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\* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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# Reform of the mortgage interest tax relief system, policy uncertainty and precautionary savings in the Netherlands

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## Abstract

We examined the mortgage interest tax relief (MIR) system in the Netherlands and reforms to this system, based on answers to direct questions in survey data for the period 2010-2012. As well as tracking individuals over time and at strategic moments in the process of the policy reform, this unique data set allowed us to isolate the effect of policy uncertainty on precautionary savings and, therefore, on consumption. We found that policy uncertainty alone could increase household buffers in the form of net worth. We estimate that this uncertainty *ex ante* induces households to increase their net worth by around 6% (EUR 8,000 on average). Although a MIR reform could mitigate this effect on accumulated savings, we also show that reforms that are not credible *ex post* could exacerbate rather than mitigate the effect on precautionary savings.

*Keywords:* precautionary savings, income uncertainty, mortgage interest policy reform

*JEL codes:* D12, D91, E21

## 1. Introduction

Summer 2012 saw the sharpest drop in house prices in the Netherlands, with prices falling in July by around 8% relative to 12 months earlier. The numbers of transactions and approved mortgages had never been so low, and no signs of recovery have yet emerged. The obvious repercussions that this situation has for the mortgage market and, therefore, for banks, is undermining financial stability. This situation is the result of many factors: the general crisis, specific features of the heavily regulated Dutch housing market, fiscal incentives and the tightening of the mortgage eligibility rules.

One frequently mentioned explanation for the current stagnation on the housing and mortgage markets is uncertainty. Prices are dropping because uncertainty is preventing prospective buyers from entering the market, even those whose liquidity is not constrained. A link has been established in literature between income uncertainty and consumption (Browning et al 1996), and this can easily be extended to include the consumption of housing services. Uncertainty about future outcomes is neither new nor special. However if the fiscal treatment of mortgages heavily affects future income, these fiscal policies may be partly responsible for the slowing down of the housing market (due to reduced expenditure).

We have identified two reasons for the link between income uncertainty and the mortgage market. The first is the feeling of general uncertainty, which may be exacerbated in times of crisis (in other words, will I have enough income to pay my mortgage?), while the second depends on the effect that individuals expect the worsening of the economic outlook to have on the fiscal treatment of their mortgage (in other words, will I still get the same tax refund on my mortgage interest if the tax system is reformed?). In addition, so many policy changes have been proposed and implemented (sometimes even temporarily) that many people now expect further and continuing intervention on the housing and mortgage markets, thus further increasing the sense of uncertainty. These proposals have often promised radical abolition of the tax relief on mortgages, while at the same time promising to grant exemptions for mortgages and incomes below certain thresholds.

In this study we claim that the uncertainty surrounding the housing market also translates into income uncertainty, while the channel linking these two variables in the Netherlands is the generous system of mortgage interest relief.

The subject of policy uncertainty has often been researched by macro and environmental economists. Pastor et al (2012), for example, reviewed studies on the role of policy uncertainty in determining stock prices and presented a theoretical model. Less empirical research, however, has been conducted at a micro level.

Our research focused on the effect of policy-related uncertainty on the behaviour of potential or current home-owners and on how to separate this from the effect of standard uncertainty. The study explored the effects that the uncertainty about the possible reform of the mortgage interest relief system is currently having on savings in the Netherlands. Our research questions were twofold: What is the

effect of policy uncertainty on savings and, consequently, consumption? And if an *ex ante* effect is found, has the new policy reduced uncertainty and savings *ex post*?

### *1.1 Some institutional details*

The Netherlands is one of the few countries (other countries include Switzerland, Italy and the US) where all interest paid on a mortgage loan is deductible from taxable income and so translates into a substantial tax refund. The amount of this refund depends on factors such as the marginal tax rate, meaning that its benefit increases in line with income and the amount of the mortgage<sup>1</sup>. The fact that high amounts are at stake could prompt a response from risk-averse consumers. We chose to focus on the Netherlands in this study as we had previously conducted special surveys for this country at various strategic moments during the reform process, and also because the Dutch MIR is particularly generous by international standards.

Faced with the high costs of these programs and some negative externalities (Glaeser et al 2003), the Dutch government introduced some limitations to the MIR system over time. The recession in the late 1980s and early 1990s resulted in the MIR being limited to a maximum of 30 years. Various reforms have been proposed since then, and sometimes even implemented. However the process has been slow and it generated considerable uncertainty. Although further reforms seemed inevitable, and indeed many lobbies were initiated (see BOX 1), it took another 20 years, spring 2012, before any substantial reform of the system was seen. The government agreed to abolish the MIR for new interest-only mortgages. However, comprehensive reform of the housing market (including the heavily regulated and often subsidised rental market) was not addressed until the government's autumn 2012 plans. These followed on the September 2012 elections, and are planned to be implemented from 1 January 2013.

Over time, the possible reform of the MIR system created uncertainty about consumers' future income as the details of the reform remained unclear. This uncertainty could affect savings behaviour (Guiso et al., 1992). Our research question is consequently relevant because it helps to understand how policy uncertainty can depress consumption and economic growth with it and what can be done to mitigate

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<sup>1</sup> The highest tax rate in the Netherlands is 52%. This means that someone paying EUR 18,000 mortgage interest a year (which is a normal amount for a standard house valued at around EUR 350,000) could receive a monthly tax refund of around EUR 800, which is almost as high as social assistance benefit!

this effect. The paper is structured as follows: Section 2 outlines our strategy, while Section 3 describes the data and how it is processed and leads to usable proxies of the interesting variables. Section 4 presents the empirical model, while the results are discussed in Section 5. Section 6 explains how the reforms implemented ultimately affected uncertainty, and our conclusions are set out in Section 7.

**BOX 1: Policy discussion prior to 2012 elections: Housing market 4.0, the direct effect of the housing market reforms on income.**

The four relevant social partners (i.e. representative of home owners, housing associations, real estate agents and tenants associations) in May 2012 agreed on a common platform for reforming the housing market.<sup>2</sup> They called their agreement “*Wonen 4.0*” (Living 4.0) because of the four parties involved. The proposal was adopted by various political parties in the run-up to the elections; it links the MIR system to income policy and essentially proposes the following:

- Gradually phasing out the MIR system over a period of thirty years, during which higher mortgage costs will be offset by lower income tax rates, a reduction in the imputed rent and the abolition of transfer tax on property sales;
- Rents below the market level will gradually be increased, with higher rents being offset by lower income tax rates. This will lead to a more balanced relationship between rents and the quality and value of properties;
- A residential supplement will be available for lower and lower middle incomes with a rental or resale property.

The above represents the final stage of the debate initiated before the 2010 elections.

## 2. Strategy and policy environment

DHS (see below) has monitored the uncertainty about MIR reform since 2003. Figure 1 summarises the evolution of this uncertainty over time. The figure shows that after the 2003 political elections, 56% of the sample believed the MIR system would be reformed within 10 years. The situation remained largely unchanged after the November 2006 elections, with the DHS 2007 measurement for this period ending up at around 62%. This was a period of political instability as both elections followed a premature fall of the government. The unchanged uncertainty shown in Figure 1 may reflect the assumption that MIR reform would occur only in the event of a

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<sup>2</sup> Retrieved from: <http://www.aedesnet.nl/content/artikelen/achtergrond/unknown/dossier-woningmarkt/docx-2012/Wonen-4-0-in-het-kort.xml>.

stable majority. From then on, according to respondents, the likelihood of reform increased. A new DHS measurement, and our first separate survey, was conducted around election time in 2010 and found that 76% of respondents were expecting MIR reforms within ten years. This is the primary period on which we focused our study.

