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Three Essays in Household Finance

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Abstract

This thesis explores the impact of two behavioural finance concepts, social psychology and psychology, on household financial decisions. Under social psychology, I investigate whether the variety and intensity of social engagement enhances stock market participation. With regard to psychology, I examine two behavioural biases. First, I investigate whether mental accounting influences portfolio choice in three asset classes and whether financial advice and housing tenure increase (decrease) the effects of mental accounts on portfolio choice. Second, I examine whether households' self-reported housing wealth are anchored on published house price indices and whether anchoring bias is mediated by market information, mortgage refinancing decisions and social factors.

The main contributions and findings in the three studies are as follows. First, although there is an elaborate body of research concerning the relationship between social engagement mechanisms and portfolio choice, most studies investigate specific mechanisms in isolation. Using three waves in the British Household Panel Survey (BHPS), I bring together five social engagement measures in one model and show that socially engaged individuals are more likely to participate in the stock market. Consistent with Granovetter's (1973) theory of social networks I find that a weak tie (measured by social group involvement) has a positive effect on stock market participation whereas a strong tie (measured by talking to neighbours) has no effect. More trusting individuals are more likely to participate in the stock market, as are those who identify with a political party. In contrast, the degree to which religion is important appears to have little impact. These results are robust using different specifications. Overall, the results of this study demonstrate that the likelihood of stock market

participation increases with the variety and intensity of social engagement.

Second, despite the established theoretical underpinnings of mental accounting in behavioural portfolio theory (BPT) and recent extensions, not much is known about their implications in real life situations. I use a recent UK household survey, the Wealth and Assets Survey (WAS), which has comprehensive information about financial assets to investigate whether there are differences in the ownership and portfolio share of three asset classes among individuals who exhibit no mental account, a single mental account and multiple mental accounts, and the conditional influences of financial advice, housing, cognitive ability, time preference and risk tolerance. Overall I find that mental accounting together with financial advice and housing tenure explain variations in both the probability of ownership and portfolio share in the three asset classes. Households that exhibit a single mental account have low share of investments in, and are less likely to own, a risky asset when compared to those that exhibit no mental account or exhibit multiple mental accounts. I also find that, when compared to having no mental account, exhibiting a single mental account or multiple mental accounts increases both the probability and investment share in a fairly safe asset but decreases portfolio share in safe assets. In addition, among those that exhibit a single mental or multiple mental accounts, financial advice decreases portfolio share in risky assets and fairly safe assets and increases portfolio share in safe assets. Housing tenure increases both the probability and portfolio share in risky assets, decreases portfolio share in fairly safe assets and increases portfolio share in safe assets. These results are consistent using multi-equation regressions, sub-samples, reparametrised variables and poisson regressions.

Finally, as little is known about how households derive the self-reported house prices estimates that are commonly used to determine housing wealth, the third study examines whether households are anchored on published house price indices. The key conjecture is that, while assessing the values of their homes, homeowners place more weight on house price news at the expense of property characteristics and other market information. I find support for this hypothesis using sixteen waves of the BHPS, multiple methods, and both regional and national house price indices. I conclude that changes in self-reported housing wealth are anchored on changes in published house price indices. Specifically, ownership through a mortgage and greater financial expectations increase anchoring effects while mortgage refinancing decreases the effects. Moreover, use of money raised from refinancing for home investment, as opposed to other consumption purposes, has a positive association with change in self-reported house value and both uses reduce anchoring bias. In addition, I find that computer use increases anchoring bias and, among social engagement mechanisms, religiosity reduces anchoring while other measures have no effect. These results are robust to internal instrumental variables, national aggregate house prices, alternative indices and sub-samples.

Dedication

I dedicate this thesis to:

My Mom, Mather Kabon Chebii

Your unrelenting prayers, faithfulness to the family, hard work, love and humility saw us through the difficult times

My late Dad, Charles Changwony Chebii (Kipkolomiy)

You stirred-up my thirst for knowledge, intellectual curiosity and the quest for perfection

My late Sister, Nancy Sogome Koimett

Your candle burned out long before your legend ever did

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Chapter 1 Introduction

"We do not need elegant models; we need models that describe real people in real markets"

(Statman, 2010)

