

# The Role of Borrower Expectations in Mortgage Choice

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## Abstract

This paper analyses the role of interest rate expectations in determining a household's selection of mortgage product. We use a bespoke survey of 1,484 mortgage holders conducted by the Central Bank of Ireland to investigate the choice between safe fixed rate and risky adjustable rate products. Our empirical methodology adopts a probit model to estimate the effect of a series of household characteristics, behavioural influences and mortgage criteria on product selection. This research provides novel insights into the determinants of mortgage choice, as our study is the first in the literature to explore expectations utilising a new measurement technique. Our results indicate that while pricing matters, future interest rate expectations are a key motivating factor in the mortgage choice decision. In addition to this, we investigate the accuracy of expectations and find higher levels of education and financial literacy increase the probability of correct predictions.

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## 1 Introduction

Following the financial crisis of 2007/2008, an expansive literature emerged on household financial decisions, particularly with reference to the mortgage market. Given the role of household mortgage debt in the global financial crisis, this is unsurprising. One aspect of the literature concerns whether households make the right decisions in choosing their mortgage. Selection of a mortgage product is the most significant financial decision undertaken by a household. During the choice process, households are forced to contemplate a litany of factors across an extended time horizon, such as interest rate fluctuations and income risk, which may have previously been deemed extraneous. Due to the vast amounts of complex information required to analyse products, households can make suboptimal decisions, often leading to regret (Campbell et al., 2011). Therefore, developing an understanding of mortgage choice is important for household vulnerability assessments. Choice of mortgage instrument also has important implications on a macroeconomic scale; a dominant variable rate debt may leave the economy susceptible to exogenous shocks and short run fixed rate contracts may not provide the macroeconomic stability of long run fixation (Leece, 2000).

While a sizable volume of literature exists on the determinants of mortgage choice <sup>1</sup>, there remains a need to explore the relationship between choice and behavioural motivations. In particular, the influence of interest rate expectations needs to be quantified. Dhillon et al. (1987) performed an inaugural empirical examination on the effect of borrower characteristics and pricing on mortgage choice. It was established that while price plays a dominant role in their results, socio-demographic characteristics did not significantly influence the decision <sup>2</sup>. An ever-growing strand of research has expanded this basic form to encapsulate a more diverse range of economic and behavioural factors (Coulibaly and Li (2009), Mori et al. (2009), Bacon and Moffatt (2012)). The rapid expansion of household debt, combined with its fundamental role in the recent financial crisis, motivates us to query the importance of these behavioural factors and the true degree of their influence on the type of mortgages households select.

Within this context, we contribute to the existing literature in two ways. Our research is based on an extensive survey on mortgage choice of 1,484 households in Ireland conducted in 2016, in which we incorporated bespoke questions on behavioural characteristics and mortgage holder expectations at the time of choosing a mortgage. We identify two different groups of mortgages based on their perceived levels of risk; safe fixed rate and risky adjustable rate mortgages. Using these data, we seek to disentangle the relationship between interest rate expectations, risk preferences and financial literacy in the context of mortgage choice. Throughout the literature, generic expectations are often derived from high-level forecasts by either professional or government institutions. The use of these mea-

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<sup>1</sup>See Basciano et al. (2008) for a brief review of mortgage choice literature.

<sup>2</sup>Vickery (2006) also finds that household characteristics have low explanatory power for mortgage choice.

sures require assumptions that households only base their macroeconomic views on such sources. To the best of our knowledge, we are the first in the literature to measure the influence of expectations through survey questions asked directly of borrowers relating to interest rate movements at the time of mortgage origination. This paper will act as a test of validity for this new measurement technique to determine if it provides an intuitive and novel method to gauge household predictions. Secondly, we utilise a wider combination of household socio-demographic characteristics, mortgage criteria and behavioural influences than have been applied in the literature to date. Lastly, we compare expectations with realised interest rate movements to explore if education levels and financial literacy contribute to more accurate outcomes.

Our findings show that both levels of interest rate pricing, financial literacy and interest rate expectations influence the type of mortgage product chosen. We see that households select products which align with their predictions of future rate movements. This is an important finding and can be used to help guide policymakers to better tailor mortgage market interventions. For example, ensuring that the mortgage choice decision is well informed through policy that focuses on providing households with digestible information disclosures on past and potential future interest movements. Our exploration on the accuracy of expectations finds that the presence of a high level of education or financial literacy increases the likelihood of households correctly predicting rate movements. Thus, outlining the ability of certain households to not only select the correct mortgage product in line with their expectations but also anticipate future rate movements.

This paper is structured as follows: Section 2 presents a review of the relevant literature, outlines our hypotheses and provides a background on the Irish mortgage market. Section 3 outlines our data and summary statistics. Section 4 presents the empirical model and results. Section 5 provides robustness checks and Section 6 concludes.

## 2 Background Literature & Hypotheses

A series of both theoretical and empirical studies have focused on the choice between fixed rate mortgages (FRMs) and adjustable rate mortgages (ARMs)<sup>3</sup>, the distinct product types in the marketplace. An ARM can be viewed as the risky choice for households; as if interest rates fluctuate, they may be exposed to increased repayments ([Bacon and Moffatt, 2012](#)). This risk can be mitigated through the choice of a stable FRM product, frequently at the cost of a higher rate. It is often the case that when fixed interest rates rise, households are more likely to select an adjustable product, and when they fall there is a surge in demand for fixed rate products ([Campbell, 2006](#)). [Ehrmann and Ziegelmeyer \(2014\)](#) explore the effects of macroeconomic factors on the selection of mortgage instrument. They provide a comprehensive cross-country study of demand for mortgage types. Across fifteen

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<sup>3</sup>[Hendershott et al. \(1997\); Krainer et al. \(2010\); Ghent and Yao \(2016\); Hemert et al. \(2005\).](#)

European nations, it is found that more ARMs are chosen in periods of strong economic growth, when the interest rate spread is high or unemployment is experiencing low levels of volatility. There is also evidence in Ireland and the UK that pricing promotions are used to attract consumers to higher cost mortgage products (King et al., 2018). While there is evidence that households react to the interest rate spread and macroeconomic influences, a wide gamut of other components need to be taken into consideration to fully explain borrower choice. For the purpose of this paper, we consider expectations, risk preferences and financial literacy.

*Hypothesis 1: Households base their choice of product on the best value interest rate.*

Expectations are subjective beliefs held by consumers about uncertain future outcomes. They play an integral part in the financial decision making process used by households. These expectations are formed based on current or past experiences about which individuals are not fully informed (Pesaran and Weale, 2006). Research on the role of expectations in selection of mortgage products is limited. If we deem households to be rational, the main influencing factor in selecting an FRM or ARM should be the differential between the current fixed rate and expectations of future rate movements that will affect the ARM over its life cycle. A seminal paper on the subject is Friedman (1980), who utilised survey evidence to calculate the rationality of interest rate expectations. Tests showed that, over different time intervals, respondents made biased predictions, lacked consistency and failed to accurately capitalise on available information<sup>4</sup>. Gramlich (1983) provided an empirical study to understand the efficiency of expectations across different groups due to their importance in macroeconomic models. The comparison between economists and household inflation expectations found that neither adhered to rational forecasting. Similar research was administered by Carroll (2003), who compared news reports by professional forecasters with survey data to test if household expectations were logical. His results outline significant gaps between the beliefs of professionals and the public, with households providing irrational forecasts. While the influence of news reports on expectations had limited effect, Fujiwara (2005) explored if central bank publications were influential. Findings across both qualitative and quantitative evaluations suggest that central banks guide professional forecasters, helping the public to comprehend the bank's view of future economic movements, thus minimalising uncertainty<sup>5</sup>. Kojien et al. (2009) use a VAR model to posit that households are capable of timing their mortgage choice based on interest rate movements. ARMs are taken out when FRMs are expensive due to an expected high rate risk premium. In a recent paper, Badarinza et al. (2018) shed light on the extent to which households are forward looking when making their mortgage choice decision. Across a nine-country panel, it is found that short-term expectations of movements in ARM rates do affect mort-

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<sup>4</sup>The two time horizons covered in the research were relatively short-term, either 3-months or 6-months.

<sup>5</sup>The study was based on the Bank of Japan's biannual publication "Outlook and Risk Assessment of the Economy and Prices".

gage choice. However, households lack the ability to predict longer-term rate movements required to minimise the costs of their mortgages over the life cycle. Ben-David et al. (2018) show significant heterogeneity in expectations across macroeconomic outcomes for US households. Individuals with lower education and living in counties with higher unemployment are more uncertain in their expectations regarding inflation, and exhibit more precaution in their credit behaviours. They find that respondents with higher education are those whose subjective uncertainty is closer to the objective volatility of forecasted outcomes. This paper is comparable with the work of Bacon and Moffatt (2012), who use building society mortgage data to move the mortgage choice decision further into the domain of behavioural economics by separating the role of risk attitude from that of expectations.

*Hypothesis 2: Households select mortgage products in line with their expectation of future interest rate movements.*

The theoretical base posited by Campbell and Cocco (2003) outlines the influence of household risk aversion, stating risk averse households with a degree of income risk are more attracted to the stable FRM due to the possible volatility of ARMs. Coulibaly and Li (2009) utilised the Survey of Consumer Finances to provide empirical backing to the finding that attitudes to risk affect mortgage choice, with less risk averse borrowers more likely to choose ARMs. Duffy et al. (2005) extend this finding to the Irish perspective, and their results from a single borrower dataset mirror the aforementioned studies. Experimental evidence by Mori et al. (2009) suggests that risk-averse households tend to become more risk seeking when choosing a mortgage type, preferring ARMs when the mortgage choice problem is presented as part of a loss situation. Their incorporation of prospect theory<sup>6</sup> posits that intrinsic influences can explain why ARM mortgage holders may underplay the risk linked with ARMs, prioritising pricing factors when selecting mortgage type. Donkers and Van Soest (1999) show that household financial decisions depend on rate of time preference, the degree of available information and risk aversion. The effect of risk aversion on the decision to invest in financial risky products is negative and highly significant, increasing with age and showing women to be more risk averse than men. When exploring risk attitudes across different contexts, including financial matters, Dohmen et al. (2011) show strong indications that households with higher levels of income are more willing to take risks. In terms of the mortgage choice decision, Brueckner and Follain (1988) find high-income borrowers prefer ARMs, which can perhaps be explained by the fact that high future income makes interest rate risk easier to bear. An increasing number of households have begun to explore alternative mortgage products (AMPs), such as interest only mortgages, which postpone amortisation. LaCour-Little and Yang (2010) define a

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<sup>6</sup>See Kahneman and Tversky (1979).

theoretical model outlining that households with greater risk tolerance are more likely to select these products. However, they create a higher risk of default among lower income households. Empirical evidence is provided by [Cox et al. \(2015\)](#), who highlight willingness to take financial risk influences a household's selection of mortgage product. The study of Dutch households shows that AMPs are selected by sophisticated, high-income borrowers less likely to make financial mistakes due to better comprehension of the risks linked to these products. While a common feature of the literature is that risk appetite impacts the mortgage choice decision, we test this theoretical and empirical finding through the application of both quantitative and qualitative measurements.