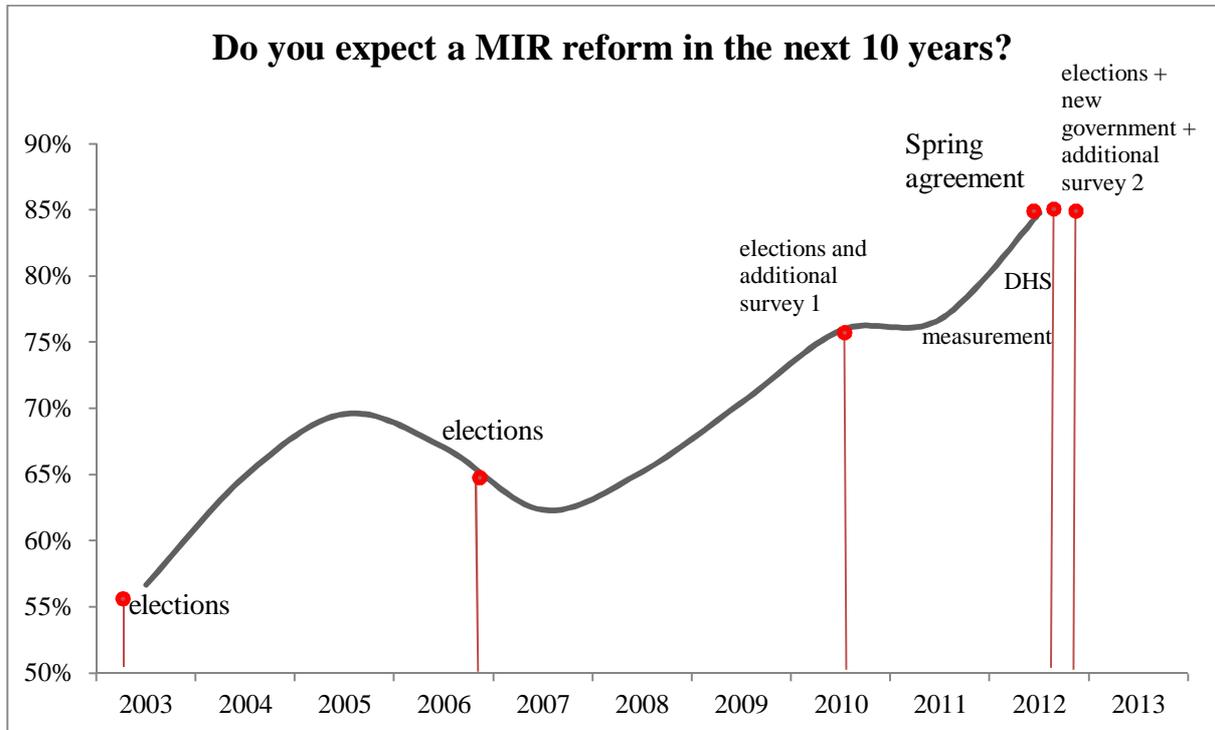


Figure 1: Source: DHS

Two years later and a few weeks before the latest reform was first announced,<sup>3</sup> the 2012 DHS measurement was conducted. This revealed that around 85% of respondents now believed in the possibility of MIR reform. The latest elections were held in September 2012, and a few weeks later the MIR reform was announced. We completed our final separate survey at the end of that week.

Our strategy was to use the high level of uncertainty about a limitative reform of the MIR system prior to the 2010 elections. This uncertainty is reflected in Figure 2, which shows the results of the exit polls in terms of Parliamentary seats at the beginning and end of the week in which we sent out the questionnaire. That was also the week in which the results of the political elections were published, as also depicted in the chart.

<sup>3</sup> This is shown in the graph as the Spring Agreement, an agreement reached between the government and opposition at a time when new elections were already being planned.

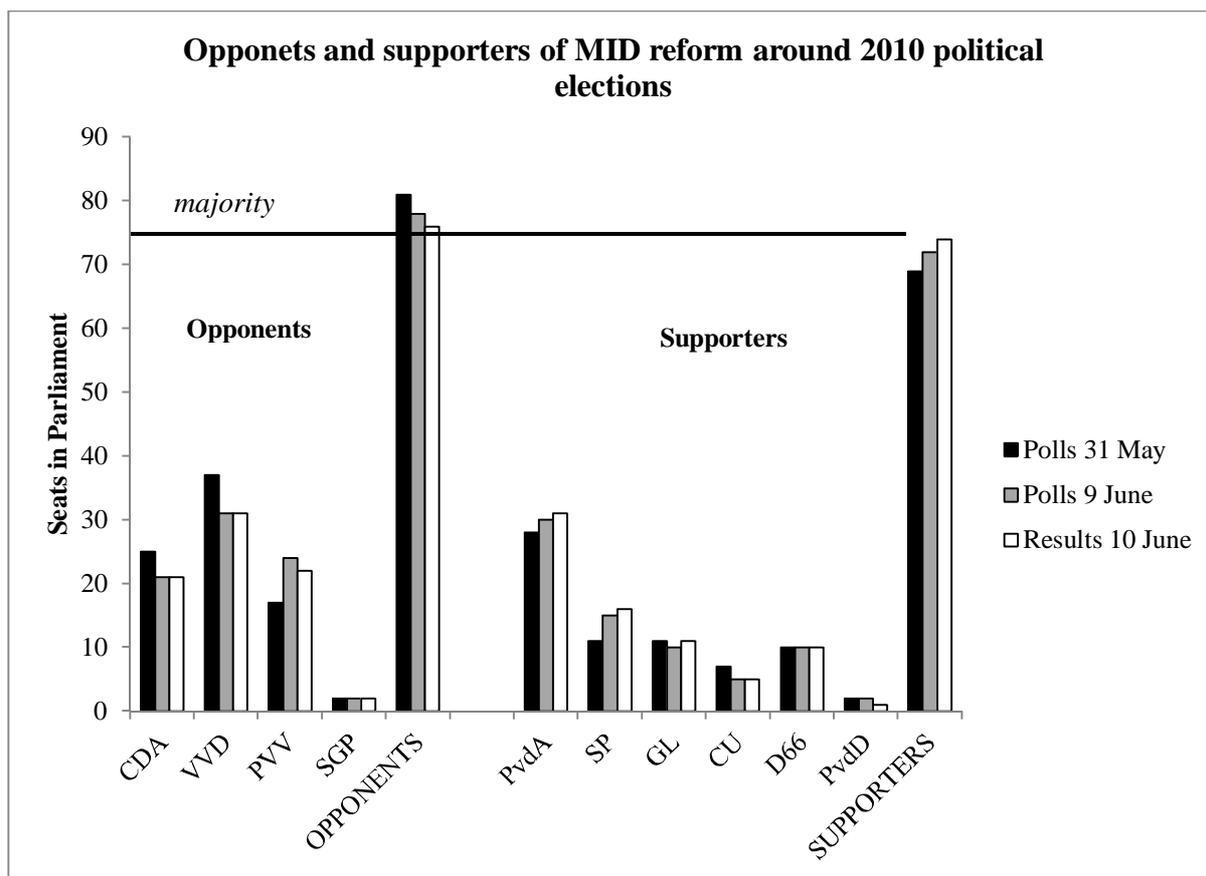


Figure 2: Opponents and supporters of the MIR reform prior to 2010 elections.

The above graph separates opponents and supporters of MIR reform and shows that each side represents about half of the seats in Parliament. It was therefore highly uncertain at the time of the survey whether the new coalition would implement a reform (or at least more uncertain than in 2012, when more parties had announced plans to reform the MIR).

During our separate survey in 2010, we asked a representative sample of the Dutch population about their uncertainty about the value of their homes in general, if no reform were to be implemented. Next, we confronted our respondents with one of the three randomised, hypothetical and simplified reform scenarios that the Dutch Social Economic Council had recently proposed to Parliament (see BOX 2) and asked them several questions about MIR reform (see below). We then asked them again about their housing value uncertainty assuming one of the hypothetical scenarios was to be implemented. We took the difference in uncertainty between the first and last answer as a proxy for the additional uncertainty attributable to the prospective policy reform.

Using the data collected during the week after the 2012 reform was announced, we sought to establish whether the reform was felt to be credible and whether respondents expected to change their savings behaviour as a result of the new policy.

### **BOX 2: Hypothetical reform scenarios**

Three hypothetical reform scenarios:

- The current 52% mortgage interest relief will gradually be reduced to 30% for new and existing mortgages in small steps of 1%-point per year.
- Mortgage interest relief will be allowed in 2015 on mortgage loans up to a maximum of EUR 500,000. The relief will then be reduced to EUR 250,000 in steps of approximately EUR 11,000 each year. For both new and existing mortgages, interest on loans above EUR 250,000 will then no longer be tax-deductible.
- In 22 years' time, the primary residence and the mortgage will receive the same fiscal treatment as disposable wealth. In other words, the interest relief will amount to 30% after 22 years. Mortgage interest of 4% will be assumed (irrespective of the actual interest rate). The imputed rent will be abolished by then, with housing wealth taxed in the same way as savings and investments (i.e. an effective wealth tax of  $30\% \times 4\% = 1.2\%$ ). This will apply both to new and existing mortgages.

### *2.1 Literature*

We chose to use savings as the dependent variable because non-durable consumption was not available in our data. Empirically, this has also been investigated by Caballero (1991), who introduced uncertainty into the income process (by assuming a random walk) in an overlapping generation model. Carroll and Samwick (1998) used a similar model to estimate the 'buffer stock model' in a reduced form. With simulations based on a CRRA (constant relative risk aversion) utility consumer, they found high correlation between the target wealth to income ratio and income uncertainty. The empirical estimations of Kazarosian (1997) and Mastrogiacomo and Alessie (2012) confirmed these results. Using different measures of uncertainty and different data sets, they showed that the share of precautionary savings attributable to income uncertainty ranges between 30% and 46% of net worth, and is therefore substantial in relative terms. These studies used panel data (such as the Panel Study of Income Dynamics, the National Longitudinal Survey and the DHS) to determine the measure of income risk (e.g. variance of income). Guiso et al. (1992) and

Mastrogiacomo and Alessie (2012) investigated people's actual responses by asking direct questions about their future income. The first of these studies established the share of total savings that could be attributed to individual earnings uncertainty by regressing the log of the wealth to income ratio on the subjective earnings variance, while the second study looked at household income uncertainty and the subjective uncertainty about future household income expressed by both household members.