1.1 Household financial decisions and behavioural finance

The branch of the finance literature known as household finance describes the different financial decisions which households make, such as consumption, saving, investment and portfolio choice, and the different tools that they use to achieve their goals. Households' financial decision-making processes can be better understood in the context of two competing, albeit complementary, finance theories. In contrast to standard finance theory in which people are considered to be rational, behavioural finance theory is based on the view that some financial phenomena can be better understood using models in which some people are not fully rational, and so depicts the behaviour of both 'normal people' and 'normal markets' (Shefrin and Statman, 2000; Barberis and Thaler, 2002). It challenges some of the basic foundations and assumptions of standard finance theory, for example, that portfolio choices are based on the rules in Markowitz's (1952) mean-variance theory. Instead, behavioural finance acknowledges that people sometimes make irrational financial decisions and are subject to judgement and decision biases - largely attributed to cognitive constraints and dissonance - which include heuristic simplification, self-deception, and emotions and self-control (Hirshleifer, 2001).[1] Hirshleifer also identifies social interaction as an important determinant of financial decisions.

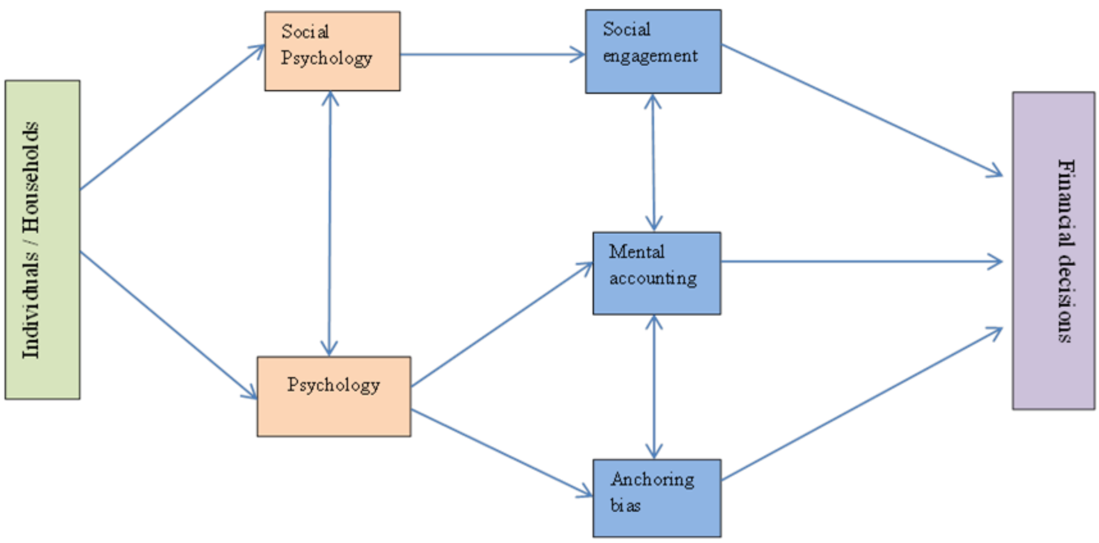
[1] Heuristic simplification includes behavioural biases such as attention effects, reference effects and the representativeness heuristic. Self-deception includes biases such as overconfidence, self-attribution, hindsight bias and confirmatory bias. Biases associated with emotions and self-control includes distaste for ambiguity, misattribution biases and time preference. Social interactions can lead to biases such as the conformity effect, the false consensus effect and the curse of knowledge.

From the early work by Slovic (1972) regarding the psychology of human judgement and Tversky and Kahneman (1974) concerning behavioural heuristics and biases, subsequent theoretical and empirical studies in household finance identify patterns of irrational investor behaviour and psychological biases, also referred to as behavioural biases. They include psychological dispositions such as overconfidence (Barber and Odean, 2001; Gervais and Odean, 2001), overreaction (Bondt and Thaler, 1985), loss aversion (Kahneman and Tversky, 1979; Shefrin and Statman, 1985; Odean, 1998), herding (Huberman and Regev, 2001), miscalibration of probabilities and hyperbolic discounting (Laibson, 1997) and regret (Bell, 1983; Clarke *et al.*, 1994). Further, normal investors are influenced by other socioeconomic, technological and environmental factors that shape preferences, attitudes and values. Existing evidence documents the influence of social interaction (Hong *et al.*, 2004; Brown and Taylor, 2010), trust (Guiso *et al.*, 2008), political values (Kaustia and Torstila, 2011), religion (Guiso *et al.*, 2006), computer usage (Barber and Odean, 2002; Bogan, 2008), housing (Flavin and Yamashita, 2002; Cocco, 2005), human capital (Heaton and Lucas, 2000c; Ibbotson *et al.*, 2007) and private ownership of businesses (Heaton and Lucas, 2000b; Faig and Shum, 2002).