*Hypothesis 3: Borrower's selection of mortgage product is influenced by their appetite for risk.*

A sphere of household finance literature focuses on the concept that households have poor financial literacy, limiting their understanding of core economic concepts such as interest and inflation ([Van Rooij et al., 2011](#)). The financial transaction costs incurred by these less-informed individuals were dubbed 'the costs of ignorance' by [Lusardi and Tufano \(2015\)](#), who found a key component of these costs related to a lack of financial knowledge. Further evidence of the influence of financial literacy has emerged in a number of different sectors, including mortgage choice, highlighting limited rationality and awareness in selection of financial products. [Bucks and Pence \(2008\)](#) compared responses to the Survey of Consumer Finances with distributions in bank data to find out if mortgage holders know their terms. It was found that while most understood basic mortgage terms, ARM holders underestimate the degree to which their interest rates can fluctuate. An Italian study by [Paiella and Pozzolo \(2007\)](#) ratify this finding using the Survey of Household Income and Wealth to show that those who select ARMs miscalculate the overall cost of their mortgage and the risk of a rise in the reference rate. [Miles \(2004\)](#) undertook a review of the UK mortgage market and found further evidence that consumers do not pay attention to the future level of interest rates when making the choice between FRMs and ARMs. In a unique paper comparing proprietary bank data with the Health & Retirement Survey, [Agarwal et al. \(2009\)](#) provide evidence that households make notable errors when calculating their loan-to-value ratio. Younger and older consumers have a tendency to incorrectly estimate the value of their house, which leads to a higher interest rate. Work by [Gathergood and Weber \(2017\)](#) highlights how poor financial literacy raises the likelihood of choosing an alternative mortgage product, with financially literate individuals also more likely to choose an adjustable rate mortgage.

*Hypothesis 4: Financially literate households are more likely to prefer complex mortgage products.*

This paper expands upon the existing literature by using survey data to provide a novel measure of future interest rate expectations asked directly of borrowers, linked to the time of mortgage selection. The approach also incorporates both qualitative and quantitative measures of risk preferences, allowing us to account for distinctive interpretations of risk appetite across contexts. Financial literacy is accounted for by proven survey questions yet to be administered in the domain of mortgage choice. In line with previous research, these behavioural variables are combined with detailed socio-demographic, pricing and loan characteristics to provide a comprehensive account of the mortgage choice decision.

## 2.1 Irish Mortgage Market & European Comparison

To accurately evaluate the context in which the mortgage choice decision is made, a brief overview of the Irish mortgage market is provided. For a long period, the market was dictated by a small number of public and non-profit institutions, who provided cautious lending and adhered to stringent regulation (Murphy, 1995). During the 1980s, deregulation of the commercial lending sector occurred, promoting competition through easing interest rate restrictions and lowering the reserve requirements of banks (Kelly and Everett, 2004). Research by Norris and Winston (2003) has shown that in the early 1990's over 80 per cent of households in Ireland were owner-occupiers. The mid 1990's brought economic prosperity in the form of the Celtic Tiger with a fall in interest rates and declines in mortgage-servicing costs acting as the catalyst for extensive lending growth.

In the decade from 2000 to 2010, the amount of credit institutions serving the Irish mortgage market grew from 12 to 17 (Norris and Coates, 2014). A trifecta of factors contributed to this; the entry of foreign lenders into the Irish market, custom entities to focus on mortgage lending and the emergence of Irish banks into the mortgage market. This competition, and introduction of sophisticated foreign lenders, influenced the types of mortgage products available in the marketplace. Riskier products such as interest-only mortgages and tracker mortgages entered the market<sup>7</sup>. At the beginning of 1999, variable rate mortgages accounted for over half of all outstanding mortgages increasing to 75 per cent by end 2007. The remaining fixed rate mortgages were predominantly short-term fixations, with less than a third fixed for a period greater than 3 years, and only 8 per cent fixed for more than 5 years (Doyle et al., 2009). The selection of safer fixed rate products was declining, as their interest rates were relatively higher than tracker and variable products. As the period of economic growth continued, the high percentage of variable rate mortgages left borrowers susceptible to interest rate movements. In many cases, borrowers who selected fixed rates quickly reverted to variables due to the short fixation duration.

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<sup>7</sup>Mortgages where the interest rate is equal to the main European Central Bank (ECB) refinancing rate plus a premium set by the bank at origination.

With the onset of the financial crisis in 2007, credit institutions began to scale back both the volume of mortgages drawn down and type of products offered. Tracker and interest only mortgages were no longer provided, variable products fell in availability and more fixed rate products were being advertised. By 2013, there were only five major lenders in the marketplace due to mergers, wind downs and exits. Since then there has been limited new entry: two new firms between 2016 and 2017 ([Competition and Commission, 2017](#)). Therefore, at the time of this survey the market was defined by a small number of firms, a lack of competition between lenders and low levels of entry by new players.

Figure 1: New Lending Interest Rates

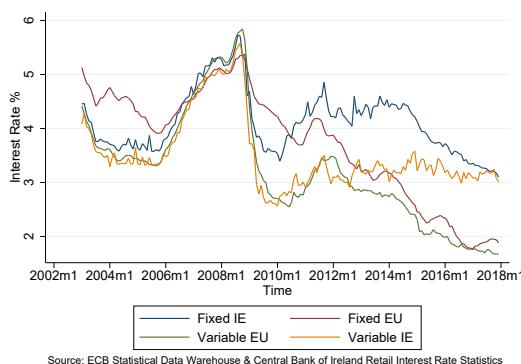
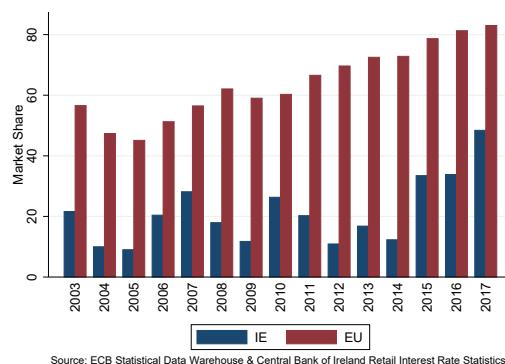

Source: ECB Statistical Data Warehouse & Central Bank of Ireland Retail Interest Rate Statistics

Figure 2: New Lending Amounts - Fixed Rate


Source: ECB Statistical Data Warehouse & Central Bank of Ireland Retail Interest Rate Statistics

Central Bank of Ireland Data highlights the longstanding focus on interest rate pricing. As can be seen in Figure 1 & Figure 2, the share of fixed rate new mortgages was lowest from 2004 to 2005, a period defined by declining interest rates and an above average spread between fixed and variable rates. Once the rate spread fell, and rates in general began to rise, the proportion of fixed rate mortgages increased. The dominant share of variable rate mortgages also reflected the introduction of new variable products during this period. Tracker mortgages were estimated to account for approximately 40 per cent percent of the outstanding variable rate mortgage stock at end-2016. With these products, when the ECB refinancing rate decreases the financial institution is obliged to pass the reduction onto tracker mortgage holders. Therefore, a significant proportion of Irish mortgage holders are highly sensitive to ECB rate movements. From 2014 to end-2017 there was a fall in both rates and the interest rate spread, once again reflected in the share of new business fixed rate mortgages being selected.

As shown by new contract agreements in Figure 2, fixed rate loans are more popular across the EU than in Ireland. In countries where fixed rate loans dominate, the majority of loans are fixed for long periods of time, typically 10 years or more. As can be seen in Figure 1, clear difference exists between the pricing of fixed and variable rates in Ireland and the EU. There are many reasons for this gap. Firstly, there is no "one way" of doing retail banking in euro area retail financial markets ([McElligott et al., 2007](#)). The presence

of different regulatory regimes, legal frameworks and degree of competition all contribute to difference in interest rates. Low levels of competition in the Irish mortgage market in recent years is a particularly important factor in explaining the above average mortgage rates. Alignment of these interest rates are obstructed by factors such as banking practises and market preferences.

The exact reasons why fixed or adjustable rates become ubiquitous in a country can be difficult to disentangle. Demand, supply and institutional structures all contribute. Structural differences across mortgage markets can be referenced as an example of cross-country heterogeneity in the effect of monetary policy. Nations with a recent history of macroeconomic stability and stable inflation may be prone to longer-term planning, and this helps to explain why fixed rates are dominant in countries such as Germany. German banks tend to use long-term bonds for funding; this aligns with preferences for a longer-term interest rate fixation (Drudi et al., 2009). The level of market sophistication may also contribute, as lack of appropriate long-term bonds may have prevented banks in some countries in offering mortgages with a longer-term interest rate fixation.

### 3 Overview of Data

#### 3.1 The Survey

Our analysis is based on a unique survey undertaken by the Central Bank of Ireland to explore household mortgage decisions. The underlying dataset includes comprehensive information on mortgage criteria at origination, in addition to a plethora of variables relating to the socio-demographic, financial and behavioural characteristics of the surveyed households. Importantly, the survey was customised to account for those variables that the theoretical literature on mortgage choice suggests are important in the selection of mortgage products. For example, inclusion of risk preferences, financial literacy and expectations about future interest rate movements as important determinants of the decision to choose a fixed rate product relative to an adjustable rate. The precise variables included in this study are discussed further below.

The survey was administered to over 2,003 mortgage holders in 2016, through face-to-face interviews. Qualifying respondents were current mortgage holders with a mortgage on the house or apartment in which they lived (i.e. only households classified as having a mortgage on their primary dwelling were included in the sample)<sup>8</sup>. The questions can be summarised along the following lines:

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<sup>8</sup>Further details of the sampling methodology and the overall representativeness of the sample are available in the Appendix.