## *2.2 Contribution*

The studies referred to above investigated only the subjective anticipation of income changes when institutions remain constant. We have added to the literature by introducing an extra dimension to income uncertainty. We isolated one specific source of uncertainty, while previous studies had taken only one total measure of uncertainty into account. Income uncertainty may stem from a range of different perspective events, including perceived unemployment risk, health deterioration, family circumstances, and so on). Isolating uncertainty about fiscal policy is important because policy makers can take action to reduce this (by adopting credible reforms for instance), whereas they are typically unable to reduce uncertainty relating to personal circumstances. Literature to date, however, has been silent on the specific effect of income uncertainty on precautionary savings when this stems from an insecure policy environment. This is because uncertainty is normally regarded as a general concept relating to lack of knowledge about future outcomes and is not broken down into its underlying components.

But why should uncertainty about house prices signal income uncertainty in a changing policy environment? There are two reasons to expect a link between policy-related uncertainty and the actual or forecast value of a house. Firstly, a restricted reform of the MIR system results in less generous tax relief for specific groups. This means that their mortgage costs rise, leaving them with a lower disposable income and capacity to purchase a house and resulting in falling house prices and housing-market stagnation. In this case, uncertainty about house prices (due to the prospective reform) is a signal of uncertainty about incomes. Secondly, increases or decreases in housing wealth affect future income if people are planning to annuitize housing wealth later on in life. In this case, uncertainty about house prices is a signal of a wealth effect on future income.

It is only at first sight, therefore, that the decision to use price uncertainty as a proxy for uncertainty about the fiscal treatment of the MIR may seem unintuitive. Most of all the attractiveness of this proxy is its simplicity, as respondents are more familiar with house prices than tax rules.

We have built on Carroll and Samwick’s method by including a term for income uncertainty, as well as adding a term for subjective housing wealth uncertainty attributable to MIR reform. This study consequently follows the reduced form approach, while adding to the empirical method used in earlier research by specifying separate sources of uncertainty. In the appendix we have also outlined a theoretical example justifying the reduced form approach.

### 3. Data and descriptive statistics

We used the DHS data to carry out our analytical strategy. This is a panel dataset (unbalanced) for the period 1993-2012, sponsored by the Dutch Central Bank. For the years 2010 and 2012, we used an extension to this survey that includes additional information about the housing market. Each year the survey covers around 1500 households.<sup>4</sup> We used the entire panel in order to define income variance and permanent income. We adjusted for inconsistencies in order to prepare the data for use. Table 1 shows the data selection process.

<i>Table 1. Data selection</i>	<b># of obs left</b>
<b>Process</b>	
Raw data	66295
Inconsistent indicator of “head of the household”	66189
Gender or age inconsistencies	65855
From individual data to household data.	37583
Missing item - non-response on crucial variables	37109
Elimination of time gaps	34419

**Explanatory note:** Data are inconsistent if, for instance, individuals age by more than one year in each consecutive wave, or when adjacent waves are more than one year apart.

Some steps in this process are worth mentioning. There is a natural drop in point observations when transforming the sample from individual-based to household-based data. The elimination of time gaps resulted in our losing observations as these gaps could have biased our proxy of permanent income (the sampling procedure allowed

<sup>4</sup> See Els et al (2003) for a more extensive description of the survey.

households to return into the survey after having dropped out for one or more waves). The overall loss in information was limited.

### 3.1 Descriptive statistics

We first focused on the home ownership rate as an indicator of housing wealth. Home ownership in the Netherlands has some features peculiar to this country. Figure 3 shows the homeownership rate by age and year-of-birth cohort.

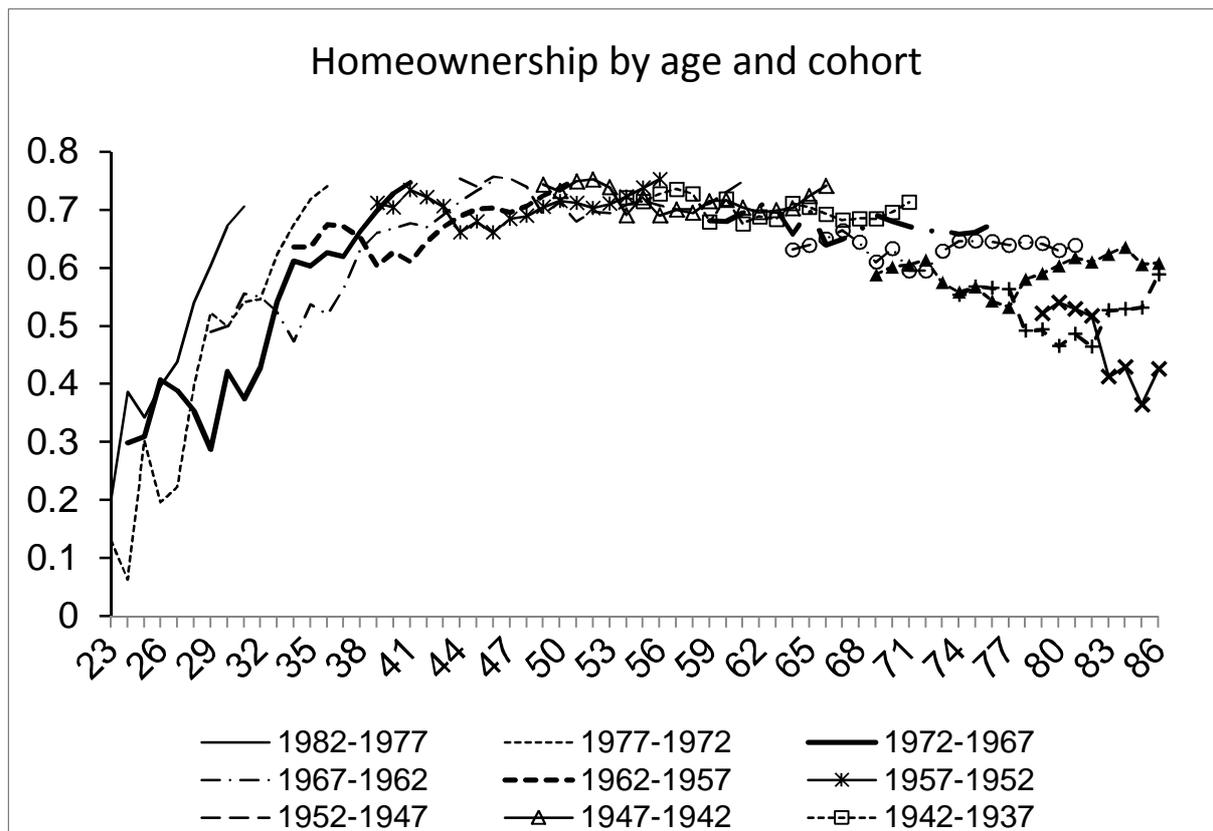


Figure 3. Source: DHS

We used five cohorts, with the oldest cohort born between 1912 and 1917, and the youngest cohort between 1977 and 1982. This cohort, together with the previous one, born in the years 1972-1977, shows a remarkably steep slope in ownership. This could indicate that prices have been sustained by demand in this group, mostly first-time buyers. This is relevant to point out because the announcement of the 2012 reform made it clear that the MIR would change only for first-time buyers. For each segment, we had data from 1993 to 2012 at our disposal, which was sorted by the age of the various cohorts. The vertical distance between two adjacent segments in

the chart reflects the differences between cohorts. This path is the result of two effects that are difficult to isolate: time-age effects (which can be observed along each segment, where homeownership increases at a young age and stays almost constant at later ages) and time-cohort effects. The overall curve has a hump shape, which indicates that home ownership increases up to around the age of 60, and gradually declines after that. The decline is mainly due to differences between cohorts. It is not common, for example, for older cohorts to own a house (see Van der Schoors et al, 2007). Some of the older cohorts (e.g. cohort 1927-1922) show an increase in home ownership; this may be attributable to selective mortality (of people living in rented properties). About 85% of home owners in the Netherlands have a mortgage. The MIR system consequently applies to a majority of the Dutch population, spread across the various cohorts.<sup>5</sup>

