<i>(0.065)</i>
Lag 2 of (log) benchmark share	<i><b>-0.109</b></i>	<i>(0.031)</i>	<i><b>-0.189</b></i>	<i>(0.063)</i>	<i><b>-0.189</b></i>	<i>(0.063)</i>
<u>Growth rate GDP</u>	-0.002	(0.028)	0.004	(0.029)	-0.030	(0.022)
<u>Inflation</u>	<i><b>-0.227</b></i>	<i>(0.078)</i>	<i><b>-0.227</b></i>	<i>(0.081)</i>	0.093	(0.060)
<u>Interest</u>	<i><b>0.176</b></i>	<i>(0.036)</i>	0.161	(0.034)	-0.048	(0.025)
Policy measures (dummies)						
1992	0.101	(0.186)	0.114	(0.184)	<i><b>-0.668</b></i>	<i>(0.133)</i>
1997	0.217	(0.149)	0.191	(0.166)	-0.250	(0.133)
2001	0.184	(0.188)	0.214	(0.199)	-0.285	(0.150)
2004	<i><b>1.356</b></i>	<i>(0.205)</i>	<i><b>1.366</b></i>	<i>(0.212)</i>	<i><b>-0.504</b></i>	<i>(0.171)</i>
2008	<i><b>0.742</b></i>	<i>(0.158)</i>	<i><b>0.879</b></i>	<i>(0.175)</i>	0.026	(0.138)
R-squared	0.912		0.815		0.158	



## Figures

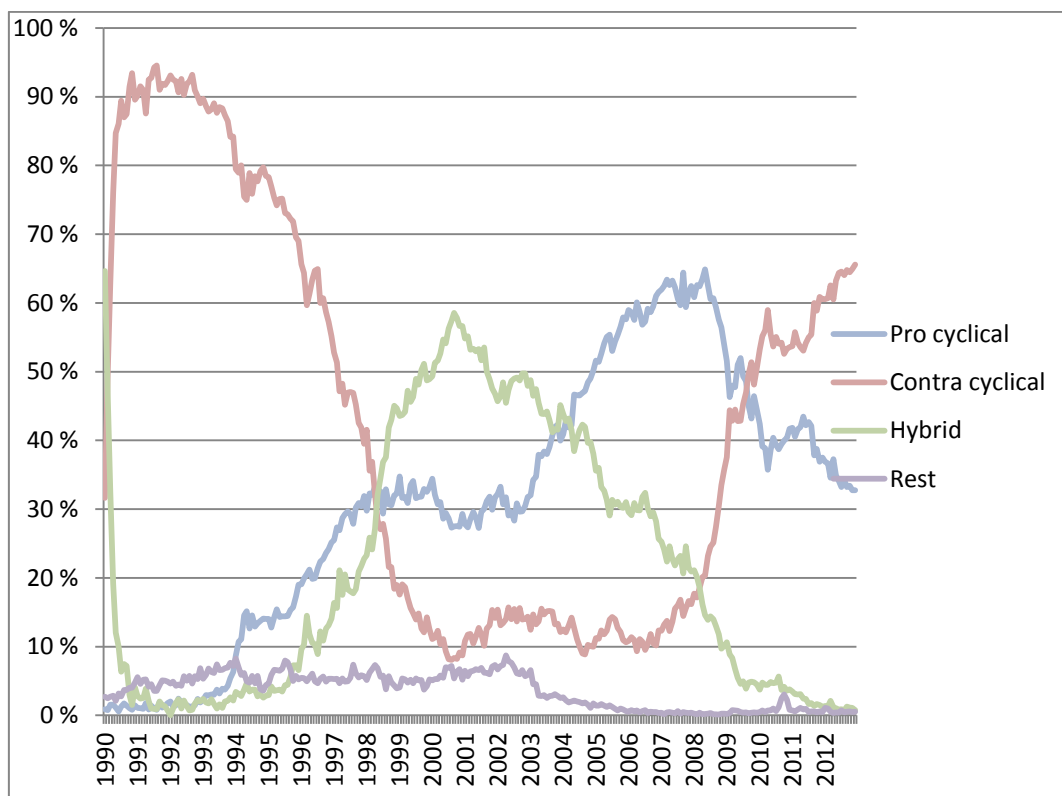


Figure 1: Overview of mortgages market shares in terms of monetary values (Source: Blauwtrust group)