1. Mortgage background, covering mortgage and borrower characteristics at the point of initial mortgage drawdown.
2. Mortgage choice, including questions on the factors related to the choice of mortgage product and mortgage provider.
3. Behavioural characteristics and expectations, including questions on risk preferences.
4. Financial knowledge and literacy.

### 3.2 Descriptive Statistics

In Table 1 we provide a brief overview of the sample of interest to this study. We focus on the sample of households that provided full information on our baseline dependent and independent variables, so the sample size at this stage is 1,484. We present the results for the whole sample (column 5) in addition to the results by mortgage type (fixed, variable, tracker and other mortgage types). Among the sample, the largest proportion of respondents are in the 35-44 year age group (47 per cent). The majority of respondents are based in urban locations (73 per cent), are employed (96 per cent), and relatively well educated, with 51 per cent having at least a third-level degree. While these patterns tend to hold across mortgage types, there are some interesting differences between the groups.

Fixed rate mortgages had, on average, higher interest rates compared with other available rates, reflecting the certainty premium linked to safer products. They also reflect the highest proportion of first time buyers at 81 per cent and lowest level of high income borrowers at 12 per cent. Borrowers on variable rates had the highest proportion of male mortgage holders and lowest cohort of third level education. Notably, the bulk of trackers mortgages originated at some point during the 2000 to 2012 period, which is unsurprising given tracker products were only available during this period. The bottom panel of Table 1 illustrates the average responses to questions on financial literacy, expectations and risk. At the total level, 55 per cent stated that they have no preference for risk, 58 per cent correctly answered questions linked to financial literacy and half the population expected periods of interest rate volatility following selection of their mortgage product. These questions, and the heterogeneous responses across cohorts, are explored in the next section.

### 3.3 Behavioural Characteristics, Expectations and Financial Literacy

A unique feature of the survey underlying the current study is the spectrum of information capturing risk preferences, expectations and financial literacy. As noted earlier, a variety of theoretical models of mortgage choice posit that such variables affect mortgage choice. Unlike previous studies, we capture all these factors within one framework. This section discusses the key variables of interest, and explores how these vary across the choice of mortgage product.

Table 1: Summary Statistics by Mortgage Type

	Fixed <i>n</i> = 601	Variable <i>n</i> = 716	Tracker <i>n</i> = 156	Other <i>n</i> = 11	Total <i>n</i> = 1,484
<b>Demographics</b>					
Age 18-34	0.19	0.18	0.10	0.18	0.18
Age 35-44	0.44	0.46	0.63	0.45	0.47
Age 45-54	0.25	0.24	0.21	0.27	0.24
Age >54	0.12	0.12	0.06	0.09	0.11
Male	0.51	0.55	0.51	0.36	0.53
Children	0.29	0.31	0.31	0.18	0.30
Joint Decision	0.78	0.74	0.72	1.00	0.76
Urban	0.72	0.74	0.71	0.91	0.73
Junior Cert or Lower	0.07	0.06	0.08	0.09	0.07
Third Level Education	0.51	0.50	0.56	0.55	0.51
Leaving Cert and Non-degree	0.41	0.43	0.36	0.36	0.42
Unemployed	0.02	0.01	0.00	0.00	0.01
Employed	0.95	0.97	0.98	1.00	0.96
Other Employment Status	0.04	0.02	0.02	0.00	0.03
<b>Mortgage, Income &amp; Pricing</b>					
Mortgage Pricing Difference	0.17	-0.30	-1.09	-1.26	-0.20
First Time Buyer	0.81	0.78	0.71	0.73	0.79
Income: Less than €50,000	0.34	0.31	0.29	0.27	0.32
Income: €50,000 - €70,000	0.27	0.32	0.26	0.18	0.29
Income: €70,000 - €100,000	0.27	0.22	0.25	0.36	0.25
Income Greater than €100,000	0.12	0.14	0.21	0.18	0.14
Origination Year Pre-2000	0.16	0.15	0.00	0.09	0.14
Origination Year 2000-2006	0.29	0.27	0.40	0.36	0.29
Origination Year 2006-2012	0.31	0.30	0.49	0.36	0.33
Origination Year 2012-2016	0.24	0.28	0.10	0.18	0.24
<b>Behavioural &amp; Expectation Variables</b>					
Financial Literacy	0.54	0.60	0.61	0.73	0.58
Interest Rate Expect: Volatility <sup>b</sup>	0.57	0.42	0.54	0.36	0.50
Interest Rate Expect: Rise <sup>c</sup>	0.45	0.29	0.34	0.40	0.36
Interest Rate Expect: Fall <sup>c</sup>	0.11	0.20	0.15	0.10	0.16
Interest Rate Expect: Same <sup>c</sup>	0.32	0.32	0.34	0.40	0.32
Interest Rate Expect: No View <sup>c</sup>	0.12	0.20	0.17	0.10	0.16
Lottery Risk Group I	0.55	0.55	0.51	0.73	0.55
Lottery Risk Group II	0.19	0.19	0.19	0.18	0.19
Lottery Risk Group III	0.14	0.15	0.18	0.09	0.15
Lottery Risk Group IV	0.07	0.08	0.06	0.00	0.07
Lottery Risk Group V	0.02	0.02	0.03	0.00	0.02
Lottery Risk Group VI	0.02	0.02	0.03	0.00	0.02

Notes:<sup>b,c</sup> Due to refused or erroneous response the overall usable sample for these variables is 1,354 and 1,412 respectively.

### 3.3.1 Expectations

While the importance of household expectations in determining microeconomic outcomes is well established, there has been relatively little research dedicated to modelling empirical expectations data. In the majority of cases, household expectations are derived from government institutions (Fujiwara, 2005), media outlets (Carroll, 2003) or zero coupon bond yield spreads (Bacon and Moffatt, 2012). The inclusion of such variables, therefore, requires a number of assumptions relating to how households form their expectations. We offer an alternative to these methods by providing a measure linked to questions asked directly of survey respondents, which reference the time at which their mortgage originated. This novel approach is instigated through the use of survey questions:

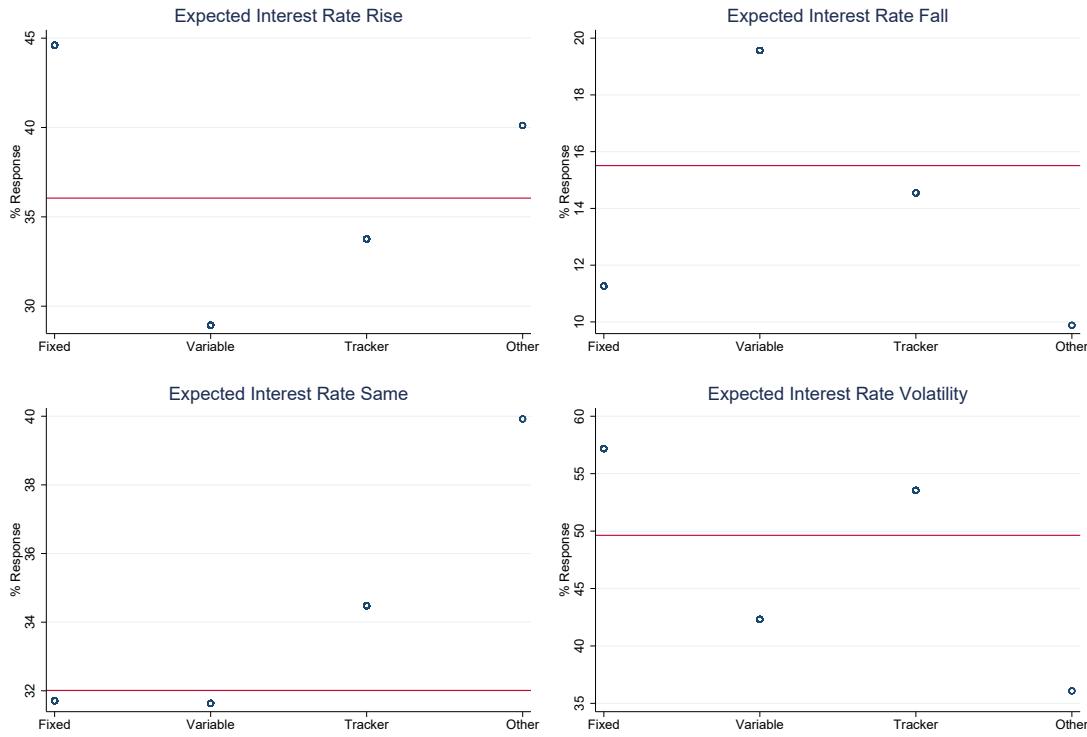
1. At the time you took out your mortgage, did you think that interest rates were going to increase, decrease, stay the same or did you have no view on this?
2. At the time you took out your mortgage, were you concerned that interest rates would change a lot in the future? (Yes / No)

Table 2: Expectations

Interest Rate Expectation	Percentage
Expects Future Volatility	50%
Expects Future Increases	36%
Expects Future Decreases	15%
Expects Unchanged Rates	32%
No View	16%

As shown in Table 2, across the sample we find that 36 per cent of respondents expected interest rates to rise when taking out their mortgage, while 32 per cent assumed that rates would remain the same. Future rate volatility was anticipated by the largest proportion of our sample, with a level of 50 per cent. We note some important differences in Figure 3, which shows the average response to rate movements by mortgage type. Firstly, a more sizeable proportion of fixed rate holders expected a rise in interest rates at some point in the future relative to the remainder of the sample, and a much lesser proportion of fixed rate holders expected a fall in interest rates in the future. Holders of variable rate products were the opposite of this, with a greater cohort expecting a rate fall and a smaller proportion expecting a rate rise. Lastly, a larger proportion of fixed rate holders expected interest rate volatility relative to those on a variable rate product. This unconditional examination, therefore, suggests that interest rate expectations could be correlated with mortgage choices. Using these interest rate questions, we create categorical and binary variables respectively, for use in our empirical model of mortgage choice.