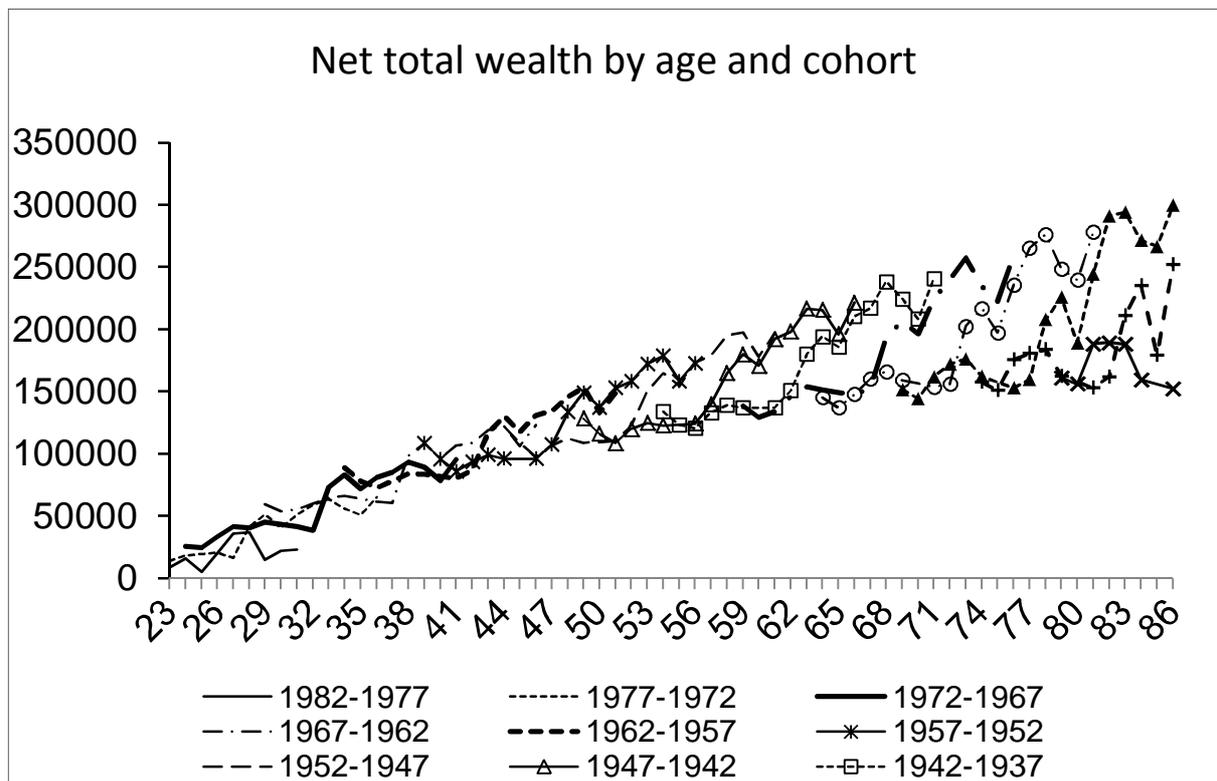


Figure 4. Source: DHS

In order to construct a measure of total wealth, we added total financial wealth (including balances on current and saving accounts, business accounts, deposits and savings certificates, stocks, bonds, mutual funds and other assets) and

<sup>5</sup> Statistics Netherlands reported there to be approximately 4.2 million owner-occupied households and 3.7 million households with a mortgage in 2012.

total non-financial wealth (including housing wealth, durables and secondary properties), and subtracted total debt (residual mortgages, overdrafts, credit card debts and study-related and other debts).

Figure 4 shows the total wealth for the different cohorts. Wealth increases with age, the cohort-time differentials are relatively larger for the older cohorts than for the younger cohorts. This may be attributable to the selection and/or length of the accumulation process. Total ealth in our estimating sample was about EUR 130,000.

### 3.2 Descriptive statistics – data extensions

This section describes the information in the two separate datasets that were collected around the time of the elections in 2010 and 2012. Elections have to be held every four years, but on these occasions they were held early due to political crises.

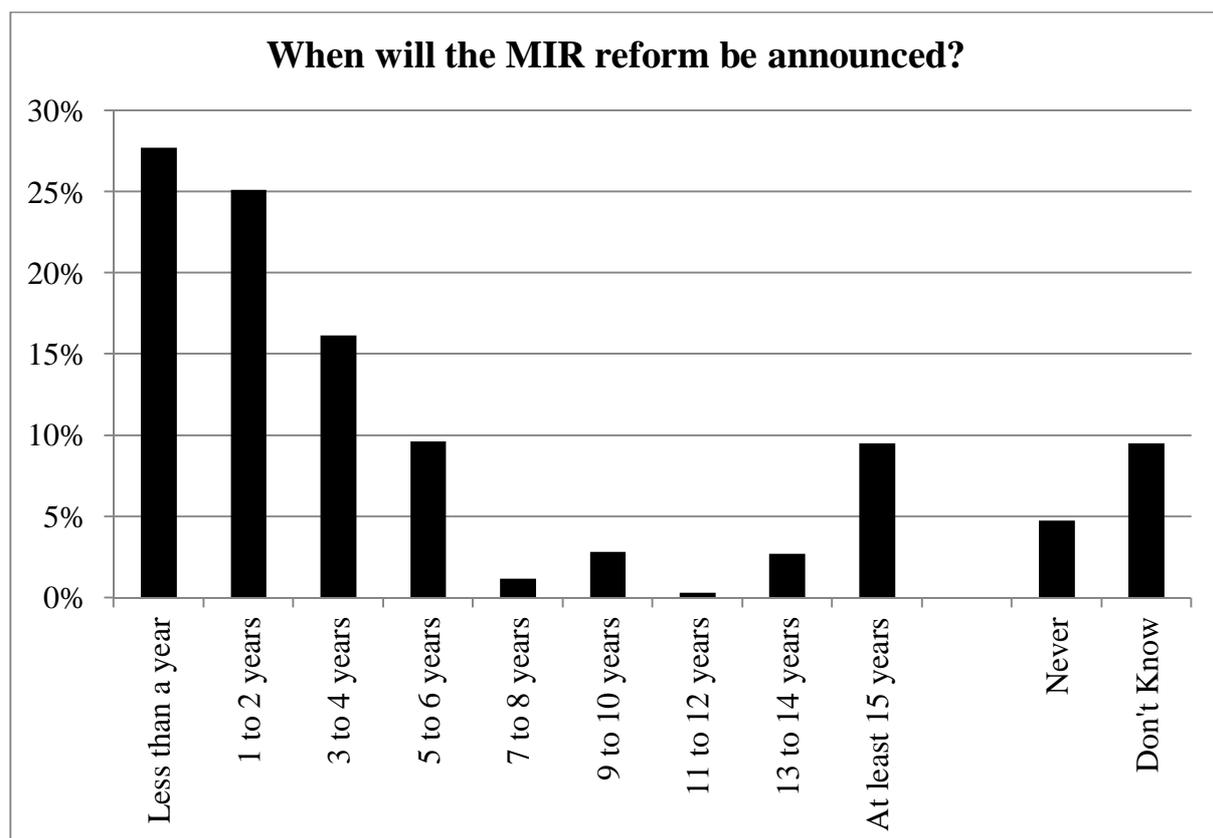


Figure 5. Source: DHS

The most recent crisis was bridged by a new coalition agreeing to changes in the MIR system for new entrants to the mortgage market (see the earlier reference to the Spring Agreement).

The 2010 data are the most relevant to our analysis and are described first. The initial questions concerned risk perceptions. These were used to check the understanding of the (disposable) income risk embedded in the mortgage choice<sup>6</sup>.

Most respondents indicated that they thought that the Dutch government would announce a reform of the MIR system within two years, (see Figure 5). Figure 6 shows that most respondents thought that the MIR system would be reformed within five to six years. These results indicate that housing wealth uncertainty may affect precautionary savings since only a few respondents indicated that they thought that the MIR system would never be reformed.