In this thesis, I focus on the relationships between household financial decisions and social engagement, which I derive from Putnam's Social Capital Index (Putnam, 2000) and two behavioural biases: (1) mental accounting, which refers to the process of planning and separately managing wealth in layers, or goals (Thaler, 1980); and (2) anchoring bias, which refers to the influence of reference points when estimating the true value of a subject (Tversky and Kahneman, 1974).

Figure 1.1 presents the theoretical framework that underpins the above three studies. Behavioural finance theory mainly emerges from two interrelated fields: psychology and social psychology (see for example Hirshleifer, 2001; Baker and Nofsinger, 2002). Psychology deals with the various mental processes that influence individual behaviour and decisions, in which I examine the roles of mental accounting and anchoring. Social psychology encompasses the influence of interactions among individuals or groups and how this affects an individual's decisions; I examine the variety and intensity of social engagement.

Figure 1.1 Theoretical framework



1.2 Motivation and objectives of the study

The last two decades have witnessed a global shift in pension plans from defined benefit plans to defined contribution plans, an increase in new types of financial products and services, and a substantial increase in homeownership that is typically associated with mortgage finance (Guiso *et al.*, 2003; Campbell, 2006; Office of National Statistics, 2013a). Changes in pension plans have meant that households must take on more responsibility for the manner in which they invest their money (Campbell, 2006) whilst new financial products have led to an increase in ownership of financial assets (Guiso *et al.*, 2003).[2] These changes have occurred against the backdrop of evidence that most households are ill-equipped to make informed financial decisions or to understand complex financial products owing to financial illiteracy (Campbell, 2006; Van Rooij *et al.*, 2011; Klapper *et al.*, 2013) and that these decisions are subject to various judgement and decision biases (see for example, Hirshleifer, 2001; Baker and Nofsinger, 2002). Further, although owner occupied housing and home purchase through a mortgage declined over the decade to 2011, house prices grew steadily and thus housing wealth constitutes a substantial proportion of household total wealth (Office of National Statistics, 2013a). In response to stock market downturns, it is also argued that investors have tended to shift investment in stocks to housing because of the perception that housing is the "best investment" and that it cannot "lose money" (Case and Shiller, 2003).

This thesis examines the role of social engagement, mental accounting and anchoring in households' financial decisions. First, I examine the role of social engagement mechanisms on stock market participation. As previously mentioned, despite growth in the variety of financial products linked to the stock market, improved awareness about investment in stocks and a shift in the responsibility of managing retirement funds from both government and employers to households, low stock market participation persists across and within countries (Guiso *et al.*, 2003). The literature attributes this to the fixed costs of acquiring information, amongst other factors. Previous studies investigate

[2] For example, in the UK direct stock market participation dropped to 17% in 2010 from 26% in 2002; in contrast, participation through new products such as Individual Savings Accounts (ISAs) increased from 28% in 2002 to 40% in 2010. These data are collated from the Savings and Investments Series in the Family Resources Survey, which provides individual income details for women and men in Great Britain (Department for Social Development, 2013).

how increased levels of social capital, arising from social engagement, could reduce information costs and so mitigate barriers to stock market participation. However, most studies investigate various social capital measures in isolation (e.g. Hong *et al.*, 2004) or bring together a few measures in one model (e.g. Georgarakos and Pasini, 2011). Furthermore, studies that use popular proxies for social engagement such as frequency of talking to neighbours and involvement in social groups do not distinguish between these two channels of information diffusion, as suggested in social interaction theory (Granovetter, 1973). In Chapter Two, I add to this literature by bringing together five social engagement measures in one model, to examine their independent and joint effects on stock market participation.