Figure 3: Expectations by Interest Rate Type



Source: Central Bank of Ireland Survey & Author's Workings

### 3.3.2 Risk Preferences

To capture household risk preferences, we first employ a question that originated in [Dohmen et al. \(2011\)](#) to capture risk preferences in financial decision making. We present households with the following hypothetical scenario, to which they could respond with one of six options (shown in parenthesis):

1. Imagine that you have just won €100,000 in the lottery. Immediately after collecting the winnings, a bank contacts you and offers you the opportunity to invest some or all of the money in a risky asset, which either doubles the amount invested (resulting in €200,000), or returns only half (resulting in €50,000), with equal probability in two years. How much of the €100,000 would you choose to invest? (€0, €20,000, €40,000, €60,000, €80,000, or €100,000)

Table 3 presents the results, where we group respondents into six distinct risk preference groups; from no risk (I) to high risk (VI). The variable is coded as ‘no risk’ for households who would invest €0, and ‘high risk’ for those opting to invest €100,000. In keeping with the findings of [Barsky et al. \(1997\)](#), we see substantial heterogeneity in the estimates of risk preference across households, with no appetite for risk capturing the largest proportion of the sample (55 per cent). However, a significant proportion exhibit a willingness to make

substantial gambles with the investment. This variation remains relatively consistent across our three core mortgage types of fixed, variable and tracker. Using these data, we create a six option categorical variable for use in our mortgage choice model.

Table 3: Risk Preferences

Lottery Risk Measure	Percentage
€0	55%
€20,000	19%
€40,000	15%
€60,000	7%
€80,000	2%
€100,000	2%

### 3.3.3 Financial Literacy

There are a limited number of surveys that provide information on both financial literacy and variables related to financial decision making. Measures of financial literacy used in existing studies can often be crudely derived from other questions. In this paper, we overcome such issues by providing proven measures of financial literacy linked with comprehensive data on mortgage choice. Building upon the seminal work of Bernheim (1995), who argued that most households cannot perform simple calculations and lack basic financial literacy, we utilise questions from the literacy test run by Van Rooij et al. (2011). These questions measure the ability to understand simple inflation and interest rate concepts. alongside performing a basic mathematical calculation:

1. Suppose you saw the same television on sale at a discount in two different shops. The original purchase price of the television was €250. One shop is offering a discount of €30 off the original price, the other is offering a discount of 10 per cent off the original price. Which is the better deal - €30 off or 10 per cent off?
2. If the inflation rate is 5 per cent and the interest rate you get on your savings is 3 per cent, will your savings have at least as much buying power in a years time? (Yes/No)

Most respondents answer the first question correctly; the percentage of correct responses is 89 per cent. However, the number of correct answers falls significantly, to 62 per cent, when we consider the second question on inflation and interest rates. Interestingly, the proportion of respondents who answered both questions correctly is only 58 per cent (Table 4). Thus, while many respondents display an ability to perform simple financial calculations, financial literacy is not widespread when it comes to combining it with knowledge of inflation and interest rates. We find a slightly higher proportion of variable rate mortgage holders (60 per cent) correctly answering both questions compared with fixed rate (54 per cent). Employing these questions, we generate a binary variable, which is

based on the combined responses to the two questions. The variable is coded as zero if either of these questions was answered incorrectly and one if both questions were answered correctly.

Table 4: Financial Literacy

	Calculation Question	Inflation Question	Both Questions
Correct	89%	62%	58%
Incorrect	11%	39%	42%

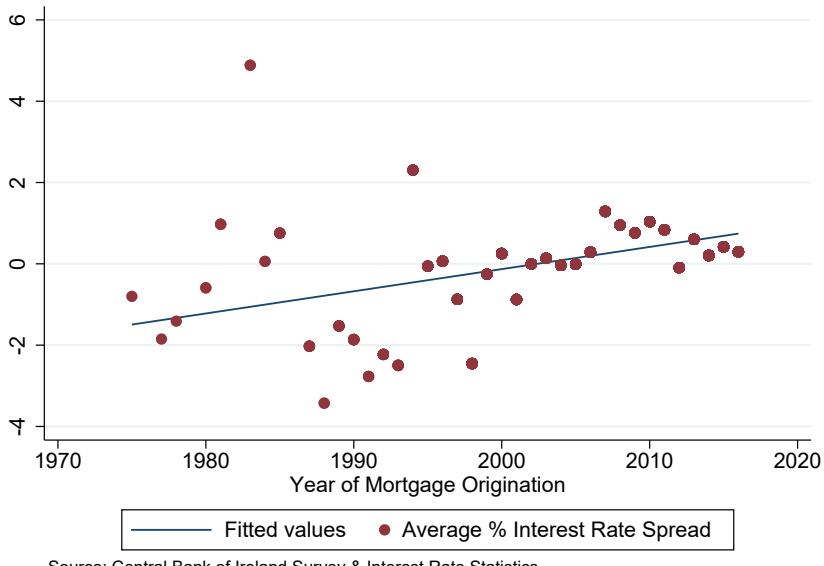
### 3.4 Mortgage Pricing

The existing literature on mortgage choices has shown a key role for interest rate pricing in the decision to take either a fixed or a variable rate product, ([Dhillon et al. \(1987\)](#), [Campbell \(2006\)](#), [Coulibaly and Li \(2009\)](#), [Ehrmann and Ziegelmeyer \(2014\)](#)). [Dhillon et al. \(1987\)](#), for example, finds that higher interest rates on fixed rate products and smaller margins on adjustable rate products favoured the choice of adjustable rate mortgages. While our dataset captures the interest rate applying to a loan at the point of loan origination, there are a number of missing observations on this variable. Furthermore, the dataset does not include a measure of the price of alternative products that the borrower could have selected when taking out their mortgage. We therefore employ an alternative interest rate statistics dataset to capture the price of mortgage products.<sup>9</sup> By matching mortgage and borrower criteria with this dataset, we generate a measure to capture the spread between the fixed and variable rate products within the market (pre 2003) and within each financial institution (post 2003). As can be seen in Figure 4, the annual average spread across the dataset fluctuated between -3.43 per cent in 1988 to 4.9 per cent in 1983. However, these are predominantly outliers with an average spread of .26 per cent over the time period.

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<sup>9</sup>Additional information is available in the Appendix.

Figure 4: Average Interest Rate Spread by Year



Source: Central Bank of Ireland Survey & Interest Rate Statistics

## 4 Empirical Approach

To explore mortgage choice in an empirical setting, we specify the following cross-sectional probit model, where the probability of choosing a fixed rate mortgage is a function of a range of household-specific controls:

$$Pr(Y_i = 1 | X_i) = \Phi(\beta X_i) \quad (1)$$

Where  $Y$ , the dependent variable ‘fixed’, equals one for those households that chose a fixed rate mortgage at origination, and zero if they chose any form of variable rate mortgage.  $\Phi$  is the cumulative distribution function of the standard normal distribution.  $X_i$  is a set of controls for borrower and mortgage characteristics for household  $i$  and  $\beta$  is the set of parameters to be estimated. We also include bank fixed effects to purge the model of any bank specific, time invariant influences.

The existing literature suggests that the choice of mortgage product should be linked with borrower and mortgage characteristics, in addition to market conditions. To control for borrower characteristics, we include variables capturing the demographics and socio-economic status of the main mortgage contributor. We also capture households that live in urban areas and those with dependent children. The former accounts for the possibility that there could be geographical variation in the take-up of fixed rate mortgages, while the latter capture the hypothesis of [Brueckner and Follain \(1988\)](#), who argue that the presence of dependent children in a household could lead that household to be more concerned about future income and consumption, thereby preferring stable future mortgage

repayments.<sup>10</sup> For mortgage characteristics we include controls for buyer type, number of mortgage contributors, year of origination and income of mortgage holders. For market conditions we include a variable that captures the price spread of mortgages. Finally, we include a host of variables on behavioural characteristics and expectations suggested by prior theoretical and empirical literature to affect mortgage choice (Campbell and Cocco, 2003; Cox et al., 2015; Bacon and Moffatt, 2012). Unlike previous studies that had to rely on macroeconomic data to assess the role of expectations, our dataset includes a household specific measure relating to the time that the mortgage was originally taken out.

#### 4.1 Results

Column 1 of Table 5 presents the results of the initial baseline specification where the marginal effects and standard errors are reported. A picture begins to emerge as to the profile of Irish households that choose fixed rate mortgage products. At this stage in our analysis, we assume that borrowers are free to choose the specific type of mortgage that they want - i.e. we expect that financial providers do not restrict the mortgage choice to fixed or variable products for any group of borrowers. Firstly, it appears that interest rate pricing is a key determinant of mortgage choice, with higher premiums associated with fixed rate products making them less likely to be selected relative to cheaper variable products. Arguably borrowers do not focus on the overall market price of fixed rate products but their difference relative to variable rate products. In this case, we find that the spread between fixed rate and variable rates prices has a negative and significant association with the choice of a fixed rate product. The results are intuitively appealing, and suggest that rational borrowers opt for the cheapest mortgage products. However, it is possible that this relationship changes for alternative expectations of future interest rate movements.

Similar to Vickery (2006), we find household characteristics have low explanatory power for mortgage choice. We find tentative evidence of a negative relationship between high income levels and fixed rate mortgages. This corresponds with the work of Brueckner and Follain (1988) & Cox et al. (2015), who find that high income borrowers have a greater propensity for adjustable rate and alternative mortgages, respectively. Turning next to the behavioural variables linked to risk and financial literacy, we find little evidence showing levels of financial literacy or risk attributes impact the mortgage choice decision.

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<sup>10</sup>Table 15 of the Appendix provides a full overview of the independent variables used in the model.