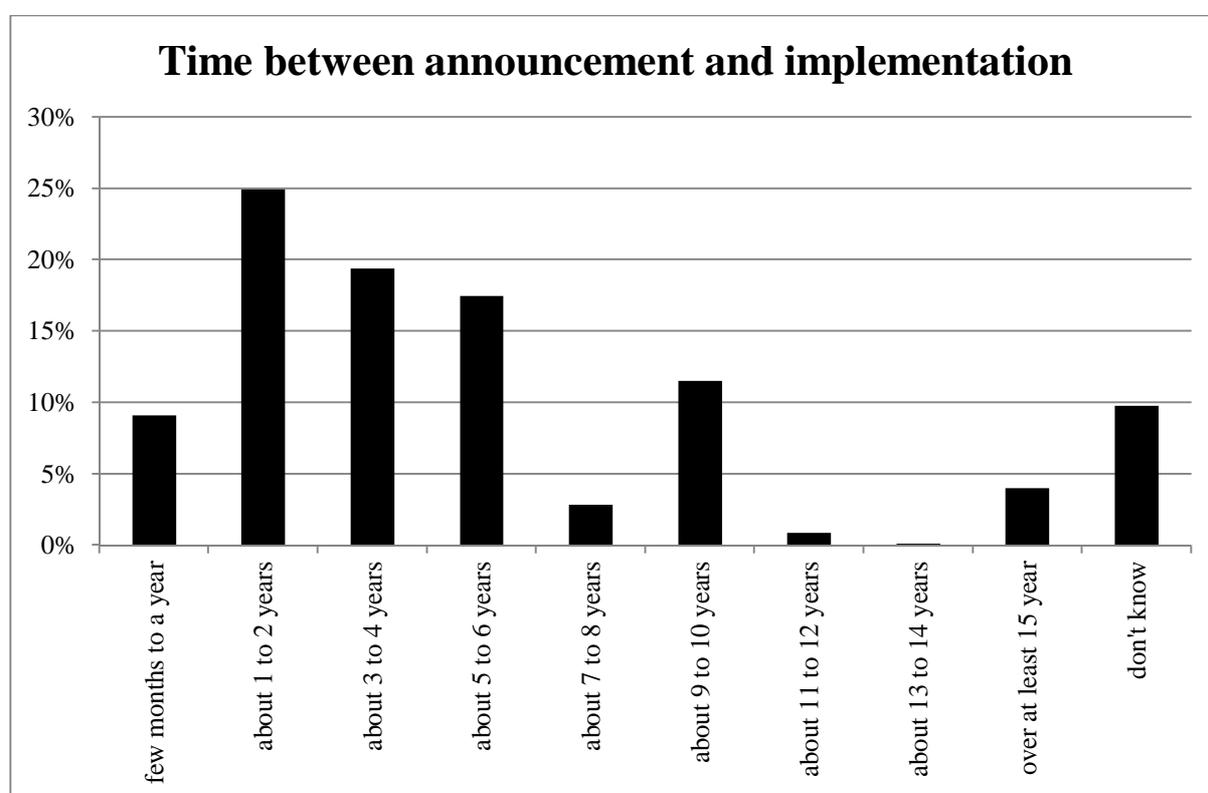


Figure 6. Source: DHS

In the second section of the 2010 questions, respondents were asked how they thought that the MIR would be reformed. Their answers are reported in Figure 7. More than half (54%) of the respondents indicated that they thought that the MIR

<sup>6</sup> Approximately 65% (20%) of the respondents characterised their mortgage as hardly risky or not risky at all (somewhat risky or risky). In this group 10% had an investment-linked mortgage and 21% had a savings or endowment mortgage, neither of which are entirely risk-free, while 46% had an interest-only mortgage. Although the latter may not seem risky upfront, it involves a higher risk from a life-cycle perspective if people postpone repayment. There is also evidence that some higher-risk mortgage characteristics were correctly perceived. Respondents indicated that they perceived a high LTV (loan to value), a high LTI (loan to income) and a mortgage invested in shares as risky.

would be reformed for mortgages above a certain threshold, while 35% thought that the rates at which mortgage interest could be deducted from tax would be reduced, and approximately 38% believed that the MIR would be slowly phased out.

We also asked our respondents about their preferences and expectations. They indicated that some limitation of the MIR would be justified as it currently benefited homeowners with high incomes more than those with low incomes. They did not have a preference for capping the MIR system at a specific level rather than eliminating MIR, providing the revenues generated by eliminating it were used to reduce income taxes. Some 78% currently took no account of the possible limitation of MIR in their financial decisions, while only 18% of respondents stated that a 20% fall in house prices would cause them financial problems. One third would experience problems paying their mortgage if the MIR system were to be reformed in any of the scenarios described in BOX 2.

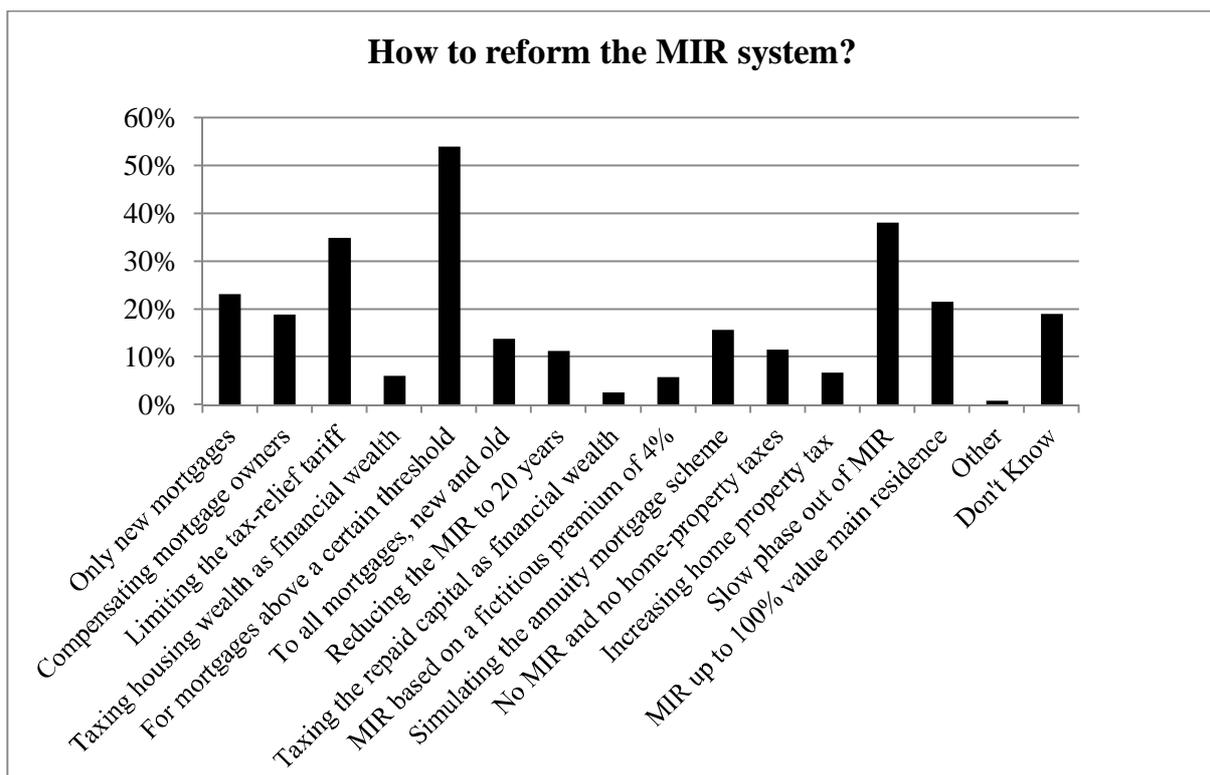


Figure 7: Source DHS

Figure 8 shows whether respondents planned to react to the reform of the MIR system. As the chart shows, most respondents (homeowners and tenants) would not change their behaviour since they were not constrained by their housing

expenses. Approximately 24% of our respondents indicated that they would change their behaviour. Only 5% of respondents would change their savings behaviour. This suggests that housing wealth uncertainty could be expected to have a minor effect on wealth accumulation.

#### 4. Precautionary savings

The descriptive statistics suggest that policy uncertainty has a limited impact on savings. Current savings incorporate both the uncertainty of those expecting a policy shift and those who do not. We will look at the share of precautionary savings when respondents are confronted with the two hypothetical situations with and without MIR reform. Among the variables needed in the analysis, a proxy for permanent income is based on the method by Kapteyn et al. (2005).<sup>7</sup>

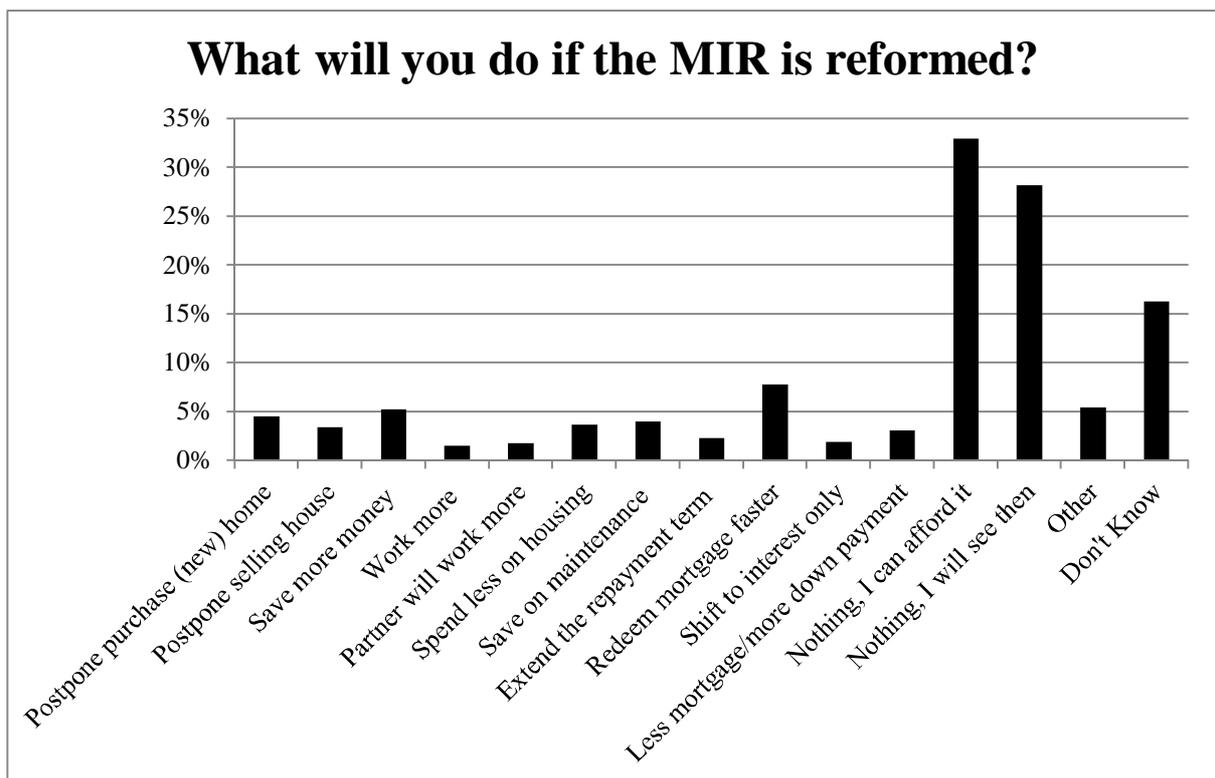


Figure 8. Source: DHS

<sup>7</sup> Eliminating the observations with missing values for permanent income reduced the sample size from 17904 to 16742 observations. The variance of log housing wealth also had missing values, which further reduced the sample size to 16329 observations.

