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Is Poor Financial Literacy a Barrier to Home Ownership?

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Abstract

The decision to buy a home is one of the most important choices faced by a household. Most households who purchase a home do so using a mortgage. But mortgages are complex financial instruments and this complexity may be a barrier to less sophisticated households becoming homeowners. Using survey data from a sample of English and Welsh households we measure household financial literacy related to mortgages, including concepts such as loan duration, interest compounding and amortization. We also measure time preference and risk attitude. We find that in the population mortgage financial literacy is generally low, as on average only two out of four questions are answered correctly. Among renters, mortgage financial literacy is substantially worse than among homeowners and this difference is not explained by socio-economic factors. Econometric estimates suggest mortgage financial literacy predicts home ownership, but instrumental variable estimates show that mortgage financial literacy is acquired endogenously with housing tenure choices.

Keywords: home ownership, financial literacy, mortgage
JEL Codes: D10, D12, G21

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1 Introduction

The decision to buy a family home is one of the most important financial choices made by households. The family home is the largest single durable good purchased over the life-cycle, for which financial and non-financial costs of adjustment can be large. It is also an investment asset, a source of collateral and in many cases the main component of a bequest. A large literature has considered the benefits arising from home ownership (DiPasquale and Glaeser, 1999; Engelhardt et al., 2010; Grinstein-Weiss et al., 2013; Coulson and Li, 2013), including local amenities and social capital effects plus also positive effects on child well-being (Haurin et al., 2002) and consumption smoothing (Benito and Mumtaz, 2009). For a review of the effects of home ownership see Dietz and Haurin (2003).

Given the importance of home ownership, understanding the barriers to achieving ownership is an important research topic. Prior studies have identified a broad range of potential barriers including borrowing constraints (Haurin et al., 1997; Ortalo-Magné and Sven, 2006; Chambers et al., 2009; Kolodziejczyk and Leth-Petersen, 2013), lack of mortgage market development (Sanders, 2005) and racial differences (Charles and Hurst, 2002; Collins and Margo, 2011). A large literature also considers the interplay between house price volatility, rental price volatility and income risk (Sinai and Souleles, 2005; Banks et al., 2015; Amior and Halket, 2014; Bostic and Lee, 2008; Diaz-Serrano, 2005). Many government initiatives have been introduced to alleviate barriers to home ownership including, for example, mortgage subsidies (Fetter, 2013; Glaeser and Shapiro, 2003) and discounted private sales of social housing (Aalbers, 2004)

Is poor understanding of mortgages also a barrier to home ownership? For the majority of households an integral component of purchasing a home is a mortgage. Most households in the US and the UK purchase their first home when young and when doing so smooth consumption using a mortgage, which for the majority of households is the only means of funding a home purchase. But a mortgage is a complex financial product requiring a degree of financial sophistication on the part of households. Moreover, financial innovation in US and UK mortgage markets through the early 2000s further complicated the mortgage offerings available to households. Lack of financial understanding of mortgage products, also known as ‘financial literacy’, may be an important barrier to home ownership for some households. Although liberalization of mortgage markets has led to the general perception that mortgages were easier to obtain throughout the 2000sUS data shows home ownership rates in the population actually declined from 67.4% in the year 2000 to 64.5% in 2014

(Bureau of Labor Statistics). In England and Wales, the context for this study, the home ownership rate fell from 69.2% to 63.4% over the same period (Office for National Statistics; ONS).

In this paper we use a specially commissioned survey of a representative sample of English and Welsh households to examine whether poor financial literacy is a barrier to home ownership. To our knowledge ours is the first study to examine the relationship between financial literacy and home ownership. Recent studies have shown that poor financial literacy discourages households from participation in a range of financial markets. For example, lack of understanding of the stock market and investment vehicles lowers the likelihood of households owning stocks (van Rooij et al., 2011a). Also, ignorance of basic financial concepts integral to retirement saving discourages individuals from forming a plan for retirement saving (Lusardi and Mitchell, 2007a). In recent research we show that financial literacy is an important determinant for choice of mortgage type (Gathergood and Weber, 2015). Faced with complex mortgage options, poor financial literacy might similarly be an important barrier to home ownership.

We measure the financial literacy of households in the domain of mortgage choice by inserting multiple-choice questions into our survey, encapsulating concepts of loan duration, interest calculation, interest compounding and loan amortization. The multiple-choice questions we include do not require complicated mathematical calculations, but do require an understanding of key economic concepts in order to answer the questions correctly. Alongside our questions on financial literacy, we include a broad set of questions to capture relevant variables which explain home ownership choices, including measures of income risk and credit constraints. We also consider other behavioral determinants of home ownership, including the role of risk attitude and time preference in the form of patience and present bias[3]. We supplement our data with extensive local level data which includes measures of house price affordability and house price risk.

Survey results show levels of mortgage financial literacy among our sample are generally low. Among our whole sample comprising homeowners and renters, the average number of questions answered correctly is 1.96 out of four. Most respondents answer questions on loan duration and simple interest calculation correctly, but only 40% show understanding of compound interest and less than one third answer our loan amortization

[3] In our recent paper we show that time preferences are important for choice of mortgage type, specifically the choice over a standard repayment mortgage or an alternative mortgage with interest-only payments (Gathergood and Weber, 2015).

question correctly. However, financial literacy is better among homeowners compared with renters. Households who score highest on the financial literacy index are 20 percentage points more likely to be homeowners compared with the lowest scoring households. In an unconditional comparison, answering one more financial literacy question correctly is associated with a 5 percentage point increase in the likelihood of home ownership.

Econometric estimates from probit models show that much, but not all, of the relationship between financial literacy and home ownership is explained by covariates which we include in our models. In keeping with the prior literature, we find that the likelihood of home ownership is lower for households who are credit constrained or who exhibit higher income volatility (and lower levels of income). Home ownership also falls with the house price to income ratio and with the level of house price volatility in the locality of the household. Conditional on these and other characteristics, we find financial literacy is statistically significant in our model of home ownership, but the marginal effect from a one unit increase in the financial literacy index is only one third of the unconditional effect – raising the likelihood of home ownership by approximately 1.5 percentage points.

Should we interpret our estimates as evidence that poor financial literacy causes households to remain renters? Recent studies have emphasized that the acquisition of financial literacy may arise endogenously with financial choices and that financial literacy is acquired depending upon the choices made by a household (Jappelli and Padula, 2013; Lusardi and Mitchell, 2014; van Rooij et al., 2011a). The decision to invest in understanding mortgages is perhaps secondary to the decision to become a homeowner, or is potentially learned through mortgage experience. We therefore follow recent studies in adopting an instrumental variable (IV) strategy in which we instrument our financial literacy index with a source of variation in financial literacy which pre-dates mortgage market experience. Among a range of possible instruments we use mathematical performance when young, as suggested in a recent study by Jappelli and Padula (2013).

The results from instrumental variable models return no statistically significant effect of financial literacy on home ownership. The most likely explanation for this result is that financial literacy is obtained by a household endogenously with the decision to become a homeowner. Overall, our results suggest that poor understanding of the functioning of mortgage products is not a barrier to home ownership. While there are quite large average differences in the performance of homeowners and renters on our financial literacy survey questions, these should not be interpreted as differences which cause variation in the likelihood of home ownership across households. Instead, our results show that financial

literacy is acquired endogenously with home ownership choices. We also find little evidence that other behavioral traits such as household's degree of impatience, present bias or risk affect attitude home ownership choices.