Table 5: Mortgage Choice: Probit Model Marginal Effects

	Pricing	Risk & Literacy	Expectations
<b>Demographics</b>			
Age: 18 - 34	0.025 (0.059)	0.026 (0.059)	0.043 (0.061)
Age: 35 - 44	-0.030 (0.050)	-0.029 (0.050)	-0.010 (0.051)
Age: 45 - 54	0.001 (0.049)	0.000 (0.049)	0.023 (0.050)
Male	-0.018 (0.026)	-0.014 (0.026)	-0.021 (0.027)
Children	-0.001 (0.031)	-0.004 (0.030)	-0.006 (0.032)
Urban	0.001 (0.029)	0.001 (0.029)	-0.029 (0.031)
Leaving Cert and non-degree	0.014 (0.052)	0.015 (0.053)	0.014 (0.056)
Third Level Education	0.038 (0.054)	0.041 (0.054)	0.037 (0.057)
Unemployed	0.213* (0.120)	0.211* (0.120)	0.189 (0.133)
Retired/Student/Homemaker	0.115 (0.084)	0.114 (0.084)	0.135 (0.088)
<b>Mortgage, Income &amp; Pricing</b>			
Joint Decision	0.064** (0.032)	0.062* (0.032)	0.047 (0.034)
First Time Buyer	0.051 (0.033)	0.050 (0.033)	0.034 (0.034)
Income: €50,000 - €70,000	-0.074* (0.038)	-0.072* (0.039)	-0.074* (0.041)
Income: €70,000 - €100,000	-0.023 (0.043)	-0.018 (0.044)	-0.038 (0.047)
Income Greater than €100,000	-0.102** (0.049)	-0.096* (0.049)	-0.119** (0.051)
Mortgage Pricing Difference	-0.030*** (0.008)	-0.030*** (0.008)	-0.030*** (0.008)
<b>Behavioural &amp; Expectations</b>			
Lottery Risk Group II		-0.007 (0.033)	-0.009 (0.035)
Lottery Risk Group III		-0.010 (0.037)	-0.016 (0.040)
Lottery Risk Group IV		-0.020 (0.049)	-0.062 (0.053)
Lottery Risk Group V		-0.051 (0.092)	-0.076 (0.100)
Lottery Risk Group VI		-0.042 (0.087)	-0.011 (0.096)
Financial Literacy		-0.047* (0.026)	-0.052* (0.028)
Interest Rate Expect: Volatility			0.083*** (0.028)
Interest Rate Expect: Fall			-0.196*** (0.040)
Interest Rate Expect: Same			-0.065* (0.035)
Interest Rate Expect: No View			-0.173*** (0.041)
Controls for Provider & Year	Yes	Yes	Yes
Observations	1,482	1,299	1,299

Notes: Probit Regressions. Dependant Variable =1 if borrower selected fixed mortgage product at origination.

Omitted Categories; Age: Over 54, Primary Education, Employed, Income: Less then €50,000

Lottery Risk Group I, Interest Rate Expect: Rise.

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Finally, we note a strong and highly significant link between interest rate expectations and mortgage choice. Persons expecting interest rates to fall in the future relative to those expecting rates to rise, had a lower probability of choosing a fixed rate product. On the other hand, households expecting interest rates to be more volatile in the future had a higher probability of opting for a fixed rate product. Thus far, the baseline results suggest that mortgage decisions are primarily linked to interest rate pricing and expectations on future interest rate movements. From a policy perspective, the results relating to future interest rates are particularly important as they suggest that households interpretation of market rate movements could affect product selection. These results bode well for our novel measure of borrower expectations, vindicating their inclusion in our analysis, as they appear to provide us with an alternative technique from which to empirically measure beliefs.

## 4.2 Does Fixation Duration Matter?

As fixed rate mortgages are associated with a safer product choice, it is worth asking if the duration of such products plays a role. To do this, we employ an ordered probit model to estimate relationships between an ordinal dependent variable of fixation duration and our previously established set of independent variables. In ordered probit models, an underlying score is estimated as a linear function of the independent variables and a set of cutpoints. The probability of observing outcome  $i$  corresponds to the probability that the estimated linear function, plus random error, is within the range of the cutpoints estimated for:

$$Pr(Y_j = i) = Pr(k_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \dots + \beta_k x_{kj} + u_j \leq k_i) \quad (2)$$

$u_j$  is assumed to be normally distributed and the coefficients  $\beta_1, \beta_2, \beta_k$  are estimated together with the cutpoints  $k_1, k_2, \dots, k_{I-1}$ , where  $I$  is the number of outcomes.

Similar to the approach used by [Bacon and Moffatt \(2012\)](#), we incorporate the ordinal fixation period variable coded 0 for variable rate, 1 for fixed rate up to 3 years, 2 for Over 3 and up to 5 years fixation and 3 for over 5 years fixation.<sup>11</sup> Table 6 outlines the marginal effects and standard errors of this ordered probit model across our key explanatory variables. Our results add further weight to the findings of the previous section, as we see the size of coefficients growing in line with the duration of fixation. This would lead us to believe that the greater the fixation period, the safer it may be deemed by those making the mortgage choice decision. For results linked to expecting volatility and a fall in rates, we see respective increasing and decreasing marginal effects in line with length of fixation. The finding on price difference is also intuitive as longer term fixation periods are associated with higher rate premiums, which would increase costs and make them less

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<sup>11</sup>The rate breakdown of our sample is available in Table 11 in the Appendix. Also provided is the full ordered probit output in Table 12.

appealing. Unlike the previous standard probit model, the ordered approach delivers a significant result on our financial literacy measure. Much like the findings of [Gathergood and Weber \(2017\)](#), financially literate individuals are more likely to choose a variable rate mortgage compared to those with different fixation periods.

Table 6: Mortgage Choice: Ordered Probit Model - Marginal Effects

<b>Mortgage Price Difference</b>		
Variable Rate	0.031***	(0.007)
Up to 3 years fixation	-0.006***	(0.001)
Over 3 & up to 5 years fixation	-0.011***	(0.003)
Over 5 years fixation	-0.014***	(0.003)
<b>Financial Literacy</b>		
Variable Rate	0.070***	(0.025)
Up to 3 years fixation	-0.013***	(0.005)
Over 3 & up to 5 years fixation	-0.025***	(0.009)
Over 5 years fixation	-0.032***	(0.012)
<b>Interest Rate Expect: Volatility</b>		
Variable Rate	-0.072***	(0.026)
Up to 3 years fixation	0.013***	(0.005)
Over 3 & up to 5 years fixation	0.026***	(0.010)
Over 5 years fixation	0.033***	(0.012)
<b>Interest Rate Expect: Fall</b>		
Variable Rate	0.132***	(0.041)
Up to 3 years fixation	-0.024***	(0.008)
Over 3 & up to 5 years fixation	-0.047***	(0.015)
Over 5 years fixation	-0.061***	(0.019)
<b>Interest Rate Expect: Same</b>		
Variable Rate	0.113***	(0.040)
Up to 3 years fixation	-0.021***	(0.008)
Over 3 & up to 5 years fixation	-0.040***	(0.015)
Over 5 years fixation	-0.052***	(0.019)
Borrower and Mortgage Controls	Yes	
Observations	1,301	

Notes: Result of an Ordered Probit Model.

Dependant variable choice between: variable ; fixed < 3 year; fixed > 3 & up to 5 year and > 5 year.

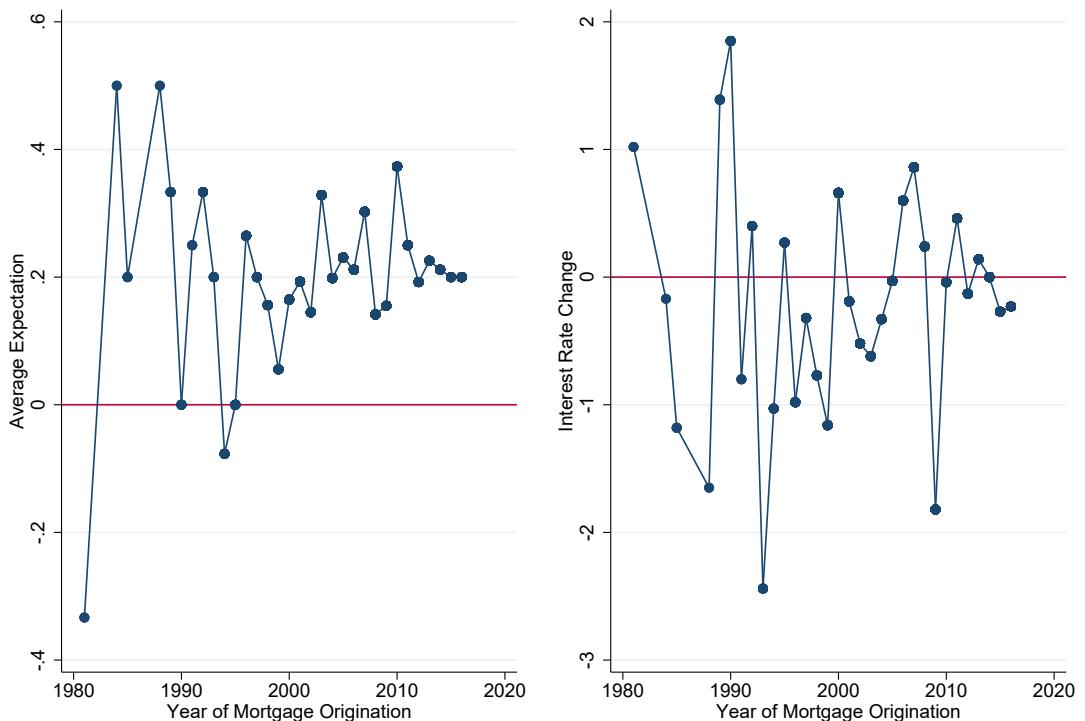
Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 4.3 Accuracy of Expectations

The previous sections have provided robust evidence of the importance of expectations in the mortgage choice process. However, it remains to be established if households can accurately match these expectations with realised interest rate movements. Figure 5 provides a comparison between the mean interest rate expectation direction and the realised interest rate movement across mortgage origination years<sup>12</sup>.

Figure 5: Average Expectation & Interest Rate Change by Origination Year



Source: Central Bank of Ireland Survey, Interest Rate Statistics & Authors Workings

To analyse the accuracy of expectations, we introduce two types of interest rate movements. These are *Market Rate Movements* and *Own Rate Movements*. The general market movement reflects overall changes in the Irish mortgage market while own rate movements were those of the interest rate type held by the household. Using Central Bank of Ireland interest rate data, we matched the household's expectations on interest rate movements with those that occurred at two intervals following their mortgage draw down, 1-year and 3-year. Degrees of accuracy were taken across the two measures outlined above to establish if certain household characteristics held greater predictive power for either measure. Binary variables were generated for the four categories, with 1 denoting an accurate interest rate expectation.

<sup>12</sup>A breakdown by rate type is available in Figure 7 of the Appendix.

As can be seen in Table 7, across all measures we find evidence of the role of education levels in the ability to predict rate movements, with third level education having a significantly positive impact on accuracy. This effect is strongest for households own rate over the first year, implying increased challenges in forecasting in the longer term. These results are similar to [Ben-David et al. \(2018\)](#) who showed the subjective uncertainty for high education individuals to be closer to the objective volatility of the economic outcomes forecasted. We also find evidence of financial literacy contributing towards a higher probability of accuracy, although this is primarily over the first year time horizon for market rates. These results mirror those in the areas of stock market participation ([Van Rooij et al., 2011](#)), retirement savings ([Lusardi and Mitchell, 2011](#)) and high cost credit ([Disney and Gathergood, 2013](#)) which show the positive relationship between measured financial literacy, education and beneficial financial outcomes. Lastly, our results show that households based in urban areas have an increased likelihood of correctly forecasting over the 3 year time horizon, with first time buyers also showing accuracy in the first year of their own rate type. This may reflect households paying additional attention to their initial interest rate movements in advance of their first house purchase.