The subjective expectation of housing wealth risk is only available in the data extension. This limits the empirical analysis to the year 2010 and limits the sample size to 830 households. We estimated the Carroll and Samwick (1998) model, and a more hybrid model proposed by Mastrogiacomo et al 2012. Both require wealth ratios on the left hand side, which we computed net of housing wealth.

#### *4.1 Subjective variance of housing wealth and the uncertainty about MIR*

Below, we will discuss how and why we link the information of future house prices to our data to changes in MIR and its reform.

To determine the subjective variance of housing wealth without a policy change, we used the answers to a question included in the additional 2010 survey:

*“Assuming the new government decides to leave the fiscal treatment of the mortgage on primary residences unchanged and reliefs, taxes and fees will stay the same. Please report in the table below how large you estimate the chance that the value of your home (for tenants, an average Dutch private home) will change in the next two years with the following percentages: 15% or more, between 5% and 15%, between -5% and 5%, between -15% and -5%, -15% or less.”*

We asked the question first and then discussed the policy options with the respondents. In order to determine the subjective variance of housing wealth in case of a policy change, we repeated the above question, asking the respondent to imagine a hypothetical MIR reform. The respondents were presented with one of the three possible reform scenarios in BOX 2, which were randomly assigned to different respondents<sup>8</sup>.

Respondents can answer the above questions by indicating one of the  $j = 1, f, 5$  alternatives in Table 2 and reporting the associated probability  $p_j$ . We used the middle point of each intermediate answer category as the expected change and the lower (upper) bound for the upper (lower) categories.

If precautionary savings are determined by income uncertainty, why would we ask a question about house price changes?

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<sup>8</sup> We investigated whether there were significant differences among randomized policy scenarios in terms of reported uncertainty, but we found no significant differences. We have therefore not distinguished between these different reform scenarios in the remainder of this paper.

Disposable income is equal to after tax income ( $y_{net}$ ) plus the MIR refund, uncertainty about after-tax income and the MIR refund determines precautionary savings. the employer pays out net income and the tax office pays out the MIR refund. These two terms could be considered independent in the sense that the MIR refund does not directly depend on current income. There is an indirect relation between the two as the per-period income level helps to determine the marginal tax rate, which is partly used in the MIR computation<sup>9</sup>. The largest component of MIR is determined by mortgage premiums. These depend on the principal (outstanding debt) times mortgage interest rates plus repayments, which do not vary with current income. The principal can vary periodically if the mortgage is increased or (partly) repaid. Mortgage interest rates fluctuate (about 20% of Dutch mortgages have variable interest rates, and 70% have fixed rates up to 10 years) and even the repayment level could be changed over time (shifting for instance from an interest-only to full repayment mortgages). It is not uncommon to change the terms of mortgage contracts based on unknown future outcomes. This makes the future levels of MIR uncertain. In addition to this known uncertainty, a system reform could also make future tax refunds uncertain. We have therefore treated the variance of net income and that of MIR separately (and additively).

*Table 2. Expected change in housing wealth*

<b>Answer category</b>	<b>Expected change of housing wealth (j)</b>
15% or more	15%
between 5% and 15%	10%
between -5% and 5%	0
between -15% and -5%	-10%
-15% or less	-15%

The variance of the relative changes in net household income and in MIR must be specified empirically. Thanks to our data we are able to elicit this novel. We claim that the response to our question on house price changes reveals the uncertainty about the MIR. This is definitely true for people planning to take out a new mortgage (for instance if they are ever planning to move), as they will be exposed again to current prices. It is less obvious that house price uncertainty is a valid indication of MIR for those who are planning to stay where they are. For them,

<sup>9</sup> There is no linear relationship between changes in income and changes in the marginal tax rate, which also depend on other factors (including wealth and income of other household members), with most respondents hardly changing their marginal tax bracket during their working life.

uncertainty about house prices does, however, affect the desirability and facility to change the principal. Van der Schoors et al (2007) have documented the massive cashing in of home equity by older people in the 1990s. With falling house prices, current generations cannot expect to do the same and will be more uncertain about their capacity to extract value from their homes in the future.

We could have asked respondents after their uncertainty about their MIR directly, but this would have excluded tenants (who have now been asked about house prices in general) and those who do not have sufficient knowledge of the tax system. The simplicity of the question has a clear advantage. Besides, we were not interested in the level of price uncertainty, but in its change as a result of a prospective hypothetical reform.

## 5. Empirical model

We defined the expected percentage change of housing wealth as  $\mu = \sum_{j=1}^5 p_j * j$ . The subjective variance of housing wealth percentage changes is expressed as  $\sigma_p^2 = \sum_{j=1}^5 p_j * (j - \mu)^2$ , while the variance in the level of housing wealth is  $\sigma_{hw}^2 = \sigma_p^2 * hw$ . There are several items-non-responses to the questions needed to the computations of  $\sigma_p^2$ . We can reconstruct those missing values for  $\sigma_p^2$  that could be set equal to zero<sup>10</sup>.

The starting point of our analysis is the buffer stock model developed by Carroll and Samwick (1998). Using simulations based on a CRRA utility function, they noticed that a reduced form model for savings could be estimated with a 99% fit. This model shows that the log of wealth divided by permanent income correlates with the variance of log income ( $varly = var(log(y_{net}))$ ), which is a proxy of uncertainty, and a polynomial in age<sup>11</sup>. Their model is expressed as:

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<sup>10</sup> We set  $\sigma_p^2$  to zero if the respondent is 100% certain about one of the  $j$  answer categories. It is also set to zero, if the variable is missing but the respondents answer the question: ‘How do you think that the economic situation will change over the next five years compared to the current situation?’ with ‘Will remain the same’. In the case of no reform of the MIR system, the remaining missing values are set to zero if the respondents answer the question: ‘When do you expect the Dutch government to announce that the mortgage relief system will be reformed?’ by ‘Never’ or ‘In more than two years’. In case of a reform of the MIR system, the missing values are set to zero if the respondents answer the question: ‘How much time do you expect there to be between the government’s announcement of the reform and the actual start of the reform?’ by ‘More than two years’. The Appendix shows descriptives for  $\sigma_p^2$ .

<sup>11</sup> The life cycle model postulates a non-linear relation between wealth and age.

$$\ln \frac{W_i}{Y_i} = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \text{var}ly + \beta_3 x_i + u_i \quad (1)$$

Note that  $\text{var}ly$  can be seen as a close proxy of the variance of the relative changes in net household income. If we define  $\alpha = \frac{\Delta y_{t+1}}{y_t}$  as the relative change in income between adjacent periods, it follows that:

$$\begin{aligned} \text{var}ly &= E_t (\ln y_{t+1} - E_t \ln y_{t+1})^2 = \\ E_t (\Delta \ln y_{t+1} - E_t \Delta \ln y_{t+1})^2 &\approx E_t \left( \frac{\Delta y_{t+1}}{y_t} - E_t \frac{\Delta y_{t+1}}{y_t} \right)^2 = \text{var}(\alpha) \end{aligned} \quad (2)$$

So far this model does not describe income uncertainty as a result of policy reforms. Without loss of generality we can slightly change equation (1) in order to accommodate for the information contained in our data and estimates:

$$\ln \frac{W_i}{Y_i} = \beta_0^a + \beta_1^a \ln(Y_i) + \beta_2^a \text{var}ly + \beta_3^a \sigma_p^2 + \beta_4^a x_i + u_i \quad (3)$$

$$\ln \frac{W_i}{Y_i} = \beta_0^b + \beta_1^b \ln(Y_i) + \beta_2^b \text{var}ly + \beta_3^b \sigma_{p,policy}^2 + \beta_4^b x_i + u_i \quad (4)$$

The log of total assets ( $W$ ) divided by the permanent income of the household ( $Y_i$ ) is explained by the variance log income, the variance of expected house price changes, household characteristics and an idiosyncratic error term. Our stand is that the difference in the mean effects based on  $\beta_3^b$  and  $\beta_3^a$  will return the additional share of precautionary savings due to policy uncertainty. Identification comes from the link between house price changes and changes in net income that we established above<sup>12</sup>. Table 3, shows our estimate of these models using both OLS (see also Guiso et al 1992) and instrumenting the variance of net income (see Lusardi 1997). The reason for resorting to an IV is that our the information could measure with error the level of life cycle income uncertainty. We elicited  $\text{var}ly$  using the income variance within

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<sup>12</sup> The Appendix includes an analytical example of how post reform income changes can generate precautionary savings.

the cluster, which is based on about four point observations for each household (the average stay in the panel is four years).