The remainder of the paper proceeds as follows. In Section 2 we describe our survey design, content and questions which comprise the financial literacy index. In Section 3 we present descriptive results for the relationship between financial literacy and home ownership. In Section 4 we present estimates from our econometric models. We first show baseline estimates from probit models, then we show results from instrumental variable probit models. Section 5 concludes the paper.

2 Data

2.1 Survey Data

Our main data source is a cross-sectional survey of a representative sample of English and Welsh households into which we add supplementary questions on financial literacy and behavioral characteristics. The survey is conducted by the London-based market research firm YouGov and is known as the 'Debt Tracker' survey. YouGov has access to a panel of 350,000 households and draws a sample of approximately 2,000 households for each quarterly wave of the Debt Tracker survey[4]. We use the August 2013 wave. The survey is administered online and achieves a representative sample by making special provision for respondents who do not have access to the internet.

We first describe the core variables in our survey which cover socio-economic characteristics of the household, measures of income volatility and credit constraints. We then explain the set of variables we incorporate which describe local housing market conditions. Subsequently, we introduce our measure of financial literacy and explain how we construct a financial literacy index plus also measures of other behavioral characteristics of the household.

2.2 Core Variables and Measures of Income Volatility and Credit Constraints

The survey covers a broad range of socio-economic variables including demographics, education and labor market variables plus detailed information on the assets and debt of the

[4] The YouGov Debt Tracker surveys a representative sample of the UK population, i.e. England, Northern Ireland, Scotland and Wales. However, due to limitations with regards to the availability local level housing market statistics which we match into the survey, we only use English and Welsh households. We discuss regional housing data in more detail below.

household. We construct a core set of variables including age of the household head (in approximate 10-year age brackets), indicator variables for gender, marital status, whether the household includes dependent children, employment dummies (employed, unemployed, other) and dummy variable for whether the spouse or partner of the household head is employed. Education is measured by the age at which the household head completed full-time education. Financial variables include household gross annual income, total household savings in liquid products (excluding retirement saving) and total consumer credit debt. Housing variables include housing tenure (outright homeowner, homeowner with a mortgage, renter), the value of the main residence and total mortgage debt outstanding on the main residence.

Our data also contains measures of income volatility and credit constraints. Prior studies have shown that these are important determinants of home ownership (Haurin et al., 1997; Ortalo-Magné and Sven, 2006; Chambers et al., 2009; Kolodziejczyk and Leth-Petersen, 2013). Our survey based measure of credit constraints resembles those used in previous studies. All households in the survey are asked a succession of detailed questions about whether they have recently (within the last 6 months) had a credit application declined or a credit line withdrawn[5]. From these questions we create an indicator variable for whether the household is credit constrained. As we show later in our econometric analysis this variable is statistically significant and negatively related to the likelihood of a household owning a home.

We also construct a measure of income volatility. Ideally, we would like to observe the level of prospective income risk experienced by the household, including labor and non-labor income risk. In our cross-section of survey data we observe household income only at the point of the survey and so cannot construct panel-data based measures of income volatility based on repeat observations of individual income over time. Therefore, our measure of income volatility uses a series of survey questions which ask respondents about recent changes in their income. Four questions are used to identify reductions in income arising

[5] The set of survey questions used to construct the credit constrained measure is as follows: first, respondents are asked a series of questions to describe their current status. These are yes/no questions, comprising i) I cannot currently get credit, ii) I/my partner had a credit card withdrawn, iii) I/my partner had the credit limit on a credit card reduced, iv) I/my partner had an overdraft facility withdrawn. Second, respondents are asked a series of specific questions about the outcome of recent credit applications. We identify respondents who answered "turned down" to application to credit products (credit card, store card, unsecured loan, secured loan, home collected credit loan, DSS/Social Fund loan, overdraft facility, payday loan, mortgage, mail order catalogue, pawnbroker, hire-purchase agreements, car finance loan, credit union loan). Thirdly, we identify respondents who state they have reached/exceeded the maximum available credit for existing credit products or that the lender has withdrawn one of their credit products. From answers to questions in the three categories above we create a 1/0 dummy variable to denote the respondent faces a credit constraint.

from changes in labor or non-labor income or changes in employment status[6]. From these we construct a dummy variable which denotes whether the household has faced a recent income loss. While this variable only partially captures income volatility of the household in our econometric analysis it is statistically significant and negatively related to home ownership, consistent with prior research.

2.3 Local Housing Market Variables

We match into our survey data a set of variables which describe the housing market in the locality of the household. A range of studies show local housing market characteristics are important for explaining home ownership choices (Sinai and Souleles, 2005; Banks et al., 2015; Amior and Halket, 2014; Bostic and Lee, 2008). In total we match five variables into our survey data at the local level. The first three variables are regional due to availability of income and rental price data (9 English and Welsh regions), the other two variables are more granular to the postcode district level (84 England and Wales postcode districts). First, we calculate the house price to average income ratio in the region in which the household is resident using house price data taken from the UK's official house price sales index and income data from the UK Office for National Statistics. Second, we match in the regional home ownership rate from UK Census data. This measures the proportion of households in each region who live in a house which they own, either directly or via a mortgage. Third, we match a measure of the average simple gross rental yield in the region of residence calculated by the financial consulting agency BM Solutions. The rental yield is average annual rental over average property prices.

In addition to the above variables we also match into our data two measures of recent local house price movements. For each household in our data we match in a 5-year house price index at the postcode district level based on official sales data from the England and Wales land registry. Using these data we calculate the 5-year growth rate and 5-year standard deviation of mean house prices.

2.4 Mortgage Financial Literacy Questions

We were given the opportunity to add bespoke questions into the YouGov survey. Our first set of questions comprises four questions which measure the 'mortgage financial

[6] The income loss dummy is constructed from four questions. The dummy variable takes a value of 1 if the respondent states 'yes' to any of these four questions (and zero otherwise): i) my income has fallen significantly, ii) my partner's income has fallen significantly, iii) wife/husband/partner laid off / made redundant / lost job, iv) laid off / made redundant / lost job.

literacy' of respondents. We follow the convention in studies of financial literacy of inserting short multiple-choice questions with objective answers. Studies in the existing literature show that basic or 'core' financial literacy varies greatly within the population and that variation in correct responses to relatively simple questions about finance can explain significant heterogeneity in observed choices relating to consumer credit and debt (Lusardi and Tufano, 2009; Disney and Gathergood, 2013) retirement saving (Lusardi and Mitchell, 2007a, 2007b; van Rooij et al., 2011b) and stock market participation (Guiso and Jappelli, 2005; van Rooij et al., 2011a). A fundamental commonality across these studies is that the measure of financial literacy employed in the analysis allows the researcher to judge better and worse levels of financial understanding in an objective way.

Our financial literacy questions allow us to create an objective measure of performance and are specifically related to mortgage products. We focus on mortgages because our central interest is whether individuals do not become homeowners due to a lack of understanding of the mortgage market – engagement with which is essential for nearly all households looking to become homeowners. Prior studies on financial literacy show understanding of financial vehicles is crucial for achieving financial outcomes (see Lusardi and Mitchell, 2014 for a review of the literature). In our context a mortgage is the vehicle by which households achieve home ownership, and understanding mortgage features may be crucial for opening up the possibility of mortgage market participation to households. We show in Gathergood and Weber (2015) that these mortgage financial literacy questions are important for understanding both the choice of mortgage repayment type (standard repayment vs alternative 'interest-only' mortgages) as well as mortgage interest rate type (fixed-rate vs. adjustable-rate mortgages).