Second, I investigate the connection between mental accounting and portfolio choice. Because most households have low levels of financial literacy, mental accounting enables them to more easily manage their wealth, to simplify complex financial decisions and to discipline themselves against impulsive consumption (Shefrin and Thaler, 1988). In their description of Behavioural Portfolio Theory (BPT) Shefrin and Statman (2000) suggest that, when compared to investors who exhibit BPT multiple mental accounts, known as "BPT-MA investors", those who exhibit BPT single mental accounts, known as "BPT-SA investors", are similar to "mean-variance investors" and hold portfolios that lie on Markowitz's (1952) mean-variance efficient frontier. Das et al. (2010) use a BPT framework to argue that BPT-MA investors' portfolios also lie on the efficient frontier; however, recent theories which incorporate background risk (Baptista, 2012) and financial advice (Alexander and Baptista, 2011) show that BPT-MA portfolios are below the efficient frontier. Although BPT is now well-established, little is known about its application under real life circumstances. Previous studies use different mental frames and subsets of household portfolios (Benartzi and Thaler, 2007;

Choi *et al.*, 2009) and do not examine both investment goals (as proxies for mental accounts) and the entire household portfolio. Further, the elaborate literature on the determinants of portfolio choice only dwells on the direct influence of factors such as financial literacy and cognitive ability (e.g. Christelis *et al.*, 2010; Klapper *et al.*, 2013), general health, physical health and mental health (e.g. Atella *et al.*, 2012; Bogan and Fertig, 2013) and background risks (e.g. Guiso and Jappelli, 2000; Cocco, 2005). In Chapter Three, I examine whether investors who have no mental account and investors who exhibit a single mental account or multiple mental accounts make different portfolio choices and whether the effect of mental accounting is mediated by background risk and financial advice.

Third, I examine whether changes in self-reported housing wealth are anchored on changes in published house price indices. Housing constitutes a significant share of total household portfolios and therefore influences households' financial decisions regarding consumption and investment (Campbell and Cocco, 2007; Disney *et al.*, 2010b). Given that housing is the most talked about and watched investment (Himmelberg *et al.*, 2005; Shiller, 2007) and that house price indices are closely monitored by homeowners, we might expect self-reported housing wealth to be anchored on house price indices. Anchoring biases are well documented in studies that investigate the determinants of asset pricing (e.g. Huberman and Regev, 2001; Coval and Shumway, 2005) and asset allocation (e.g. Kahneman and Tversky, 1979; Shefrin and Statman, 1985; Feng and Seasholes, 2005). However, apart from Northcraft and Neale (1987) who use an experiment to show that property prices are anchored on the initial price at which a property is listed, not much is known about the relationship between self-reported housing wealth and house price indices. In Chapter Four, I use household survey data to examine whether changes in self-reported housing wealth are anchored on changes in published house price indices and whether information asymmetries arising from ownership tenure and mortgage refinancing reduce anchoring effects.

1.3 Data and selection of samples

To achieve the objectives of this thesis I use various sources of data. Typically, the main sources of panel and cross sectional data used in the household finance literature are drawn from household surveys that are carried out in most countries. Unlike cross sectional data, panel data are more efficient as they provide a better way of dealing with omitted variables bias and unobserved individual effects. However, data vary from one survey to another and in most surveys there is a dearth of detailed information about socio-economic characteristics and, in particular, household financial outcomes. This thesis uses two household survey datasets that provide data relevant to the issues investigated: the British Household Panel Survey (BHPS) and the Wealth and Assets Survey (WAS).

The BHPS is an annual UK household survey that began in 1991 and has, since 2010, been replaced by, and incorporated into, the database known as *Understanding Society*. The surveys are based at the Institute for Social and Economic Research (ISER) at the University of Essex. The BHPS annual survey aims to provide individual and household information about social and economic changes. The BHPS data have been used in studies that investigate household consumption and saving behaviour (e.g. Campbell and Cocco, 2007; Disney *et al.*, 2010b; Disney *et al.*, 2010a). Whereas the BHPS contains comprehensive information about the characteristics of households and individuals, it lacks detailed information concerning financial assets. This gap has been addressed in the WAS, which contains household financial information such as the level of assets, savings and debt, and factors that affect financial planning. The WAS is carried out by the Office of National Statistics (ONS). In the WAS, which began in 2006, households are interviewed after every two years. The latest revised datasets became publicly available in July 2013, for the two waves covering 2006 to 2010. The WAS data have been used in government reports and studies that examine wealth distribution in the UK (see summary in Office of National Statistics, 2013b).