Table 7: Accuracy of Expectations: Probit Model Marginal Effects

	Market 1 Year	Own 1 Year	Market 3 Year	Own 3 Year
Age: 18 - 34	0.021 (0.050)	0.075 (0.046)	0.036 (0.049)	0.032 (0.047)
Age: 35 - 44	0.000 (0.041)	0.039 (0.037)	-0.001 (0.040)	0.014 (0.038)
Age: 45 - 54	0.048 (0.040)	0.077** (0.037)	0.005 (0.039)	0.026 (0.037)
Male	-0.009 (0.022)	0.013 (0.021)	0.011 (0.021)	0.008 (0.021)
Children	0.022 (0.025)	0.024 (0.024)	0.068*** (0.024)	0.035 (0.024)
Urban	0.047* (0.024)	0.028 (0.023)	0.062*** (0.023)	0.063*** (0.023)
Leaving Cert and non-degree	0.051 (0.040)	0.054 (0.037)	0.056 (0.037)	0.049 (0.037)
Third Level Education	0.108*** (0.041)	0.119*** (0.038)	0.109*** (0.038)	0.093** (0.038)
Unemployed	-0.039 (0.101)	-0.006 (0.101)	-0.018 (0.098)	-0.003 (0.099)
Retired/Student/Homemaker	0.050 (0.066)	0.014 (0.063)	-0.022 (0.059)	-0.032 (0.057)
Joint Decision	-0.022 (0.025)	-0.025 (0.024)	-0.029 (0.024)	-0.031 (0.024)
First Time Buyer	0.050* (0.027)	0.074*** (0.027)	0.036 (0.026)	0.023 (0.026)
Financial Literacy	0.060*** (0.022)	0.048** (0.021)	0.036* (0.021)	0.043** (0.021)
Origination Year Controls	Yes	Yes	Yes	Yes
Observations	1,748	1,748	1,758	1,758

Notes: Probit Regressions.

Dependant variable =1 if borrower correctly predicted interest rate movements.

Omitted Categories; Age: Over 54, Primary Education, Employed

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 5 Robustness Checks

### 5.1 Risk Preferences

Context matters in the calculation of risk preferences (Barsky et al., 1997; Dohmen et al., 2011). Therefore, it is important to test our results from the quantitative lottery risk preferences question with another measure of preference for risk. We adopt a qualitative measure which required the respondent to give an assessment of their willingness to take risks (Dohmen et al., 2011; Gathergood and Weber, 2017). This additional approach is attractive for eliciting a different measure of risk with no set monetary values or probabilities. Therefore, we find it beneficial to see if this measure compares with the previous variable containing financial stakes and probabilities. For this measure respondents were asked :

1. Using a scale of 1 to 10, where 1 is no risk at all and 10 is a high level of risk, could you please tell me the level of risk are you prepared to take that you might lose some of the money put into your savings account/investment?

A significant result from the validation check would provide evidence that the measure of risk does not solely rely monetary value. Table 8 shows that risk attitudes vary widely. There is relative heterogeneity across the survey sample, with a substantial fraction of 42 per cent not willing to take risk at all and only 2 per cent choosing the highest possible level of risk.

Table 8: Risk Preferences

Qualitative Risk Measure	Percentage
1 - No risk at all	39%
2 - 3	19%
4 - 5	21%
6 - 7	13%
8 - 9	6%
10 - High Risk	2%

Table 13 of the Appendix contains the results when the measure of risk in our baseline is supplemented with this alternative question. The risk scale variable is divided into three categories Group I, II and III. These groups are coded as 1 - No risk, 2-5 Medium Risk and 6-10 High risk. In line with our previous measurement, we find that with all other results remaining consistent, there is no significant impact by risk preferences on the mortgage choice decision. A possible reason for this lack of influence is posited by Barsky et al. (1997), who state that the principal requirement for a question aimed at measuring risk aversion is that it must involve gambles over lifetime income. Arguably, our measurements fail to meet this criteria in the mortgage choice context.

## 5.2 Expectation Validation

An issue with the use of subjective expectations data in models is that it may be biased or endogenous (Zafar, 2011). When a household is asked about their expectations structure, they may edit their responses to support their mortgage choice as rational. However, the results shown within Manski (2004) provide sufficient evidence that individuals provide credible information of expectations for notable experiences. He recommends that subjective data is preferable to dubious assumptions. Similarly, in this paper it may be the case that a significant amount of time has elapsed between a household drawing down their mortgage and the stated expectations at the time of draw down. Households may have difficulty recalling their expectations, or set the expectations in line with past movements as a justification for selection of a certain product.

Table 9: Expectations Accuracy

Interest Rate Expectation	Pre-2000	2000-2006	2006-2012	Post 2012
Market Rate 1-Year	27.5%	35.2%	18.9%	33.9%
Own Rate 1-Year	24.8%	33.9%	16.8%	27.7%
Market Rate 3-Year	18.2%	31.4%	20.8%	27.4%
Own Rate 3-Year	20%	31.4%	19.6%	22.5%

Table 9 breaks down the accuracy of expectations across our measures and distinct time periods. We select pre-2000 to account for all historic mortgages, 2000-2006 to measure the pre-financial crisis period, 2006-2012 to capture the crisis, and post-2012 the recovery period. As expected, the higher degrees of accuracy came during the period of relatively stable rate decreases (2000-2006) while the lower degrees of accuracy appear to be linked to periods of extensive economic and interest rate fluctuations (2006-2012). A further validation of this view can be seen in Table 14 of the Appendix, confirming our beliefs that the stable period of 2000-2006 lead to a significantly positive probability of accuracy across our measures, with the crisis period of 2012-2016 having distinct lower probability of short-term accuracy. Given these intuitive results, and the relatively subdued accuracy numbers across periods, it appears unlikely that respondents altered expectations significantly from their actual beliefs.

## 6 Conclusion

A noteworthy level of analytical research has focused on the mechanisms of mortgage product selection. Nonetheless, gaps still exist in the literature. Using a unique data source for a representative sample of mortgages, we attempt to disentangle the influences on this choice decision by analysing a number of key socio-demographic characteristics, loan criteria, and behavioural traits. Our primary contribution to the literature is a unique measure

of interest rate expectations and how these forecasts interact with previously established predictors. We find that, when controlling for a host of possible contributing factors, mortgage pricing and future interest rate expectations are key components driving the decision. We show the accuracy of expectations across our sample, finding that the presence of a high level of education or degree of financial literacy improves predictions. The role of expectations, and their accuracy, raises important policy implications as borrowers relying on sources of expectations, education and financial literacy to guide their views will be misinformed if the sources are inaccurate, or sufficient education and financial literacy is not available.

It is clear that there is a responsibility on policymakers and their institutions to guide the public to better comprehend a view of future economic movements, to minimise uncertainty and set expectations in line with their beliefs. As part of a recent monetary policy strategy review, the European Central Bank has acknowledged the need for credibility, clarity and consistency in its communications<sup>13</sup>. Within this review, it has been stated that by effectively letting markets know, in less technical and more understandable terms, where to expect interest rates to be in the future, they can bring about a change in the price of borrowing for borrowers. In addition to this, the OECD have put forward a recommendation that financial education is made available to acquire the knowledge and skills to build responsible financial behaviour throughout each stage of an individual's education<sup>14</sup>. Given the importance selection of a mortgage product has as the most significant financial decision undertaken by a household, any initiative by policymakers to better arm individuals to make optimal decisions and navigate products in line with accurate expectations should be welcomed. Future work should seek to measure the impact of these policy actions on the perceptions and expectations of households in the Euro area through their financial behaviour.

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<sup>13</sup><https://www.ecb.europa.eu/home/search/review/html/monpol-communication.en.html>

<sup>14</sup><https://www.oecd.org/daf/fin/financial-education/financial-education-and-youth.htm>

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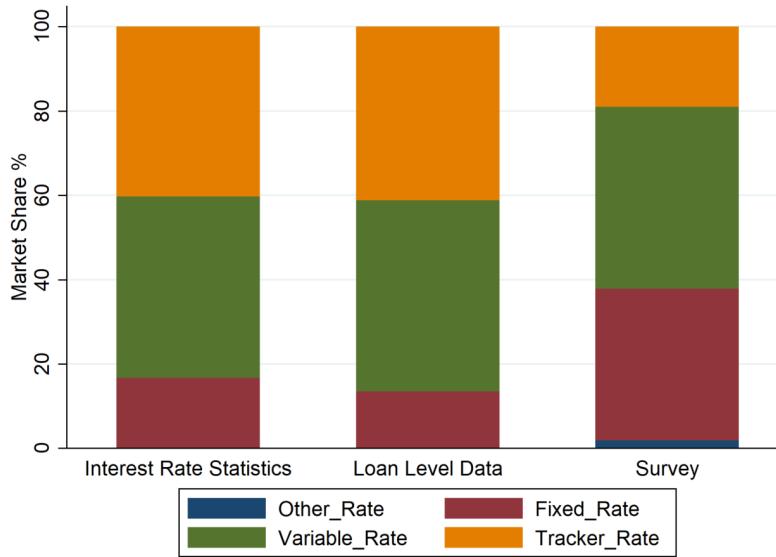
## Appendix

### The Mortgage Choice Survey

The mortgage choice survey was undertaken by an independent survey company, Behaviour and Attitudes, on behalf of the Central Bank of Ireland. The survey was designed to capture information on the key factors influencing mortgage choice. The survey included approximately 50 questions, and was administered on a face-to-face basis using a tablet computer. To be eligible for the survey, the responding household was required to be a current mortgage holder. Furthermore, only owner occupier households were included in the survey, and the mortgage under examination in the survey had to be on the owner occupier current residence. The survey took between 20 and 30 minutes to complete. The results from the survey indicated that 720 (36 per cent) respondents had a fixed rate mortgage, 863 (43 per cent) a variable rate mortgage, 381 (19 per cent) a tracker mortgage and 39 (2 per cent) held an ‘other’ mortgage type. We compare this breakdown with two other data sources; the Central Bank of Ireland Interest Rate Statistics and Loan Level Data, as shown in Figure 6. The proportion of households with a variable rate mortgage in our sample matches closely to the two other data sources. On the other hand, however, it is clear that fixed rate mortgages are over represented in our sample, and tracker rate mortgages under represented.