The four questions we design test respondents' understanding of a set of concepts which are integral to understanding the functioning of a mortgage. The first question tests whether the respondent understands that, *ceteris paribus*, the total cost of a mortgage is increasing with its duration. The second question requires a simple interest calculation. These two questions together test whether respondents grasp the most basic features of a loan product. The third question tests understanding of compound finance. Importantly, the question does not require the respondent to make a compound interest calculation (which would be mathematically challenging, especially in a survey setting). Instead, the question is constructed in such a way that a respondent who understands the concept of compounding can identify the correct answer using elimination of incorrect answers using very basic math. The fourth question, which is the most challenging question, tests whether individuals can identify the amortization profile of a mortgage.

Each question was framed in the context of a particular dimension of typical mortgage contracts. Respondents could view answers to each question on screen in the online survey and were asked to select one answer from the set of available answers.

The four questions are:

1. Suppose a 15 year mortgage and a 30 year mortgage have the same Annual Percentage Rate and the same amount borrowed. The total amount repaid will be:
    a. Higher for the 15 year mortgage
    b. Higher for the 30 year mortgage
    c. The total amount repaid on both mortgages will be the same
    d. Don't know

2. Suppose you owe £50,000 on a mortgage at an Annual Percentage Rate of 6%. If you didn't make any payments on this mortgage how much would you owe in total after one year?
    a. Less than £50,000
    b. £50,000 - £54,999
    c. £55,000 - £59,999
    d. £60,000 - £64,999
    e. More than £65,000
    f. Don't know

3. Suppose you owe £100,000 on a mortgage at an Annual Percentage Rate of 5%. If you didn't make any payments on this mortgage how much would you owe in total after five years?
    a. Less than £120,000
    b. Between £120,000 and £125,000
    c. More than £125,000
    d. Don't know

4. Suppose you owe £200,000 on a mortgage with at an Annual Percentage Rate of 5%. If you made annual payments of £10,000 per year how long would it take to repay the whole mortgage?
    a. Less than 20 years
    b. Between 20 and 30 years
    c. Between 30 and 40 years

d. The mortgage would never be repaid
e. Don’t know

From answers to the four questions we sum the number of correct answers to create a five-point financial literacy score, ranging from zero to four.

There are a number of reasons to think that financial literacy is endogenous to home ownership. Financial literacy may be correlated with individual characteristics we do not directly observe which also affect home ownership (such as parental income) and other elements of an individual’s financial situation (such as inherited wealth). In addition, there may be reverse causality between housing tenure and financial literacy. Purchasing a home via a mortgage may cause individuals to gain financial literacy as they learn about their mortgage contract. Estimations that do not control for correlated errors typically underestimate the effect of financial literacy on economic outcomes (Christiansen et al., 2008; Behrman et al., 2012; Lusardi and Mitchell, 2007b).

Consequently we also show IV regression estimates in which we instrument the respondent’s financial literacy score. An ideal instrument should contain an exogenous source of variation in financial literacy which is unrelated to housing tenure. What is a suitable instrument? Jappelli and Padula (2013) review and test a variety of instruments employed in the prior literature and conclude that the ideal instrument would be an individual’s financial literacy measured before they entered labor and financial markets, i.e. before they made selective choices over financial behaviors which could give rise to a channel for reverse causality. Pre-market financial literacy is typically unobserved, hence Jappelli and Padula (2013) suggest early-life mathematical ability as a proxy, specifically mathematical performance in primary school. We adopt their survey question, which is as follows:

- When you were at primary school aged 10 how did you perform in maths compared to other children in your class?
    - Much better than average
    - Better than average
    - About the same as average
    - Worse than average
    - Much worse than average

In the UK education system, 10 is the age before high school entry and hence before students are able to self-select into subjects of interest. From answers to this question we

create a math level score ranging from one (‘much worse’) to five (‘much better’).

2.5 Behavioral Characteristics Questions

Behavioral characteristics other than financial literacy may be important for home ownership decisions and we add an additional set of questions into our survey which measure those. We focus on two characteristics: time preferences and risk attitude.

Time preference may be an important factor in determining home ownership decisions. Saving for down payments to meet lending criteria involves postponing non-housing consumption. We measure two aspects of time preference within the survey. First, we include a measure of patience. We use a short question developed by Dohmen et al. (2010). The statement to proxy patience reads:

- “How do you see yourself: are you generally an impatient person, or someone who always shows great patience? Answers are coded on an 11-point scale, with 0 referring to ‘very impatient’ and 10 to ‘very patient’.”

The authors insert this measure of patience into the German Socio-Economic Panel to investigate the relation between risk attitude, patience and cognitive ability. Vischer et al. (2013) use incentivized time preference elicitation methods on the same survey subject pool as in Dohmen et al. (2010) and find answers to the survey question closely match those of experimental methods.

Second, we include a measure of present bias. Recent studies have used survey measures of time preference to show that patience and present bias are important for a range of household outcomes including saving (Ameriks et al., 2007), human capital accumulation (Cadena and Keys, 2015) and behavior among adolescents (Sutter et al., 2013). How does present bias differ from patience? In models of intertemporal choice the distinction is made between the rate at which an individual discounts future consumption (‘patience’) and whether the individual exhibits a bias towards immediate consumption (‘present bias’). A common representation of present bias preferences is the β-δ model of quasi-hyperbolic discounting (Laibson, 1997). We therefore include separate measures of patience and present bias to distinguish between behaviors which might arise due to these different aspects of time preference.

We elicit present bias using a Likert scale question by which respondents associate or disassociate themselves with a short statement describing ‘impulsive’ consumption behavior on a five point scale from ‘agree strongly’ to ‘disagree strongly’. The statement is:

- “I am impulsive and tend to buy things even when I can’t really afford them.”

We have used this question in two other recent studies. In Gathergood and Weber (2014) we show that responses to this question predicts the likelihood of co-holding consumer credit debt and liquid savings. In Gathergood and Weber (2015) we show that individuals who exhibit present bias in their time preferences are much more likely to use an alternative mortgage. We also show that present bias predicts the likelihood of individuals holding high cost credit, such as payday loans, and the likelihood of holding no savings. The literature has documented that these behaviors are associated with present bias (Laibson et al., 2007).

The final behavioral characteristic we measure in our survey is attitude to risk, which has been shown to be an important component of home ownership choices (Diaz-Serrano, 2005). We adopt the methodology of recent studies by including a proxy question in our survey. The question we use to measure risk aversion is developed and tested by Dohmen et al. (2011), who shows survey answers correlate closely with measured risk preferences in experimental lab tasks. The question is:

- “How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: ‘unwilling to take risks’ and the value 10 means: ‘fully prepared to take risks’.”