In the first study, which investigates the influence of social engagement on stock market participation, three waves of the BHPS are used: Wave 5 (1995), Wave 10 (2000) and Wave 15 (2005). These were the only waves during which questions regarding ownership of financial assets were asked. Despite this limitation, the BHPS provides comprehensive information regarding social factors that allow the examination of a wide range of social engagement mechanisms. In the second study, which examines the relationship between mental accounting and portfolio choice, the WAS is used as it contains detailed information about both ownership and the value of investments in various financial products and proxies for mental accounting. In the third study, which investigates anchoring on house price indices, sixteen waves of the BHPS (1993 to 2008) and both the Nationwide and the Halifax house price index data, covering the same periods, are used. Both the Nationwide and the Halifax provide quarterly house price data by house type and by region, which are used to match and merge with corresponding house types and regions in the BHPS.

1.4 Research methods

This thesis employs various quantitative research methods. Pooled probit and/or tobit regressions are used to test the main hypotheses in Chapters Two and Three while fixed effects ordinary least squares (OLS) and quantile regressions are used in Chapter Four.

In addition, Wald-type statistical tests of differences are used to test whether different levels in a categorical variable are not significantly different from zero while Chow-type tests for composite models are used to test whether coefficient estimates are not significantly different from zero across sub-sets of the data. As part of the robustness checks, poisson regressions, multi-equation probit and tobit regressions, and generalised method of moments (GMM) estimators are used to test the consistency of the main results. Standard errors are clustered either using one-way clustering at the individual level or two-way clustering at both the individual level and a combined identifier of region and house type or region and year.

In Chapters Two and Three, pooled probit regressions are used for analysis of the probability of owning a financial asset in different asset classes. I use probit regressions mainly because there are only three and two waves available in the BHPS and the WAS samples, respectively, and variations between individuals appear to explain differences in portfolio choice rather than variations within individuals. Thus, although a fixed effects model would have facilitated the control of unobserved individual effects, identification would have been more difficult. Nevertheless, in all regressions, standard errors are clustered at the individual/household level. Given that straightforward interpretation of marginal effects in non-linear models are misleading, as suggested in the literature, I calculate and plot marginal effects at representative values (Ai and Norton, 2003; Greene, 2010; Williams, 2012). To check the consistency of the results, I use alternative definitions, reparametrised variables and poisson regressions. In addition, I use conditional mixed process maximum likelihood multi-equation models in Chapter Three to control for common unobserved effects across asset class regressions.

In Chapter Four, a long panel, consisting of sixteen BHPS waves, facilitates the use of fixed effects OLS regressions. Most importantly, instead of using level prices or their logarithmic transformations, commonly used in previous anchoring studies, changes in self-reported housing wealth are modelled as a function of changes in the house price index and their logarithmic transformations. The two strategies provide a better means of identifying anchoring and controlling for both omitted variable bias and unobserved effects that may arise from property characteristics, individual characteristics – or both. Furthermore, given that house values substantially vary and the results may be driven by outliers, I use quantile regressions to examine the consistency of the OLS regressions using the 25th, median, 75th and 95th quantiles. For robustness, I test the consistency of the results using an aggregate national house price index, an alternative house price index, and instrumental variables using GMM estimators. I further test the consistency of my results using two-way clustered standard errors.

1.5 Major findings, contributions and implications

This thesis makes three main contributions to the literature concerning the influence of both social engagement and mental accounting on portfolio choice, and the influence of anchoring bias on self-reported housing wealth.

First, Chapter Two contributes to the literature concerning factors that influence stock market participation by linking and bringing together social capital measures proposed in Putnam's (2000) Social Capital Index under the theme of social engagement mechanisms. I examine whether frequency of talking to neighbours, involvement in social groups, trust, religion and political party identity are positively associated with stock market participation and are not subsumed when brought together in one model. In addition, I investigate their interactive influence and the effects of a shift in political identity. The results provide evidence that the variety and intensity of social engagement mechanisms, through involvement in social groups, trust, and political party identity increase stock market participation. The effect of frequency of talking to neighbours' is subsumed by other variables while the effect of religion is negative and dissipates when I use a more robust measure of social group involvement – the number of social groups. Further, the evidence shows that social group involvement and trust compensate for political party identity, and a shift of political identity has a negative effect on joining a right-leaning political party. The results are robust across alternative definitions of stock market participation and different econometric models.