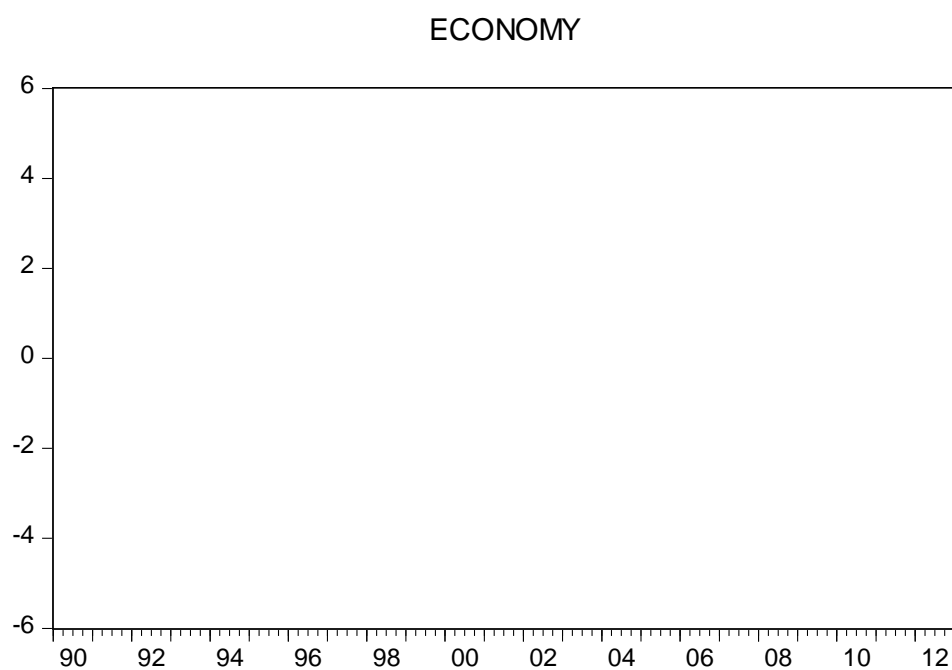


Figure 2: Monthly growth in GDP (when compared with last year, same month)

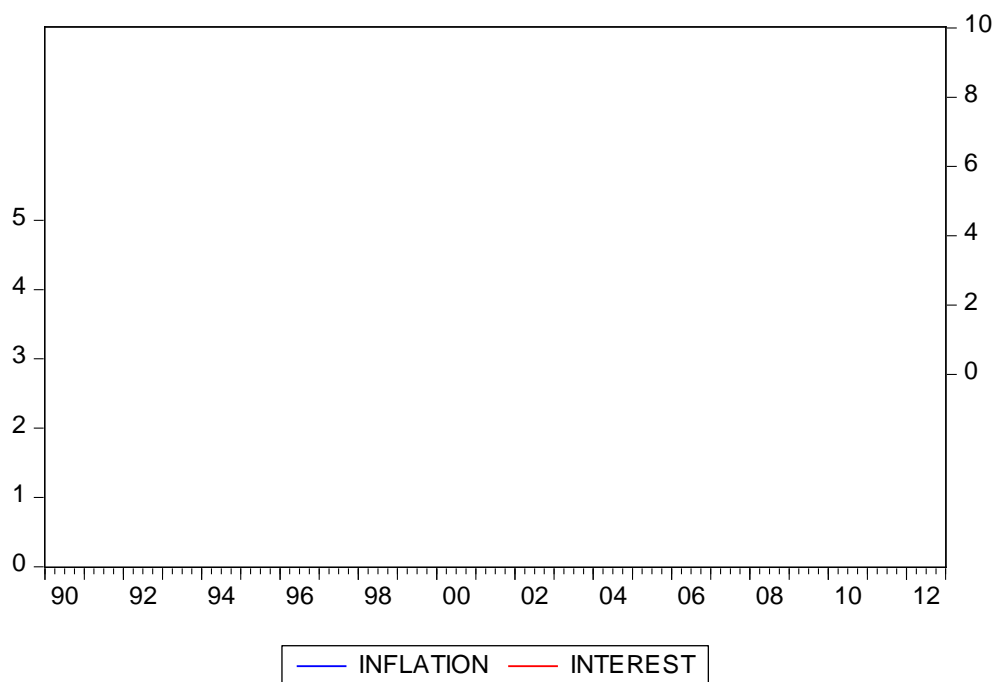


Figure 3: Inflation (source: Thomson Financial & National Source, Year-on-year change CPI reflects changes compared with previous year) and Interest rate (source: CBS refi rate until 1998, 1999-2012 Eurostat)

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