3 Descriptive Data Differences between Owners and Renters

3.1 Socio-Economic Characteristics

Table 1 presents summary statistics of socio-economic characteristics among our sample. The representative sample comprises 1,638 households in which 69% of households are homeowners who either own their home outright or via a mortgage. This is slightly higher than the aggregate England and Wales 66% home ownership rate as the YouGov survey panel comprises only individuals with stable addresses and excludes students (living at University) and other individuals living outside a stable address (e.g. due to hospital admissions or residence in elderly care homes or in other institutions).

Homeowners and renters differ as expected in average socio-economic characteristics. Homeowners are typically older – nearly 50% of homeowners are over 55 years old whereas 42% of renters are aged 18-34. Owners are slightly more likely to have a male household head and are more likely to be married and have children. Due to the age differences in owners and renters, the education leaving age of renters is slightly higher, reflecting

generational differences and the prevalence of post-school education. The employment characteristics of owners and renters are similar, though the unemployment rate is higher among renters.

Financial characteristics of owners and renters also differ in patterns similar to those found in previous studies. Average household income is higher among owners by approximately 40%. The standard deviation of household income among owners is higher in absolute terms, as is median income (shown in brackets). Owners and renters have very similar average levels of consumer credit debt. Non-pension savings are much higher among owners compared with renters. For homeowners, the average self-reported property value in the data is £225,900, which is very similar to the UK average house price in official data for August 2013 (£234,000). The average value of mortgage debt among homeowners is approximately £56,000 though many homeowners in our sample own their home outright (approximately 600 households are outright owners) so the median level of mortgage debt is much lower at £16,500. These values are also very close to average and median mortgage debt among all UK homeowners (ONS values for 2013 are £62,000 and £14,800 respectively).

3.2 Housing Market Characteristics

Table 2 provides summary data for housing market characteristics of survey respondents by home ownership status. These show that renters live in localities in which house prices are on average higher (relative to income), rents are lower (relative to house prices) and house prices are more variable. Renters in our sample live in localities where the average house price to income ratio is 4, compared with owners who live in localities where the average ratio is lower at 3.9. On average, renters also live in localities with slightly lower rental yields. Renters also live in localities in which the 5-year standard deviation of mean house prices is considerably higher compared with the localities in which owners live. Hence, there are some overall important differences in the local housing market characteristics for owners and renters in our sample. These descriptive differences do not imply causal differences, but the local level variables are important controls in our econometric model.

3.3 Financial Literacy

Summary data for responses to the financial literacy questions are shown in Table 3. Overall, the pattern of correct responses to the questions confirms our hypothesis that the questions are increasing in difficulty. Nearly 70% of respondents answered the first question

correctly and a little over half did so for the second question. The third and fourth questions, which test understanding of more complex concepts of interest compounding and balancing accrued interest against pay-downs, have much lower correct response rates. Approximately 40% of respondents answer Question 3 correctly and less than one third answer Question 4 correctly. The average literacy score of the sample, the sum of number of correct answers, is 1.96.

In the whole sample, 17% of respondents answered ‘don’t know’ to the first question. This may indicate that a fraction of respondents are potentially disengaged from this section of the survey altogether, and may have chosen the ‘don’t know’ answer in order to complete the survey quickly. For later questions, the proportions of respondents answering ‘don’t know’ increases, but accounts for only part of the reduction in correct answers. Between questions one and four the proportion of respondents choosing the correct answer falls by 39 percentage points. The proportion of respondents choosing ‘don’t know’ increases by 13 percentage points. Therefore, at a maximum, ‘don’t know’ answers chosen due to disengagement with the survey could account for only one third of the increase in incorrect answers between the beginning and the end of the financial literacy questions module. Later in our econometric analysis, we test the sensitivity of our findings to potentially disengaged respondents by excluding those who answered ‘don’t know’ to the first question or those who answered with ‘don’t know’ to three or more questions.

A comparison of homeowners and renters shows homeowners do much better on average in answering the financial literacy questions, achieving a 27% higher correct answer rate. The average literacy score among homeowners is 2.09, compared with 1.65 among renters – a difference of 0.44 points. For each question, the proportion of correct answers is higher for homeowners than for renters, with both groups showing the same pattern of higher proportions of correct responses to the earlier questions compared with the later questions.

3.4 Behavioral Characteristics

Summary data for the final set of survey questions on behavioral characteristics are shown in Table 4. In our whole sample the average self-reported degree on patience is 5.82 on a scale of 0-10 (10 meaning ‘very patient’), indicating respondents neither tend to self-identify as particularly patient or impatient. Respondents tend to be slightly more risk averse, with a sample mean of 4.24 (10 meaning ‘fully prepared to take risks’). In the whole sample, respondents tend to strongly disassociate themselves our measure of present bias. Only 12% of respondents tend to agree or agree strongly that they are impulsive in their spending

behavior.

A comparison of homeowners and renters indicates only a small difference in the degree on impatience. Homeowners self-report as, on average, being slightly less patient (5.76 compared with 5.98), though the difference between groups of 0.22 points is small compared with the standard deviation of around 2.5. The difference between groups with regards to risk attitude is similarly small: homeowners are slightly more risk averse (4.11) than renters (4.53). Among renters, a higher proportion, 18%, self-identify as present biased, compared with 9% of home owners.

3.5 Summary of Findings from Descriptive Data

The patterns seen in descriptive data indicate that financial literacy is important for home ownership. In Table 5 we summarize these patterns by drawing together data on financial literacy, socio-economic characteristics, housing status and behavioral characteristics. The table shows mean values for a wide selection of variables with observations grouped by the number of correct answers to the financial literacy questions. These summary data show that home ownership correlates very closely with financial literacy.

The home ownership rate among those answering none of the financial literacy questions correctly (330 respondents) is 62% compared with a home ownership rate of 82% among the 257 respondents who answer all four financial literacy questions correctly. In the unconditional relationship a one unit increase in the financial literacy score is associated with a 5 percentage point increase in the likelihood of home ownership. This suggests that financial literacy is an important driver of home ownership.

Summary data also indicate a range of variables that co-vary with financial literacy and home ownership. There is no clear pattern across financial literacy and age, but households who do better on their financial literacy score are typically more likely to have a male, married head with dependent children and more years in education. They are also more likely to be employed, with higher average income.

Behavioral characteristics also co-vary with financial literacy and home ownership. The degree of patience, present bias and willingness to take risks all increase with financial literacy and home ownership. These patterns suggest the strong unconditional relationship between financial literacy and home ownership may not hold in multivariate econometric models. We address this topic in the next section as well as addressing the potential endogeneity of observed financial literacy to home ownership decisions.

4 Econometric Analysis

4.1 Econometric Models and Estimation

The baseline econometric model we estimate is a probit model in which the dependent variable is a 1/0 dummy which takes a value of 1 if the household is a homeowner and a value of 0 if the household is a renter[7]. We include the covariates that we described in Section 2: local housing market characteristics (*hm*), behavioral characteristics (*bc*) and our financial literacy index (*fl*). The vector X includes a broad range of socio-economic controls. The model we estimate is then written as:

$$\Pr(\text{Owner} = 1) = \Phi(\alpha_0 + \alpha_1 hm + \alpha_2 bc + \alpha_3 fl + \mathbf{X}'\beta) \qquad (1)$$

where Φ is the cumulative normal distribution. We estimate the model by maximum likelihood and calculate average marginal effects which we report in the results.