Second, Chapter Three adds to the scant empirical literature concerning the role of mental accounting on portfolio choice. I begin by examining the relationships between three mental accounts (no mental account, a single mental account and multiple mental accounts) with time preference, risk tolerance and cognitive ability - and their influence on portfolio choice in three asset classes: risky asset, fairly safe assets and safe assets. I then investigate whether differences in portfolio choice can be explained by differences in mental accounts and whether the effect is mediated (increased) by housing tenure and financial advice, after controlling for the interactive effects of time preference, risk tolerance and cognitive ability. Taken together, the results show that mental accounting explains variations in portfolio choice and its effect is influenced by financial advice and housing tenure. For portfolio share in the three asset classes, I find significant differences among individuals who have no mental account, a single mental account and those who have multiple mental accounts. For ownership, having a single mental account has a negative and significant effect on ownership of a risky asset while mental accounting is irrelevant for ownership of a safe asset. Further, when conditioned on mental accounting, the evidence shows that financial advice and housing tenure increase the probability of ownership of ,and portfolio share in, a risky asset; reduces the probability of ownership of, and portfolio share in, a fairly safe asset; and increases the portfolio share in a safe asset. These results are consistent using conditional mixed process maximum likelihood multi-equations, using mental accounting sub-samples and using alternative definitions of dependent variables and mental accounting.

The third contribution, as discussed in Chapter Four, concerns anchoring bias and its influence on self-reported housing wealth. The objective in this chapter is to examine whether changes in self-reported housing wealth are anchored on published house price indices. Specifically, I investigate whether anchoring on a house price index varies between households that own their home outright and those that own through a mortgage and between households that use money raised from refinancing for home improvement or extension and those that use the money for other consumption purposes. In addition, I also examine whether social factors mediate the anchoring effects. The evidence shows that changes in self-reported housing wealth are anchored on changes in both the Nationwide and the Halifax house price indices. Ownership through a mortgage increases anchoring while mortgage refinancing decreases the anchoring effect. Moreover, among households that refinance their mortgages, investing on home improvement or extensions is positively associated with changes in self-reported home house values and further reduces anchoring on house price indices. Using the money raised for other consumption has no influence on changes in the self-reported house value but reduces anchoring on the house price index. For robustness check, I use alternative two-way clustered standard errors, alternative house price indices and GMM estimators and these results remain virtually unchanged.

Taken together, this thesis provides evidence that improves our knowledge about the influences of judgement and decision biases on household financial decisions. The findings will be of interest to investors, financial institutions and policy makers. The roles of both social engagement and mental accounting on portfolio choice indicate that investors and financial advisors should be aware of the shortcomings and benefits of these biases so as to be able to relate these to portfolio management. It is also important that homeowners are made aware of the dangers of anchoring on house price indices and the possible consequences of illusionary increases in housing wealth on consumption. Government and regulatory bodies should endeavour to provide more information to investors, especially those who are socially disengaged.

Furthermore, the findings have important implications for the operations of both financial markets and housing markets. Although I observe low stock market participation and minimal transitions in and out of the stock market among investors who invest directly, indirect stock market participation increased and the findings also suggest that investors shifted from direct to indirect stock market participation through mutual funds. This movement can have an impact on market volatility because fund managers are known to exhibit herding behaviour (Dennis and Strickland, 2002) and they may rebalance their indexed funds in line with market trends (Griffin *et al.*, 2011). Anchoring on house price indices and positive future financial expectations could exacerbate booms and busts in the market because of the contagion effect of market psychology (Shiller, 1990; Case and Shiller, 2003).

However, an important caveat in the interpretation of the results in Chapters Two and Three is that they do not suggest causality but rather associations. This is because the nature of the data and the methods used make it hard to appropriately address endogeneity issues. In Chapters Two and Three, I use three panels of the BHPS and two panels of the WAS, respectively, which make it difficult to control for unobserved individual effects using a fixed effects model. Moreover, although the BHPS has comprehensive information about individual characteristics, it lacks detailed information about the values of various financial assets; the opposite applies to the WAS. Thus, my results may be affected by omitted variable bias.

1.6 Outline of the thesis

Chapter Two examines the role of social engagement mechanisms on stock market participation. Chapter Three investigates the influence of mental accounting together with background risk and financial advice on ownership and portfolio share in three asset classes. Chapter Four examines whether self-reported house prices are anchored on house price indices and the mediating role of mortgage refinancing and social factors. Chapter Five presents the conclusions and provides suggestions for future research.