The sample of potential respondents was divided up into sampling units and for each sampling unit a quota or target was provided, breaking up interviews by age (under 35 years, 35-44 years and 45+ years) and by social class. A quota for type of mortgage was not imposed on the sampling frame; instead, the mortgage type was allowed to “fall out” as a result of the survey, rather than to impose such a control. Certain mortgage types may be more common in one part of the country than another, and without having definitive data to guide us, it made more sense to not quota control by mortgage type. Some individuals stated there may have been difficulty-recalling elements of their own mortgage arrangement. There were specific questions about mortgage values, interest rates and household income that respondents struggled to recall. These were often challenging when the mortgage had been taken out a number of years prior to the survey. This was evident by the large number of missing household income and mortgage criteria in the dataset. Further information on missing survey data is available below. After fieldwork had been completed, detailed data checking was undertaken, with various logic checks and random re-contacting of respondents (by phone, by mail and in person) to determine that they were indeed interviewed, and to confirm or challenge some of the responses given. Part of this involved re-checking the quota data: age, occupation etc., to ensure that the respondent had been correctly classified and did fit the quota.

Figure 6: Source Comparison



## Missing Survey Data

As stated, certain households encountered difficulty-recalling elements of their own mortgage arrangement when the mortgage had been taken out some time in the past. This problem of non-response is not unique to our survey, with previous research acknowledging the ubiquitous nature of this issue (Rubin (1987); Little and Rubin (1987)). Non-response is commonplace in a census or survey involving individual respondents. The missing values can result in less efficient estimates, through reduced sample size and inability to utilise data analysis methodologies requiring completeness. This raises further complications such as structural bias as responses can frequently differ systematically between those who respond and those who do not. Two areas of the survey required attention in this regard; interest rates and income levels.

Due to the important role interest rate pricing can play in the mortgage choice decision, a key variable in our analysis is interest rate percentage of the mortgage at origination. As our data dates back to 1973, households naturally struggled to recall these figures the back their mortgage draw down occurred. Non-response rates for this variable was 50%. However, the Central Bank of Ireland has a rich dataset of retail interest rates dating back to 1975. This data allows for both market averages and bank specific interest rates to be derived based on criteria such as interest rate type, provider and year of origination<sup>15</sup>. From this dataset, it was possible to match a number of missing interest rates with their corresponding mortgage characteristics. This decreased our non-response rate from 50% to 14%.

<sup>15</sup>Published interest data on new business retail interest rates and volumes are available back to 2003. <https://www.centralbank.ie/statistics/data-and-analysis/credit-and-banking-statistics/retail-interest-rates>

As shown in the literature ([Bacon and Moffatt, 2012](#); [Cox et al., 2015](#); [Brueckner and Follain, 1988](#)), household income levels are a core variable in the mortgage choice process. Our key variable in this regard was household income at the time of mortgage origination. Due to the same challenges as outlined above, we received a low response rate of 47%. To fill these empty observations a predictive mean matching imputation was undertaken based on the remaining core variables of our analysis. Table 10 below shows a comparison between our baseline outputs for data with income set = missing (column 1) and the imputed data (column 2). It shows that, outside of income, our core results, including those linked to price differential and expectations remain unchanged based on the imputation approach used.

Table 10: Mortgage Choice: Probit Model Comparison Marginal Effects

	Missing		Imputation	
<b>Demographics</b>				
Age: 18 - 34	0.045	(0.060)	0.043	(0.061)
Age: 35 - 44	-0.005	(0.050)	-0.010	(0.051)
Age: 45 - 54	0.027	(0.049)	0.023	(0.050)
Male	-0.014	(0.027)	-0.021	(0.027)
Children	-0.001	(0.032)	-0.006	(0.032)
Urban	-0.019	(0.030)	-0.029	(0.031)
Leaving Cert and non-degree	0.010	(0.055)	0.014	(0.056)
Third Level Education	0.033	(0.056)	0.037	(0.057)
Unemployed	0.202	(0.128)	0.189	(0.133)
Retired/Student/Homemaker	0.140*	(0.084)	0.135	(0.088)
<b>Mortgage, Income &amp; Pricing</b>				
Joint Decision	0.050	(0.033)	0.047	(0.034)
First Time Buyer	0.029	(0.034)	0.034	(0.034)
Income: Missing	-0.057	(0.039)		
Income: €50,000 - €70,000	-0.126***	(0.045)	-0.074*	(0.041)
Income: €70,000 - €100,000	-0.076	(0.049)	-0.038	(0.047)
Income Greater than €100,000	-0.216***	(0.054)	-0.119**	(0.051)
Mortgage Pricing Difference	-0.031***	(0.008)	-0.032***	(0.008)
<b>Behavioural &amp; Expectations</b>				
Lottery Risk Group II	-0.010	(0.034)	-0.009	(0.035)
Lottery Risk Group III	-0.018	(0.039)	-0.016	(0.040)
Lottery Risk Group IV	-0.053	(0.053)	-0.062	(0.053)
Lottery Risk Group V	-0.069	(0.100)	-0.076	(0.100)
Lottery Risk Group VI	-0.027	(0.092)	-0.011	(0.096)
Financial Literacy	-0.039	(0.027)	-0.052*	(0.028)
Interest Rate Expect: Volatility	0.081***	(0.028)	0.083***	(0.028)
Interest Rate Expect: Fall	-0.204***	(0.039)	-0.196***	(0.040)
Interest Rate Expect: Same	-0.064*	(0.034)	-0.065*	(0.035)
Interest Rate Expect: No View	-0.167***	(0.041)	-0.173***	(0.041)
Observations	1,327		1,299	

Notes: Probit Regressions.

Dependant Variable =1 if borrower selected fixed mortgage product at origination.

Omitted Categories; Age: Over 54, Primary Education, Employed, Income: Less then €50,000

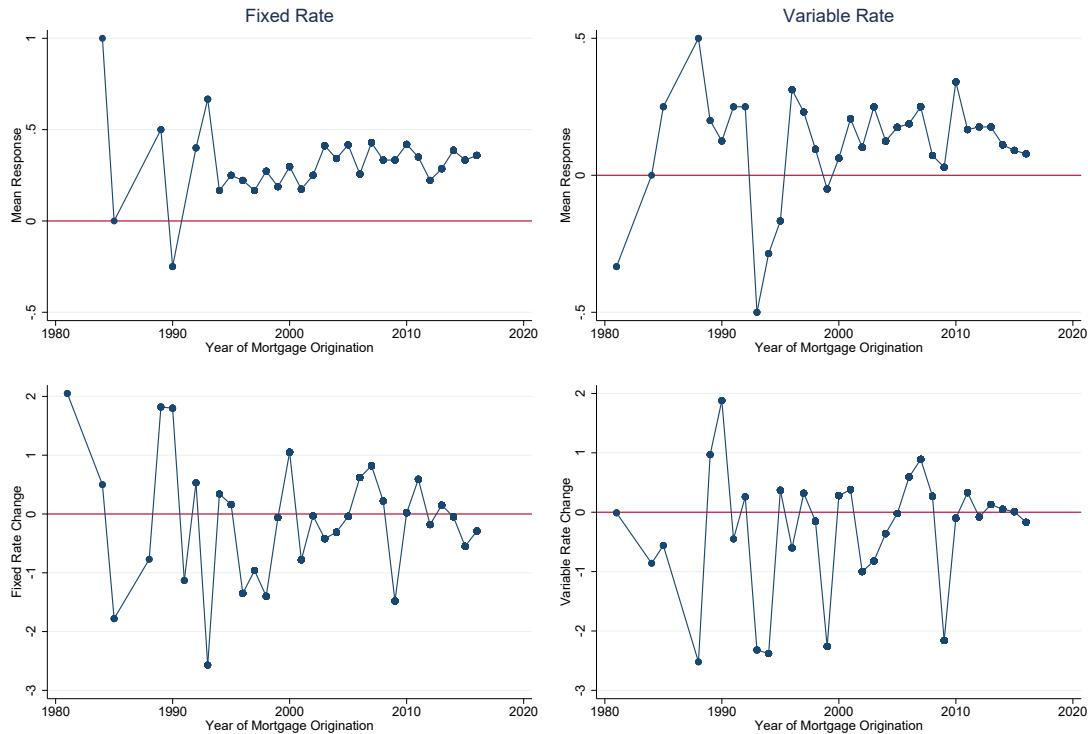
Lottery Risk Group I, Interest Rate Expect: Rise.

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Figures

Figure 7: Expectations and Interest Rate by Rate Type



Source: Central Bank of Ireland Survey, Interest Rate Statistics & Authors Workings

## Tables

Table 11: Length of Fixation

Number of Years	Percentage
No fixation	60%
Up to 3 years	16%
3 to 5 years	14%
Over 5 years	10%

Table 12: Mortgage Choice: Ordered Probit Model Full Output

	Pricing	Risk & Literacy		Expectations	
<b>Demographics</b>					
Age: 18 - 34	-0.133 (0.147)	-0.128 (0.148)		-0.087 (0.156)	
Age: 35 - 44	-0.285** (0.128)	-0.282** (0.129)		-0.249* (0.134)	
Age: 45 - 54	-0.102 (0.127)	-0.104 (0.127)		-0.051 (0.133)	
Male	-0.041 (0.063)	-0.030 (0.063)		-0.046 (0.067)	
Children	0.048 (0.076)	0.039 (0.076)		0.039 (0.081)	
Urban	-0.055 (0.073)	-0.065 (0.074)		-0.138* (0.080)	
Leaving Cert and non-degree	0.118 (0.132)	0.116 (0.133)		0.139 (0.142)	
Third Level Education	0.145 (0.136)	0.149 (0.137)		0.163 (0.145)	
Unemployed	0.326 (0.228)	0.303 (0.224)		0.226 (0.277)	
Retired/Student/Homemaker	0.326 (0.215)	0.310 (0.213)		0.372 (0.228)	
<b>Mortgage, Income &amp; Pricing</b>					
Joint Decision	0.168** (0.081)	0.161** (0.082)		0.127 (0.087)	
First Time Buyer	0.106 (0.084)	0.098 (0.085)		0.053 (0.090)	
Income: €50,000 - €70,000	-0.133 (0.097)	-0.130 (0.098)		-0.144 (0.104)	
Income: €70,000 - €100,000	-0.069 (0.106)	-0.048 (0.108)		-0.097 (0.118)	
Income Greater than €100,000	-0.251* (0.130)	-0.227* (0.132)		-0.283** (0.141)	
Mortgage Pricing Difference	-0.084*** (0.020)	-0.082*** (0.020)		-0.084*** (0.020)	
<b>Behavioural &amp; Expectations</b>					
Lottery Risk Group II		0.035 (0.084)	0.034 (0.089)		
Lottery Risk Group III		0.079 (0.093)	0.084 (0.101)		
Lottery Risk Group IV		-0.022 (0.125)	-0.084 (0.144)		
Lottery Risk Group V		-0.278 (0.215)	-0.356 (0.252)		
Lottery Risk Group VI		-0.006 (0.223)	0.051 (0.258)		
Financial Literacy		-0.172*** (0.065)	-0.190*** (0.070)		
Interest Rate Expect: Volatility				0.195*** (0.072)	
Interest Rate Expect: Fall				-0.360*** (0.112)	
Interest Rate Expect: Same				-0.048 (0.083)	
Interest Rate Expect: No View				-0.309*** (0.111)	
Constant	0.334 (0.216)	0.245 (0.220)		0.018 (0.244)	
Controls for Provider & Year	Yes	Yes		Yes	
Observations	1,484	1,484		1,301	

Notes: Ordered Probit Regressions.