As discussed above, the performance of survey respondents in our financial literacy questions may arise endogenously with home ownership choices. Therefore, we instrument observed financial literacy (the financial literacy score) using our measure of early-life mathematical ability following Jappelli and Padula (2013). We do so using a two-equation model where the relation between financial literacy and mathematical ability is estimated by the equation:

$$fl = \alpha_0 + \alpha_1 math + \alpha_2 hm + \alpha_3 bc + \mathbf{X}'\beta + u \qquad (2)$$

where *math* denotes the variable in our survey data which measures self-reported mathematical performance at school on a five-point scale. Equation 2 includes all the covariates which enter in Equation 1. We use an IV probit model which jointly estimates both equations using a maximum likelihood estimator.

4.2 Baseline Results

Results of the non-IV model in Equation 1 are shown in Table 6. The specification shown in Column 1 includes socio-economic and regional housing market control variables. This specification explains the home ownership decision reasonably well with a pseudo R-squared value of 0.373. The baseline predicted probability from the model is 0.697. Patterns in coefficient estimates show that age, education and income are important determinants of home ownership. There is a clear home ownership gradient in age with younger households

[7] We first estimate our models with a sample that classifies all respondents who own a home outright and those with a mortgage as 'homeowners'. We later show that our results are robust to excluding outright homeowners.

much less likely to own a home.

There is also a concave home ownership gradient in income with low income households much less likely to be homeowners. The coefficients on the income loss and credit constrained dummy variables are both negative, implying households who are captured by these dummy variables are less likely to be homeowners. The coefficient on the recent income loss dummy is statistically significant at the 10% level and the coefficient on the credit constrained dummy is significant at the 1% level. The marginal effect on the credit constrained dummy coefficient takes a value of -0.124, which implies a credit constrained household is 12.4 percentage points less likely to own a home. Against a baseline probability of 70% this is an 18% reduction in the likelihood of home ownership due to credit constraints.

Among regional housing market variables the coefficients on the 5-year growth and standard deviation of house prices are both significant at the 1% level, as is the local house price to average income ratio. The marginal effects imply a strong negative relationship between the level and volatility of house prices and the likelihood of home ownership. One unit increase in the house price to income ratio lowers the likelihood of home ownership by 12 percentage points. A one standard deviation increase in house price volatility lowers the likelihood of home ownership by 2.7 percentage points. The coefficient on the 5-year growth of house prices is positive and highly significant, implying individuals are more likely to own homes in localities with stronger house price growth.

Column 2 shows results from a specification which includes our measures for behavioral characteristics. Each of the coefficients on the behavioral characteristics variables has a negative sign, but only the coefficient on the present biased dummy is significant at the 5% level. The marginal effect of -0.058 implies an individual captured as present biased is 5.8 percentage points (8%) less likely to own a home.

When we include the financial literacy index in the specification shown in Column 3 the coefficient on the index score is positive and statistically significant at the 5% level. The averaged marginal effect on the index of 0.014 implies a one unit increase in the financial literacy score is associated with a 1.4 percentage point (2.2%) increase in the likelihood of home ownership. This implies that the likelihood of home ownership in the conditional relationship between with financial literacy and homeownership is considerably lower compared to the unconditional relationship. We showed before that in the unconditional relationship (see Table 1) a one unit increase in financial literacy was associated with a 5 percentage point increase in the likelihood of home ownership. The reduction in marginal

effect to 1.5 percentage points implies that approximately two-thirds of the unconditional effect of financial literacy on home ownership is accounted for by covariates in the econometric model.

4.3 Instrumental Variable Results

We now present results from estimates of Equations 1 and 2 using an IV probit model estimated by maximum likelihood. Results are shown in Table 7. For ease of comparison with the non-IV estimates, Column 1 replicates the complete non-IV specification (Column 4 in Table 6). In the first-stage regression of the IV model the instrumental variable is statistically significant at the 1% level. The coefficient value of 0.430 implies a one-unit increase in self-reported mathematical performance at school raises the financial literacy index score by 0.43 points. In the second-stage estimates all of the covariates which were statistically significant in the non-IV model remain so, but the coefficient on the financial literacy score becomes negative and is no longer statistically significant at the 10% level. The coefficient on the present bias dummy is now statistically significant at the 5% level with a very similar marginal effect to that in the non-IV model.

Why does the coefficient on the financial literacy variable become negative and statistically not significant? This is perhaps surprising, as many studies of financial literacy and financial choices that use this or similar instruments find that coefficient estimates for financial literacy in IV models are typically statistically significant and as large, or larger, compared with non-IV specifications (Lusardi and Tufano, 2009; van Rooij et al., 2011a; Gathergood and Weber, 2015; Jappelli and Padula, 2013). Why are our results different? The existence of measurement error should lead to increased precision in IV estimates, and it is unlikely that measurement error should be any more or less prevalent in our survey compared with other recent studies cited above which also use household surveys administered by similar means to outs. The set of covariates we include in our models is also very similar to those in other recent studies, hence omitted variable bias is unlikely to be a particular problem for our study compared with others.

We cannot test for an economic explanation of why financial literacy is not statistically significant in our IV estimates in this case, but we suggest the most likely explanation is that financial literacy arises endogenously with home ownership choices. In other words, homeowners have a better understanding of the financial components of a mortgage because they acquire this knowledge through home ownership – either in the run-to to making a home purchase as they make decisions over mortgages, or through feedback effects from holding a

mortgage once they become homeowners. Therefore, our IV strategy, which exploits variation in mathematical ability pre-dating home ownership choices (or preferences) at an early age renders no role for financial literacy in explaining home ownership choices.

4.4 Sensitivity Tests

In this section we present two sensitivity tests in which we modify our estimation sample by excluding observations which might bias our results. First, in Table 8 we present estimates in which we exclude individuals who answer 'don't know' to answers of the financial literacy questions. As we noted earlier it is possible that a subset of individuals were disengaged from the financial literacy module in our survey and consequently chose 'don't know' as a way of avoiding answering questions. We exclude those who answered 'don't know' to the very first literacy question (as this might indicate disengagement from the entire financial literacy question module) and/or those who answered 'don't know' to three or more questions. This removes 385 observations in total, 23% of our sample. Column 1 shows results from the non-IV model. The coefficient on the financial literacy score is very similar to before and the marginal effect is very close (0.018 compared with 0.015 in the previous sample). The coefficient is now significant at only the 5% level, which is most likely due to the reduced sample size. In the IV specification the coefficient on the financial literacy index is negative, again as before, and not statistically significant.

Second, in Table 9 we estimate models which exclude outright homeowners. We do so as we cannot verify in our cross-sectional data how these respondents became outright homeowners (e.g. via mortgage down payments or bequests). It may be the case that some outright owners purchased homes without mortgages and hence without the need to invest in mortgage financial literacy. Outright homeowners comprise a little more than half of all owners in our sample. Removing them from the estimation sample lowers the sample size in Table 9 to 1,112 observations. Results from the non-IV specification in Column 1 show the coefficient on the financial literacy score becomes statistically not significant and remains positive, though with a much smaller value and marginal effect. The marginal effect is now only 0.008 implying a one point increase in the financial literacy score raises the likelihood of home ownership by only 0.8 percentage points.