Table 3: Estimation results models with relative changes in income

	Model 1	Model 2	Model 3	Model 4
	OLS	OLS (policy reform)	IV	IV (policy reform)
Age	-0.035	-0.0257	-0.0577	-0.0478
Age <sup>2</sup>	0.0162	0.0135	0.0169	0.0137
Age <sup>3</sup>	-0.00127	-0.00103	-0.00108	-0.0008
Family size	0.643***	0.613***	0.512***	0.471***
Co-resident children	-0.512***	-0.488***	-0.470**	-0.440**
Varly	0.0642	0.0722	1.188**	1.247**
Log permanent income	-0.241***	-0.243***	0.21	0.227
$\sigma_p^2$	63.64***		75.12***	
Constant	1.919	1.803	-1.795	-2.093
$\sigma_{p,policy}^2$		87.48***		103.0***
N	830	830	830	830
R2	0.11	0.13	0.37	0.36
Mean % effect varly	1.35	1.52	22.3	23.27
Mean % effect $\sigma_p^2$ or $\sigma_{p,policy}^2$	12.4	20.16	14.47	23.29
Test of excluded instruments (F)			6.55	6.61

We used education as instrument for *varly* as this is related to unemployment that better incorporates income uncertainty in the medium term.<sup>13</sup> We used no instrument for  $\sigma_p^2$ , as it is not clear that it is needed, and we did not collect any instrument in the survey. The results are based on a small sample meaning that many background characteristics lack significance. The OLS estimates (Models 1 and 2) show no effect of *varly*, and an effect of  $\sigma_p^2$  that increases from about 12%<sup>14</sup>, based on no policy change to 20% of savings if MIR is reformed. If we instrument the variance term the mean effect increases and is significant (see also Lusardi 1997 for a similar result). Models 3 and 4 are therefore more in line with previous results in literature that report an effect of precautionary savings of between 30% and 50%.

<sup>13</sup> In the Netherlands labor contracts are binding at industry level and the wage trend is sometimes fixed for the next two or three years, leaving little room to wage uncertainty during the MIR-term. Hence, job losses and the subsequent drops in income are a better indicator of income uncertainty as unemployment benefits could vary in length between one and five years at the time the survey was held.

<sup>14</sup> We computed this mean effect as  $1 - 1/\exp(\beta_3 * \sigma^2)$ .

Here the effect is decomposed into two variance terms, which sum up to a total mean effect, all other things being equal, between 36% (Model 3) and 46% (Model 4). The main difference between these two models is the mean effect of  $\sigma_p^2$  that increases from about 14% when no MIR reform is envisaged to 23% if MIR is reformed. This is an increase of approximately 8% that appears to be significant also when we bootstrap it jointly to the estimation of the models (bootstrapped difference and standard error = 8.8 and 4.6; 100 replications). This suggests that savings increase by 8% if the uncertainty related to the implementation of the MIR reform is taken into account. This may seem a large effect, but it is conditional on having savings, which holds true for about 70% of the sample in 2010. If we extrapolate this, it suggests a decline in consumption of about 6%. Translated to levels, this means that cumulated savings would be about EUR 8,000 per household larger as a consequence of policy uncertainty. This average figure is only indicative and masks the same type of heterogeneity embedded in net worth.

In order to challenge this result, we slightly modified the models used in equations 3 and 4:

$$\ln \frac{W_i}{Y_i} = \beta_0^a + \beta_1^a \ln(Y_i) + \beta_2^a \text{varly} + \beta_3^a (\sigma_{p,MIR}^2) + \beta_4^a x_i + u_i \quad (5)$$

$$\ln \frac{W_i}{Y_i} = \beta_0^b + \beta_1^b \ln(Y_i) + \beta_2^b \text{varly} + \beta_3^b (\sigma_{p,MIR,policy}^2) + \beta_4^b x_i + u_i \quad (6)$$

Equations 5 and 6 differ from the models estimated above because these account for the variance of the level of MIR. We computed MIR (that is to say the tax refund); however lack of information on imputed rent (this is a tax concept that is available only for a small subsample) and marginal tax taxes, makes this information difficult to use. We proxy the variance in level of the MIR ( $\sigma_{p,MIR}^2$ ) using  $\sigma_{hw}^2/Y$ , where the denominator is a scaling to permanent income as in Guiso et al (1992) and Lusardi (1997). Uncertainty about future home equity is directly linked to uncertainty about future MIR and is easier to compute.

Though this is still a reduced form model, the change in the empirical model also refers to a shift in the underlying theoretical model. The Appendix shows that a CRRA utility function results in precautionary savings depending on the variance of

the change in income. Estimating the new models means shifting from a CRRA utility setting (which was at the base of the simulations of Carroll et al 1998) to a CARA utility function (for an analytical derivation see Mastrogiacomo et al 2012) where the variance of income levels is relevant. Note that only taking the variance in level for housing wealth and not in the income part, where we kept on using  $\text{var}ly$ , delivers a kind of hybrid model. We have tried to replace  $\text{var}ly$  using the variance in income levels (that returned non-significant results) and its log (that generated many missing values) but we present only results with the variance of log income here, which makes comparisons with the above models easier.

Table 5: Estimation results models with variance of housing wealth in level

	Model 5 no policy change	Model 6 policy	Model 7 no policy change	Model 8 policy
Age	0.090	0.146	0.133	0.175
Age <sup>2</sup>	-0.009	-0.021	-0.016	-0.026
Age <sup>3</sup>	0.0003	0.001	0.001	0.001
Family size	0.380**	0.284	0.371*	0.262
Co-residing children	-0.298	-0.185	-0.253	-0.145
Log permanent income	0.447	0.467	0.414	0.468
Constant	-6.302	-7.243	-6.746	-7.74
$\sigma_{hw,policy}^2$		1.925*		2.181**
$\sigma_{hw}^2$	1.537*		1.925**	
$\text{Var}ly$	0.633	0.446	0.254**	0.263**
N	830	830	830	830
R2	0.33	0.34	0.2	0.26
Mean % effect $\text{var}ly$	12.58	9.03	5.24	5.43
Mean % effect $\sigma_{hw}^2$	19.61	25.8	23.9	28.69
Test of excluded instruments (F)	3.41	3.41	2.55	1.69

As our measure of housing wealth is self-reported, with households typically overestimating home equity when prices increase, we instrumented it using regional house price percentage changes in 2009 and 2010 as reported by Statistics Netherlands. Table 5 above shows the results of these estimates. In Models 5 and 6 we instrumented both  $\text{var}ly$  and  $\sigma_{hw}^2/Y$ , while in Models 7 and 8 we only instrumented  $\sigma_{hw}^2/Y$ , which is a more comparable approach to the models in Table 4. Again, many background characteristics are not significant and comparisons of the

models including and not including policy uncertainty reveal a difference between the mean effects on savings in the same range as that estimated above (about 6.2% difference between Models 5 and 6 and about 4.8% difference between Models 7 and 8). These results need to be interpreted with caution since the F-statistic in Model 8 indicates a weak instrument (Staiger and Stock, 1997). When we checked the significance on these differences by jointly bootstrapping the difference (together with the model estimates), the latter also appeared not to be significant (standard error = 13.5).

### 6. Can we take away uncertainty about policy reforms?

Our results suggest that uncertainty about policy reforms could depress consumption by increasing precautionary savings (by about 6%). We asked respondents to make a clear distinction between their uncertainty in a situation where no policy reform is envisaged and another including a prospective policy reform. The first question incorporates the underlying uncertainty, and the second adds up the uncertainty about the reform. This is relevant because disclosing a policy reform can mitigate this second type of uncertainty. However the policy must be credible in order to eliminate this specific type of second order effects.