Dependant variable choice between: variable; fixed &lt;3 year; fixed &gt; 3 &amp; up to 5 year and &gt; 5 year.

Omitted Categories; Age: Over 54, Primary Education, Employed, Income: Less then €50,000

Lottery Risk Group I, Interest Rate Expect: Rise.

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 13: Mortgage Choice: Probit Model Alternative Risk - Marginal Effects

	Baseline	Risk & Literacy	Expectations	
<b>Demographics</b>				
Age: 18 - 34	0.025 (0.059)	0.034 (0.060)	0.039 (0.062)	
Age: 35 - 44	-0.030 (0.050)	-0.025 (0.050)	-0.014 (0.051)	
Age: 45 - 54	0.001 (0.049)	0.007 (0.049)	0.024 (0.050)	
Male	-0.018 (0.026)	-0.012 (0.026)	-0.018 (0.027)	
Children	-0.001 (0.031)	-0.007 (0.031)	-0.010 (0.032)	
Urban	0.001 (0.029)	0.002 (0.029)	-0.025 (0.031)	
Leaving Cert and non-degree	0.014 (0.052)	0.015 (0.052)	0.017 (0.055)	
Third Level Education	0.038 (0.054)	0.038 (0.054)	0.039 (0.057)	
Unemployed	0.213* (0.120)	0.204* (0.119)	0.179 (0.133)	
Retired/Student/Homemaker	0.115 (0.084)	0.115 (0.084)	0.134 (0.089)	
<b>Mortgage, Income &amp; Pricing</b>				
Joint Decision	0.064** (0.032)	0.065** (0.032)	0.052 (0.034)	
First Time Buyer	0.051 (0.033)	0.051 (0.033)	0.037 (0.034)	
Income: €50,000 - €70,000	-0.074* (0.038)	-0.076** (0.039)	-0.077* (0.041)	
Income: €70,000 - €100,000	-0.023 (0.043)	-0.019 (0.044)	-0.040 (0.046)	
Income Greater than €100,000	-0.102** (0.049)	-0.098** (0.049)	-0.120** (0.052)	
Mortgage Pricing Difference	-0.030*** (0.008)	-0.029*** (0.008)	-0.030*** (0.008)	
<b>Behavioural &amp; Expectations</b>				
Risk Scale Group II		0.025 (0.029)	0.010 (0.030)	
Risk Scale Group III		-0.039 (0.035)	-0.059 (0.037)	
Financial Literacy		-0.046* (0.026)	-0.052* (0.028)	
Interest Rate Expect: Volatility			0.084*** (0.028)	
Interest Rate Expect: Fall			-0.196*** (0.040)	
Interest Rate Expect: Same			-0.065* (0.035)	
Interest Rate Expect: No View			-0.177*** (0.042)	
Observations	1,482	1,467	1,291	

Notes: Probit Regressions. Dependant Variable =1 if borrower selected fixed mortgage product at origination.

Omitted Categories; Age: Over 54, Primary Education, Employed, Income: Less then €50,000

Risk Scale Group I, Interest Rate Expect: Rise.

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 14: Accuracy of Expectations: Probit Model Marginal Effects

	Market 1 Year	Own 1 Year	Market 3 Years	Own 3 Years
Age: 18 - 34	0.021 (0.050)	0.075 (0.046)	0.036 (0.049)	0.032 (0.047)
Age: 35 - 44	0.000 (0.041)	0.039 (0.037)	-0.001 (0.040)	0.014 (0.038)
Age: 45 - 54	0.048 (0.040)	0.077** (0.037)	0.005 (0.039)	0.026 (0.037)
Male	-0.009 (0.022)	0.013 (0.021)	0.011 (0.021)	0.008 (0.021)
Children	0.022 (0.025)	0.024 (0.024)	0.068*** (0.024)	0.035 (0.024)
Urban	0.047* (0.024)	0.028 (0.023)	0.062*** (0.023)	0.063*** (0.023)
Leaving Cert and non-degree	0.051 (0.040)	0.054 (0.037)	0.056 (0.037)	0.049 (0.037)
Third Level Education	0.108*** (0.041)	0.119*** (0.038)	0.109*** (0.038)	0.093** (0.038)
Unemployed	-0.039 (0.101)	-0.006 (0.101)	-0.018 (0.098)	-0.003 (0.099)
Retired/Student/Homemaker	0.050 (0.066)	0.014 (0.063)	-0.022 (0.059)	-0.032 (0.057)
Joint Decision	-0.022 (0.025)	-0.025 (0.024)	-0.029 (0.024)	-0.031 (0.024)
First Time Buyer	0.050* (0.027)	0.074*** (0.027)	0.036 (0.026)	0.023 (0.026)
Origin Year Pre 2000	-0.032 (0.049)	0.039 (0.047)	-0.005 (0.044)	0.035 (0.044)
Origin Year 2000-2006	0.038 (0.037)	0.110*** (0.035)	0.097*** (0.034)	0.122*** (0.033)
Origin Year 2006-2012	-0.137*** (0.031)	-0.087*** (0.028)	-0.036 (0.028)	-0.013 (0.027)
Financial Literacy	0.060*** (0.022)	0.048** (0.021)	0.036* (0.021)	0.043** (0.021)
Observations	1,748	1,748	1,758	1,758

Notes: Probit Regressions.

Dependant variable =1 if borrower correctly predicted interest rate movements.

Omitted Categories; Age: Over 54, Primary Education, Employed

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 15: Variable Description

Variable	Description
<i>Age 18 - 34</i>	Dummy variable indicating if respondent are aged between 18 and 34 years
<i>Age 35 - 44</i>	Dummy variable indicating if respondent is aged between 35 and 44 years.
<i>Age 45 - 54</i>	Dummy variable if the survey respondent is aged between 45 and 54 years.
<i>Age Over 54</i>	Dummy variable indicating that the survey respondent is aged over 54 years.
<i>Male</i>	Dummy variable indicating if the survey respondent is male.
<i>Children</i>	Dummy variable if dependent children in household at time of origination.
<i>Joint Decision</i>	Dummy variable if mortgage choice was a joint decision.
<i>Urban</i>	Dummy variable if geographic location of respondent is urban.
<i>Junior Cert or Lower</i>	Dummy variable if respondent has education lower level of education.
<i>Leaving Cert and Non-degree</i>	Dummy variable if respondent has a medium level of education.
<i>Third Level Education</i>	Dummy variable if respondent has a high level of education.
<i>Employed</i>	Dummy variable if respondent is employed
<i>Unemployed</i>	Dummy variable if respondent is unemployed
<i>Retired/Student/Homemaker</i>	Dummy variable if respondent is retired, student or homemaker.
<i>First Time Buyer</i>	Dummy variable if respondent was a first time buyer at mortgage origination
<i>Income: Missing</i>	Dummy variable if the household income was not reported.
<i>Income: Less than €50,000</i>	Dummy variable if the household has an income less than €50,000.
<i>Income: €50,000 - €70,000</i>	Dummy variable if the household has an income between €50,000 and €70,000.
<i>Income: €70,000 - €100,000</i>	Dummy variable if the household has an income between €70,000 and €100,000.
<i>Income Greater than €100,000</i>	Dummy variable if the household has an income over €100,000.
<i>Origin Year Pre 2000</i>	Dummy variable if mortgage originated prior to 2000.
<i>Origin Year 2000 - 2006</i>	Dummy variable if mortgage originated between 2000 and 2006.
<i>Origin Year 2006 - 2012</i>	Dummy variable indicating if mortgage originated between 2006 and 2012.
<i>Origin Year 2012 - 2016</i>	Dummy variable if mortgage originated between 2012 and 2016.
<i>Mortgage Price Difference</i>	Continuous variable on the pricing difference between fixed and variable rate mortgages.
<i>Interest Rate Expect: Volatility</i>	Dummy variable if respondent expected interest rate volatility at origination.
<i>Interest Rate Expect: Rise</i>	Dummy variable if the respondent expected interest rates to rise after origination.
<i>Interest Rate Expect: Fall</i>	Dummy variable if the respondent expected interest rates to fall after origination.
<i>Interest Rate Expect: Same</i>	Dummy variable if the respondent expected interest rates to stay the same after origination.
<i>Interest Rate Expect: No view</i>	Dummy variable if the respondent had no expectations of interest rate movements after origination.
<i>Lottery Risk Group I</i>	Dummy variable if the respondent has no preference for risk
<i>Lottery Risk Group II</i>	Dummy variable indicating that the respondent has a lowest preference for risk
<i>Lottery Risk Group III</i>	Dummy variable indicating that the respondent has a low preference for risk
<i>Lottery Risk Group IV</i>	Dummy variable indicating that the respondent has medium preference for risk
<i>Lottery Risk Group V</i>	Dummy variable indicating that the respondent has a high preference for risk
<i>Lottery Risk Group VI</i>	Dummy variable indicating that the respondent has a highest preference for risk
<i>Risk Scale Group I</i>	Dummy variable indicating that the respondent has no preference for risk
<i>Risk Scale Group II</i>	Dummy variable indicating that the respondent has a medium preference for risk
<i>Risk Scale Group III</i>	Dummy variable indicating that the respondent has a high preference for risk
<i>Financial Literacy</i>	Dummy variable indicating that the respondent has a level of financial literacy