However, with the exclusion of outright homeowners the baseline predicted probability from this specification is much lower at 51%, implying a 1 unit increase in financial literacy rises the likelihood of home ownership by around 1.5%, which is approximately half the proportional increase from the non-IV model estimated on the whole sample. Once again, the

IV estimates show the coefficient on the financial literacy score turns negative and is not statistically significant at the 10% level. Overall, therefore, our main results are not sensitive to these augmented definitions of the estimation sample.

5 Conclusion

In this paper we use a specially commissioned bespoke consumer survey covering a representative sample of households in England and Wales to examine the relationship between financial literacy and home ownership. Recent studies have shown that poor financial literacy affects household choices over stock market participation and retirement saving. There is also evidence from within the housing literature that financial literacy is relevant for mortgage equity withdrawal and mortgage choices. We use four financial literacy questions together with a broad range of control variables and measures of behavioral characteristics to estimate probit and instrumental variable probit models in which the dependent variable is a dummy variable indicating whether the household is a homeowner or a renter.

Descriptive analysis of our survey data shows a strong, positive correlation between financial literacy and home ownership, suggesting that poor financial literacy may be a barrier to owning a home. But econometric model estimates show the magnitude of the marginal effect on our financial literacy index is lower than in an unconditional comparison, but nevertheless remains statistically significant and positive. However, when we estimate instrumental variable models which account for the potential endogeneity of financial literacy to housing tenure choice, we find no statistically significant relationship between financial literacy and home ownership.

Our results cast doubt on the notion that consumer ignorance in the mortgage market is an important barrier to home ownership. While homeowners clearly possess better understanding of mortgage products compared with renters, our evidence shows this difference between owners and renters is most likely a result of home ownership choices and not due to financial literacy acting as a barrier to home ownership.

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Table 1: Sample Characteristics

	(1) Sample	(2) Homeowner	(3) Renter
Age			
18–34	0.21	0.12	0.42
35–44	0.18	0.18	0.18
45–54	0.18	0.21	0.14
55+	0.42	0.49	0.26
Demographics			
Male (= 1)	0.49	0.51	0.45
Married/living as married (= 1)	0.67	0.78	0.42
Dependent children (= 1)	0.21	0.21	0.18
Education leaving age	18.43	18.37	18.56
Math level in school (1–5)	3.58	3.58	3.57
Employment			
Employed (= 1)	0.58	0.58	0.58
Unemployed (= 1)	0.02	0.01	0.06
Retired/Student/Housewife/Disabled	0.39	0.41	0.36
Spouse employed (= 1)	0.39	0.44	0.26
Household Finances			
Household income (£)	33100 (28000)	36300 (31000)	25900 (21500)
Consumer credit debt (£)	1900 (0)	1900 (0)	1800 (0)
Liquid savings (£)	12300 (0)	15900 (0)	4000 (0)
Property value (£)	157200 (130000)	225900 (185000)	0 (0)
Mortgage outstanding amount (£)	39200 (0)	56300 (16300)	0 (0)
Financial Circumstances			
Recent income loss (= 1)	0.14	0.12	0.17
Credit constrained (= 1)	0.06	0.03	0.13
Observations	1638	1140	498

Note: Table shows summary statistics for all individuals in the survey (Column 1), plus for all individuals divided into two mutually exclusive and exhaustive groups: those owning a home (either outright or via a mortgage) in Column 2 and those renting in Column 3. The variable ‘education leaving age’ is the age at which the survey respondent finished full-time education. The variable ‘math level in school’ is the individual’s self-reported mathematical ability at school on a scale from 1 to 5. Mean values reported, medians in parentheses for financial variables.

Table 2: Regional Housing Market Characteristics

	(1) Sample	(2) Homeowner	(3) Renter
5-year σ of mean house prices	13100 (8400)	12100 (8200)	15300 (9200)
5-year growth of mean house prices	0.14	0.18	0.04
Home ownership ratio in 2011	64.89	65.17	64.25
House price to average income ratio	3.94	3.93	3.99
Rental yield	6.06	6.07	6.04
Observations	1638	1140	498

Note: Variables are calculated as follows: 5-year growth of mean house prices and standard deviation of mean house prices are calculated from all sales within the postcode district in which the household is located using England and Wales Land Registry sales data. Homeownership ratio in 2011 is calculated at the regional level from UK Census data. This measures the proportion of households in each region who live in a house which they own, either outright or via a mortgage. House price to average income ratio in the region in which the household is resident is calculated using house price data taken from the UK's official house price sales index and income data from the UK Office for National Statistics. The simple gross rental yield in the region of residence is calculated by the financial consulting agency BM Solutions. The rental yield is average annual rental over average property prices. Mean values reported, medians in parentheses for financial variables.

Table 3: Mortgage Literacy Performance

	(1) Sample	(2) Homeowner	(3) Renter
1. Suppose a 15 year mortgage and a 30 year mortgage have the same Annual Percentage Rate and the same amount borrowed. The total amount repaid will be:			
Higher for the 15 year mortgage	0.05	0.04	0.06
Higher for the 30 year mortgage	0.69	0.73	0.60
The total amount repaid will be the same	0.10	0.09	0.11
Do not know	0.17	0.14	0.23
2. Suppose you owe £50,000 on a mortgage at an Annual Percentage Rate of 6%. If you didn't make any payments on this mortgage how much would you owe in total after one year?			
Less than £50,000	0.03	0.02	0.04
£50,000 – £54,999	0.55	0.59	0.47
£55,000 – £59,999	0.14	0.14	0.14
£60,000 – £64,999	0.03	0.02	0.03
More than £65,000	0.03	0.03	0.03
Do not know	0.23	0.20	0.29
3. Suppose you owe £100,000 on a mortgage at an Annual Percentage Rate of 5%. If you didn't make any payments on this mortgage how much would you owe in total after five years?			
Less than £120,000	0.14	0.14	0.14
Between £120,000 and £125,000	0.21	0.21	0.22
More than £125,000	0.42	0.46	0.35
Do not know	0.22	0.20	0.29
4. Suppose you owe £200,000 on a mortgage with at an Annual Percentage Rate of 5%. If you made annual payments of £10,000 per year how long would it take to repay the whole mortgage?			
Less than 20 years	0.02	0.02	0.03
Between 20 and 30 years	0.27	0.27	0.25
Between 30 and 40 years	0.11	0.11	0.13
The mortgage would never be repaid	0.30	0.32	0.24
Do not know	0.30	0.28	0.36
Literacy score (0–4)	1.96	2.09	1.65
Observations	1638	1140	498

Note: Table shows breakdown of answers to financial literacy questions. Column 1 shows statistics for whole sample, Column 2 for homeowners only and Column 3 for renters only.

Table 4: Behavioural Characteristics

	(1) Sample	(2) Homeowner	(3) Renter
Patience: "Are you generally an impatient person, or someone who always shows great patience? Answers are coded on an 11-point scale, with '0' referring to 'very impatient' and '10' to 'very patient'."			
Patience (0–10)[a]	5.82	5.76	5.98
	2.51	2.52	2.48
Risk attitude: "Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: 'unwilling to take risks' and the value 10 means: 'fully prepared to take risks'."			
Risk attitude (0–10)[a]	4.24	4.11	4.53
	2.37	2.32	2.46
Present biased: "I am impulsive and tend to buy things even when I can't really afford them."			
Agree strongly	0.02	0.01	0.03
Tend to agree	0.10	0.08	0.15
Neither agree nor disagree	0.18	0.18	0.19
Tend to disagree	0.30	0.30	0.30
Disagree strongly	0.38	0.42	0.29
Don't know	0.02	0.02	0.04
Present biased (= 1)[b]	0.12	0.09	0.18
Observations	1638	1140	498

[a] First row shows averages, second row shows the standard deviation of answers.
[b] 'Present biased' = 1 if answer 'agree strongly' or 'tend to agree', and = 0 otherwise.