Chapter 2 Social engagement and stock market participation

"You have to assume that you do not have rational consumers. Faced with complex decisions or too much information, they default…They hide behind credit rating agencies or behind the promises that are given to them by the salesperson."

(Martin Wheatley, Financial Times, January 2012)

2.1 Introduction

Most households underinvest in stocks despite the long-term risk premium and diversification gains that are available (Mehra and Prescott, 1985). Limited stock market participation (SMP) has persisted in spite of the growth of stocks held indirectly through vehicles such as mutual funds (Mankiw and Zeldes, 1991; Haliassos and Bertaut, 1995) and it afflicts European as well as US households, albeit to a lesser extent (Guiso *et al.*, 2002). Low stock market participation is evident in this study and the puzzle of persistent low participation is especially concerning at a time when individuals bear more responsibility for investing their money (Campbell *et al.*, 2011); when new and complex financial products are continuously being introduced in financial markets (Guiso *et al.*, 2008) ; and when evidence suggests that financial literacy levels are low among most individuals (Lusardi and Mitchell, 2007; Lusardi and Mitchell, 2011; Van Rooij *et al.*, 2011).

In this Chapter, I assess the extent to which the variety and intensity of an individual's social engagement affects stock market participation. Access to information on how to start investing in the stock market and how to manage a portfolio reduces the fixed costs of stock market participation. Guiso and Japelli (2005) find that greater awareness of stocks, mutual funds and investment accounts is positively correlated with social interaction, while Ivković and Weisbenner (2007) find evidence that local information diffusion leads to common portfolio choices among neighbouring households. Socially engaged households have more opportunities to learn about investment opportunities from peers who are already informed. Over time, social engagement generates social capital, which reduces information cost barriers to stock market participation. Prior literature suggests that social engagement measures are important determinants of stock market participation (e.g. Hong *et al.*, 2004; Georgarakos and Pasini, 2011; Kaustia and Torstila, 2011). However, most studies investigate these factors in isolation.

In this study, I make four important contributions to the literature. First, I examine information diffusion through two channels of social interaction: frequency of talking to neighbours and involvement in social groups. Although regarded as distinct channels in social interaction theory (Granovetter, 1983) empirical studies assume that they capture the same information (e.g. Hong *et al.*, 2004; Georgarakos and Pasini, 2011). Second, most studies investigate social engagement measures such as trust and religiosity and social group involvement in isolation whereas I bring them together in one model to determine their independent effects. I add to the findings of Georgarakos and Pasini (2011) who combine trust and social group involvement by bringing in religiosity and political identity. Third, I use an integrated measure of political party identification based upon responses to four questions to examine the role of political identity and shifts in political party preferences. Apart from Kaustia and Torstila (2011) and Bonaparte and Kumar (2013) political party identification has not been examined in the context of stock market participation. I extend their analyses by including political identity and shifts in political party preferences, along with other social engagement measures, within the same model. Finally, motivated by the findings in Ai and Norton (2003) and Williams (2012), the results are interpreted using marginal effects to show the separate and joint influences of social engagement.

A major factor limiting research on the determinants of stock market participation is a dearth of detailed data (Hong *et al.*, 2004; Georgarakos and Pasini, 2011; Kaustia and Torstila, 2011). I take advantage of data on both individual characteristics and stock market participation available in the BHPS across a diverse range of age groups. I use individual level data rather than household level data as most of the social engagement variables in the BHPS are derived from individual observations.

The evidence shows that both the variety and the intensity of social interaction influence stock market participation. Based on social network theory I measure *strong ties* using the binary variable *talking to neighbours* and *weak ties* using both a binary variable *active in social groups* and a categorical variable *number of social groups*. When the set of social engagement measures are analysed in separate equations, all apart from *strong ties* have significant effects on stock market participation in contrast to the findings of Hong *et al*. (2004). I conclude that *strong ties* and *weak ties* are distinct channels of social interaction. Further, I find that religion has little effect, contrary to the findings of (Renneboog and Spaenjers, 2012).