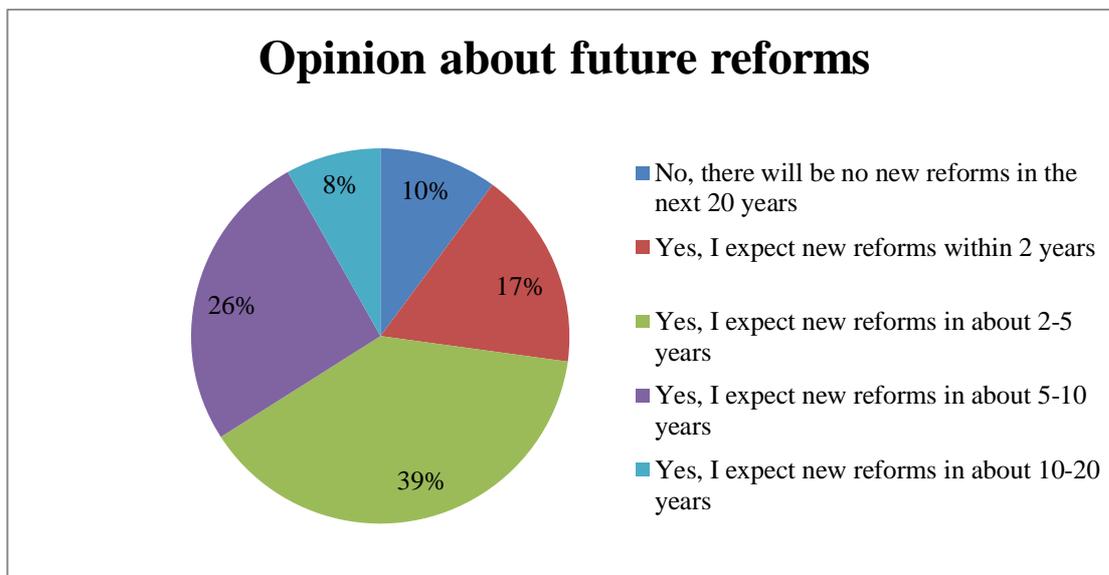


Figure 9. Source: DHS.

Following the premature fall of the 2010 government and new elections, the Dutch Prime Minister on 29 October 2012 announced the new government plans,

which included MIR reform to become effective by 1 January 2013. The reform would leave unaffected those who already had a mortgage and limit the tax relief on new mortgage contracts. The news was given huge media coverage. At the end of that week, we interviewed our sample again and asked our respondents direct questions about their uncertainty<sup>15</sup>.

Figure 9 shows the answers to the question whether respondents think that the reform will be definitive in the long term. Only 10% of respondents believes that there will be no new reforms in a period of twenty years, while 56% thinks that new reforms will be announced five years. When asked about their response to the current reforms (Table 6 shows selected answers from an originally larger list) most respondents think that they will not do anything in response to the reforms. Those who will take action are planning to save more, also 16% of the home-owners who were left unaffected by the reform will.

Table 6: Response to reform

	All	Owners	Tenants
I will not respond to this reform	49%	56%	30%
I will postpone the purchase of a house	4%	3%	6%
I will renegotiate my interest rate and fix it for a longer period of time	3%	4%	0%
I will save more	15%	16%	12%

Legend: Source DHS.

Compared with the 5% that expected to save more when the reform was in the pipeline (see Figure 8), this is a striking result<sup>16</sup>. Finally, Table 7 shows expectations about the future development of several market fundamentals, such as price levels, transactions and uncertainty. Respondents expect that price levels and the number of transactions will fall, which is hardly surprising following restrictive reforms.

The surprising result is that a relative majority of respondents thinks that the reform has fuelled rather than dampened uncertainty. Combining this with the statement about extra savings, it is not evident at all that the reform will mitigate the effect of total uncertainty on savings and consumption.

<sup>15</sup> This additional survey is described in our report entitled: “*De impact van onzekerheid over de hypotheekrenteaftrek op consumenten*” (Mastrogiacomo, M. and van Rooij, M.C.J., 2012 )

<sup>16</sup> Other options are not popular, including moving house and shifts to the rental market that we have not listed in the table.

Table 7: What will happen in 2013?

		Fall	Rise	Remain unchanged	don't know
All	House prices	68%	7%	17%	8%
	Uncertainty on the housing market	16%	46%	32%	6%
	Number of transactions	44%	18%	29%	9%
Owners	House prices	71%	5%	18%	6%
	Uncertainty on the housing market	16%	46%	32%	5%
	Amount of transactions	45%	19%	29%	7%
Tenants	House prices	61%	13%	14%	12%
	Uncertainty on the housing market	15%	44%	33%	8%
	Amount of transactions	42%	17%	28%	12%

## 7. Conclusions

We investigated the perspective and actual reform of the MIR system in the Netherlands and its effect on uncertainty. We evaluated the effect of this uncertainty on savings, which allows us to gauge the effect on expenditure. This is relevant as many observers believe that the growing immobility in the housing market depends on postponing reforms that most people believe to be inevitable. Asking questions about standard market uncertainty and that linked to a hypothetical MIR reform, we unravelled the effect of policy uncertainty, which is a novel contribution. We estimate that policy uncertainty alone pushes up savings by about 6%; expressed in amounts this is about EUR 8,000 of accumulated savings per household. This is an interesting result as it suggests that approving MIR reforms could mitigate this effect and reduce the extra savings. However when the government, two years later, presented partial reforms, these reforms appeared not to be convincing. Descriptive evidence suggests that uncertainty increased rather than decreased as a result of the new reforms, and that respondents are planning to save more as a consequence of it.

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## Appendix

### A1

Table A1. Distribution of subjective variance of house price changes

	Without policy change		With policy change	
	%	cum %	%	cum %
$\sigma_p^2 = 0$	61.68	61.68	53.61	53.61
$\sigma_p^2 > 0 \ \& \ \sigma_p^2 \leq 0.002$	4.33	66.02	3.614	57.22
$\sigma_p^2 > 0.002 \ \& \ \sigma_p^2 \leq 0.004$	9.75	75.78	13.01	70.24
$\sigma_p^2 > 0.004 \ \& \ \sigma_p^2 \leq 0.006$	8.91	84.69	10.72	80.96
$\sigma_p^2 > 0.006 \ \& \ \sigma_p^2 \leq 0.008$	8.19	92.89	9.15	90.12
$\sigma_p^2 > 0.008 \ \& \ \sigma_p^2 \leq 0.010$	3.85	96.74	5.54	95.66
$\sigma_p^2 > 0.010 \ \& \ \sigma_p^2 \leq 0.012$	1.92	98.67	2.89	98.55
$\sigma_p^2 > 0.012 \ \& \ \sigma_p^2 \leq 0.014$	1.08	99.75	0.96	99.51
$\sigma_p^2 > 0.014 \ \& \ \sigma_p^2 \leq 0.016$	0.12	99.87	0.24	99.75
$\sigma_p^2 > 0.016$	0.12	100	0.24	100
N	830		830	

### A2

This Appendix shows an example of how to link the post MIR reform income changes to precautionary savings. For simplicity's sake we assumed that the reform will cause a proportional drop in income and we only accounted for two periods: before ( $t$ ) and after ( $t+1$ ) the reform.

Assuming  $w =$  wage,  $s =$  per period savings, consumption  $= c = w-s$ . Future income has an uncertain slope  $\alpha$  ( drop in net income after the MIR reform) and intercepts  $k =$  mean preserving spread to income with  $E(k)=0$  and  $\sigma_k^2 = E(k^2)$ . Suppose  $0 < \alpha < 1$  as a restrictive reform is expected. Post reform consumption is therefore equal to  $c_{t+1} = (\alpha w - k + s)$  and is uncertain as in  $t$  it is not known how steep the income drop will be in  $t+1$ .

If we assume a constant relative risk aversion utility function with parameter  $\gamma$ , a return on assets  $R$  and a discount factor  $\lambda$ , the Euler equation in this example would be expressed as:

$$(w - s)^\gamma = \lambda E_t \{ R_{t+1} (\alpha w - k + s)^\gamma \} \quad (\text{a1})$$

By successive Taylor series expansions, some standard simplifications, and taking logs (computations available from the author) we get a recursive solution where

$$s = \frac{(1-\alpha)w}{2} + \frac{1}{4} \text{Var}((\alpha-1)w - k + 2s) \quad (\text{a2})$$

This simplifies further into

$$s = \frac{(1-\alpha)w}{2} + \frac{w^2 \sigma_\alpha^2 \gamma}{4} + \frac{\sigma_k^2 \gamma}{4} + \frac{f_{\alpha,w,s}}{4} \quad (\text{a3})$$

where  $\sigma_\alpha^2 = \text{var}(\alpha)$  and  $f$  is function that we will leave indicated for the sake of simplicity. The first element on the right hand side captures life cycle savings and establishes the relation between (permanent) income and wealth accumulation. These savings are half way between the incomes of the two periods as we have simplified away the interest rate and the discount rate. The remaining terms capture precautionary savings and other savings motives. We have not solved this further because it is already clear that savings are a function of the variance of the income change ( $\sigma_\alpha^2$ ), as a consequence of the MIR reform. This simple two periods model allows us to justify the use of the variance of relative income changes (or log income) in the analysis of the precautionary savings stemming from a MIR reform. In the main text, we estimated a model for cumulated savings regressed on, among others,  $\sigma_p^2$  that is a proxy of  $\sigma_\alpha^2$  which is based on our survey questions.

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