Note: Table shows breakdown of answers to behavioral characteristics questions. Column 1 shows statistics for whole sample, Column 2 for homeowners only and Column 3 for renters only.

Table 5: Characteristics of Mortgage Holders by Mortgage Literacy

	0	1	2	3	4
Age					
18–34	0.24	0.19	0.23	0.21	0.20
35–44	0.15	0.17	0.19	0.17	0.22
45–54	0.19	0.16	0.18	0.20	0.18
55+	0.42	0.48	0.41	0.42	0.40
Demographics					
Male (= 1)	0.33	0.42	0.47	0.58	0.67
Married/living as married (= 1)	0.65	0.64	0.65	0.68	0.73
Dependent children (= 1)	0.19	0.19	0.20	0.20	0.26
Education leaving age	17.62	17.83	18.39	18.85	19.59
Math level in school (1–5)	2.98	3.30	3.66	3.91	4.06
Employment					
Employed (= 1)	0.49	0.57	0.59	0.62	0.64
Unemployed (= 1)	0.05	0.01	0.02	0.01	0.02
Retired/Student/Housewife/Disabled	0.46	0.42	0.38	0.37	0.34
Spouse employed (= 1)	0.39	0.34	0.39	0.42	0.38
Household Finances					
Household income (£)	24100 (20000)	30100 (25000)	34400 (30000)	36800 (32300)	40800 (35000)
Consumer credit debt (£)	1000 (0)	1700 (0)	2000 (0)	2600 (0)	1900 (0)
Mortgage outstanding amount (£)	34900 (0)	33300 (0)	38200 (0)	38800 (0)	53200 (0)
Homeowners (= 1)	0.62	0.63	0.70	0.74	0.82
Renter (= 1)	0.38	0.37	0.30	0.26	0.18
Behavioral Characteristics					
Patience (0–10)	5.98	5.92	5.89	5.87	5.35
Present biased (= 1)	0.15	0.14	0.11	0.11	0.09
Risk attitude (0–10)	4.03	4.29	4.39	4.27	4.16
Observations	330	283	407	361	257

Note: Table shows summary statistics for whole sample of respondents by their financial literacy score (number of financial literacy questions answered correctly). Mean values reported, medians in parentheses for financial variables.

Table 6: Homeowner Probit Models

	(1) Baseline		(2) + Behavioral Characteristics		(3) + Financial Literacy	
	β / SE	ME	β / SE	ME	β / SE	ME
Age						
18–34	−1.785***	−0.384***	−1.780***	−0.380***	−1.755***	−0.373***
	(0.143)		(0.144)		(0.144)	
35–44	−0.930***	−0.200***	−0.940***	−0.201***	−0.925***	−0.197***
	(0.149)		(0.149)		(0.150)	
45–54	−0.227*	−0.049*	−0.240*	−0.051*	−0.230*	−0.049*
	(0.131)		(0.132)		(0.132)	
Demographics						
Male (= 1)	−0.082	−0.018	−0.063	−0.014	−0.096	−0.020
	(0.084)		(0.085)		(0.087)	
Education leaving age	0.050***	0.011***	0.048***	0.010***	0.042**	0.009**
	(0.018)		(0.018)		(0.018)	
Household Finances						
Household income (£10,000s)	0.292***	0.063***	0.295***	0.063***	0.277***	0.059***
	(0.055)		(0.055)		(0.056)	
Household income^2	−0.011***	−0.002***	−0.011***	−0.002***	−0.010***	−0.002***
	(0.003)		(0.003)		(0.004)	
Financial Circumstances						
Recent income loss (= 1)	−0.209*	−0.045*	−0.193	−0.041	−0.189	−0.040
	(0.118)		(0.119)		(0.119)	
Credit constrained (= 1)	−0.574***	−0.124***	−0.494***	−0.105***	−0.489***	−0.104***
	(0.163)		(0.167)		(0.167)	
Regional Housing Market Characteristics						
5-year σ of mean house prices	−0.125***	−0.027***	−0.126***	−0.027***	−0.126***	−0.027***
	(0.022)		(0.022)		(0.022)	
5-year growth of mean house prices	3.850***	0.829***	3.837***	0.819***	3.824***	0.813***
	(0.351)		(0.357)		(0.360)	
Home ownership ratio in 2011	−0.005	−0.001	−0.004	−0.001	−0.005	−0.001
	(0.007)		(0.007)		(0.007)	
House price to average income ratio	−0.537***	−0.116***	−0.532***	−0.114***	−0.538***	−0.114***
	(0.138)		(0.139)		(0.139)	
Rental yield	0.213	0.046	0.230	0.049	0.232	0.049
	(0.191)		(0.192)		(0.192)	
Behavioral Characteristics						
Patience (0–10)			−0.019	−0.004	−0.018	−0.004
			(0.017)		(0.017)	
Present biased (= 1)			−0.270**	−0.058**	−0.255**	−0.054**
			(0.124)		(0.124)	
Risk attitude (0–10)			−0.024	−0.005	−0.024	−0.005
			(0.018)		(0.018)	
Financial Literacy						
Mortgage financial literacy score (0–4)					0.067**	0.014**
					(0.033)	
Observations	1638		1638		1638	
Pseudo R^2 / R^2	0.373		0.377		0.379	
LR chi2	750.154		758.775		762.979	
Prob > chi2	0.000		0.000		0.000	
Baseline predicted probability	0.697		0.697		0.697	

Note: Table shows probit estimates and average marginal effects. * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. Sample includes all survey respondents. The dependent variable for all models is a 1/0 dummy for which a value of 1 denotes the individual is an homeowner and a value of 0 denotes the individual is a renter. Additional controls not shown: 1/0 dummies for marital status, dependent children and (spouse) employment status.

Table 7: Homeowner IV Probit Model

	(1) Probit		(2) IV Probit		(3) First Stage
	β / SE	Margin	β / SE	Margin	β / SE
Instrument					
Math level in school (1–5)					0.430***
					(0.031)
Financial Literacy					
Mortgage financial literacy score (0–4)	0.067**	0.014**	−0.122	−0.026	
	(0.033)		(0.094)		
Behavioural Characteristics					
Patience (0–10)	−0.018	−0.004	−0.021	−0.005	−0.021*
	(0.017)		(0.016)		(0.012)
Present biased (= 1)	−0.255**	−0.054**	−0.279**	−0.061**	−0.120
	(0.124)		(0.123)		(0.094)
Risk attitude (0–10)	−0.024	−0.005	−0.025	−0.005	−0.016
	(0.018)		(0.017)		(0.013)
Age					
18–34	−1.755***	−0.373***	−1.782***	−0.387***	−0.463***
	(0.144)		(0.142)		(0.098)
35–44	−0.925***	−0.197***	−0.954***	−0.207***	−0.223**
	(0.150)		(0.147)		(0.106)
45–54	−0.230*	−0.049*	−0.266**	−0.058**	−0.189**
	(0.132)		(0.130)		(0.096)
Demographics					
Male (= 1)	−0.096	−0.020	0.001	0.000	0.485***
	(0.087)		(0.097)		(0.061)
Education leaving age	0.042**	0.009**	0.057***	0.012***	0.064***
	(0.018)		(0.019)		(0.012)
Household Finances					
Household income (£10,000s)	0.277***	0.059***	0.321***	0.070***	0.213***
	(0.056)		(0.057)		(0.037)
Household income^2	−0.010***	−0.002***	−0.012***	−0.003***	−0.010***
	(0.004)		(0.004)		(0.002)
Financial Circumstances					
Recent income loss (= 1)	−0.189	−0.040	−0.196*	−0.043*	−0.035
	(0.119)		(0.117)		(0.088)
Credit constrained (= 1)	−0.489***	−0.104***	−0.472***	−0.102***	0.007
	(0.167)		(0.165)		(0.124)
Regional Housing Market Characteristics					
5-year σ of mean house prices	−0.126***	−0.027***	−0.124***	−0.027***	0.013
	(0.022)		(0.022)		(0.019)
5-year growth of mean house prices	3.824***	0.813***	3.808***	0.827***	0.362***
	(0.360)		(0.358)		(0.119)
Home ownership ratio in 2011	−0.005	−0.001	−0.002	−0.000	0.015***
	(0.007)		(0.007)		(0.005)
House price to average income ratio	−0.538***	−0.114***	−0.515***	−0.112***	0.042
	(0.139)		(0.138)		(0.098)
Rental yield	0.232	0.049	0.215	0.047	−0.045
	(0.192)		(0.189)		(0.139)
Observations	1638		1638		1638
Pseudo R^2 / R^2	0.379				0.263
t-statistic of instrument					13.420
LR chi2 / F	762.979		462.631		22.989
Prob > chi2 / F	0.000		0.000		0.000
Wald test of exogeneity			0.039		
Baseline predicted probability	0.697		0.696		1.958

Note: Table shows probit estimates, instrumental variable probit estimates and average marginal effects. * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. Sample includes all survey respondents. The dependent variable fot all models is a 1/0 dummy for which a value of 1 denotes the individual is an homeowner and a value of 0 denotes the individual is a renter. Column 1 shows probit model estimates, Columns 2 and 3 show IV probit estimates. Column 3 shows first-stage regression results and Column 2 shows second-stage regression results. Additional controls not shown: 1/0 dummies for marital status, dependent children and (spouse) employment status.

Table 8: Homeowner IV Probit Model excluding 'Don't knows'

	(1) Probit Homeowner = 1		(2) IV Probit Homeowner = 1		(3) First Stage Regression
	β / SE	Margin	β / SE	Margin	β / SE
Instrument					
Math level in school (1–5)					0.294***
					(0.032)
Financial Literacy					
Mortgage financial literacy score (0–4)	0.092**	0.018**	−0.207	−0.043	
	(0.046)		(0.162)		
Behavioural Characteristics					
Patience (0–10)	−0.007	−0.001	−0.014	−0.003	−0.023*
	(0.020)		(0.020)		(0.012)
Present biased (= 1)	−0.372**	−0.073**	−0.407***	−0.084***	−0.182*
	(0.148)		(0.144)		(0.095)
Risk attitude (0–10)	−0.030	−0.006	−0.038*	−0.008*	−0.031**
	(0.021)		(0.021)		(0.013)
Regional Housing Market Characteristics					
5-year σ of mean house prices	−0.131***	−0.026***	−0.125***	−0.026***	0.007
	(0.023)		(0.023)		(0.018)
5-year growth of mean house prices	3.902***	0.770***	3.766***	0.774***	0.188*
	(0.410)		(0.431)		(0.115)
Home ownership ratio in 2011	−0.007	−0.001	−0.002	−0.000	0.014***
	(0.009)		(0.009)		(0.005)
House price to average income ratio	−0.526***	−0.104***	−0.476***	−0.098***	0.071
	(0.165)		(0.164)		(0.099)
Rental yield	0.234	0.046	0.200	0.041	−0.062
	(0.233)		(0.227)		(0.143)
Observations	1253		1253		1253
Pseudo R^2 / R^2	0.395				0.181
t-statistic of instrument					9.130
LR chi2 / F	579.779		364.791		10.846
Prob > chi2 / F	0.000		0.000		0.000
Wald test of exogeneity			0.070		
Baseline predicted probability	0.699		0.724		2.355

Note: Table shows probit estimates, instrumental variable probit estimates and average marginal effects. * p < 0.1, ** p < 0.05, *** p < 0.01. Sample excludes all respondents who answered 'don't know' to the very first literacy question and/or those who answered 'don't know' to three or more questions (385 observations in total). Column 1 shows probit model estimates, Columns 2 and 3 show IV probit estimates. Column 3 shows first-stage regression results and Column 2 shows second-stage regression results. Additional variables not shown are: age, gender, education, household income, marital status, dependent children and (spouse) employment status.

Table 9: Homeowner IV Probit Model excluding outright homeowners

	(1) Probit Homeowner = 1		(2) IV Probit Homeowner = 1		(3) First Stage Regression
	β / SE	Margin	β / SE	Margin	β / SE
Instrument					
Math level in school (1–5)					0.464***
					(0.036)
Financial Literacy					
Mortgage financial literacy score (0–4)	0.041	0.008	−0.126	−0.024	
	(0.043)		(0.115)		
Behavioural Characteristics					
Patience (0–10)	−0.034	−0.006	−0.039*	−0.007*	−0.046***
	(0.022)		(0.022)		(0.014)
Present biased (= 1)	−0.167	−0.031	−0.177	−0.034	−0.052
	(0.149)		(0.147)		(0.098)
Risk attitude (0–10)	−0.043*	−0.008*	−0.045*	−0.009*	−0.014
	(0.024)		(0.024)		(0.015)
Regional Housing Market Characteristics					
5-year σ of mean house prices	−0.356***	−0.067***	−0.352***	−0.068***	0.003
	(0.052)		(0.052)		(0.025)
5-year growth of mean house prices	5.979***	1.130***	5.952***	1.144***	0.365***
	(0.540)		(0.540)		(0.121)
Home ownership ratio in 2011	−0.012	−0.002	−0.008	−0.002	0.018***
	(0.010)		(0.010)		(0.006)
House price to average income ratio	−0.678***	−0.128***	−0.651***	−0.125***	0.068
	(0.184)		(0.183)		(0.115)
Rental yield	0.171	0.032	0.151	0.029	−0.031
	(0.241)		(0.238)		(0.159)
Observations	1112		1112		1112
Pseudo R^2 / R^2	0.507				0.321
t-statistic of instrument					11.690
LR chi2 / F	775.295		319.977		20.543
Prob > chi2 / F	0.000		0.000		0.000
Wald test of exogeneity			0.127		
Baseline predicted probability	0.511		0.511		1.911

Note: Table shows probit estimates, instrumental variable probit estimates and average marginal effects. * p < 0.1, ** p < 0.05, *** p < 0.01. Sample excludes all homeowners who own their properties outright (i.e. without a mortgage). Column 1 shows probit model estimates. Columns 2 and 3 show IV probit estimates. Column 3 shows first-stage regression results and Column 2 shows second-stage regression results. Additional variables not shown [TBC].