The results also indicate that political identity has a separate positive influence on stock market participation. In a specification that includes these variables in one equation, I find that in addition to the independent effects of social group involvement and trust reported in Georgarakos and Pasini (2011) identification with both the Conservative and Liberal Democratic parties have positive effects whereas religion has a negative effect.[3] The results thus indicate that social group involvement, trust, religion and political identity are distinct social engagement measures with independent effects on

[3] When social group involvement is a binary variable, as in prior studies, we find that the variable “religion makes a difference” has a negative and significant effect. When we use our, arguably more robust, categorical measure of social group involvement, “number of social groups”, religion ceases to be significant.

stock market participation. When I interact these variables, I find that social group involvement and trust compensate for political identity. Further, I find that individuals who have recently identified with the Conservative and Liberal Democratic parties are less likely to participate than those who identified with the same party throughout our study, thus indicating a differential effect for consumer voters relative to ideological supporters. The net effect of social engagement is that the probability of stock market participation increases by approximately one fifth for fully engaged individuals compared to those who either do not socially engage or who have few avenues of social engagement.

A limitation of this study is the possible endogenous relationships that may arise from omitted variables and correlations among the social engagements measures, which may also be correlated with the error term. It was not possible to address these issues owing to the short panel and a low rate of transition in stock market participation (non-participation) states. Therefore, in the interpretations of the results I do not claim causality. Nonetheless, the findings in this study have important implications for various parties, including investors, fund managers and policy makers. For policy makers and financial institutions, the findings suggest that they should pay more attention to individuals who are socially disengaged when providing information about financial markets. Governments should develop policies that enhance trust in financial markets, thereby countering low rates of direct stock market participation. Further, policies that encourage the development of innovative financial products will increase indirect stock market participation and so increase ownership of diversified portfolios. Social engagement is also more likely to affect stock market participation where existing social networks are strong and individual investors are familiar with local companies and their directors (Tesar and Werner, 1995).

The rest of the Chapter proceeds as follows. Section 2.2 reviews the empirical literature and identifies the social engagement measures. In Section 2.3, I discuss the structure and features of the data, describe the variables and present the descriptive statistics while Section 2.4 discusses the research approach. Section 2.5 presents the empirical results and robustness checks are presented in Section 2.6. Finally, I conclude and discuss the implications of the study in Section 2.7.

2.2 Prior literature and hypotheses development

2.2.1 Social engagement, social capital and stock market participation

As individuals interact more with others and become more socially engaged there is reason to believe they will be more inclined to participate in the stock market. For example, those who talk more to their neighbours are more likely to find out about the stock market, as are those who are more involved in social groups. Individuals who are more trusting are more likely to take information they receive about stock market investing at face value and thus be more inclined to participate. Those for whom religious beliefs make more of a difference to their lives are more likely to be socially active in church activities and therefore to be more exposed to the possibility of stock market investing – though their views about the stock market may also be coloured by their interpretation of their religion’s perspective on investing. Finally, those who identify themselves with a political party are more likely to encounter information about stock market investing through related social activities and stock market participation is likely to be greater if their political beliefs accord with the view that market forces benefit society. In sum, social engagement mechanisms help to reduce information cost barriers that inhibit individuals from participating in the stock market.

Typically, the literature refers not to social engagement but to social capital, which I argue is simply the social capital built up over time by the process of social engagement. There is growing evidence that accumulated social capital influences financial well-being. Though there is no consensus on the definition of social capital, much research has been motivated by Putnam (1993) who defines social capital as a combination of trust, norms and networks. These become embedded in individual and group social interactions, enhancing personal and common goals in society (Narayan and Pritchett, 1997; Office of National Statistics, 2003). Although there is no general agreement regarding the best social capital metrics, the Social Capital Index composed by Putnam (2000) identifies five broad components: (1) community organizational life; (2) engagement in public affairs; (3) community voluntarism; (4) informal sociability; and (5) social trust.[4] The first four of these components reflect different aspects of social interaction, some of which are fostered by adherence to religious beliefs, while trust arises from the process of repeated social interaction (Putnam, 1995). These dimensions of accumulated social capital - social interaction, trust, and religion – are used in prior studies of stock market participation.

Some have argued that Putnam's Social Capital Index overly simplifies the different dimensions of social capital. For example, Bjørnskov (2006) suggests investigating the different dimensions individually. In this study, I investigate five forms of social engagement: Talking to neighbours (informal sociability); both membership of Social Groups and Religion (community organisational life); Political Party Affiliation (engagement in public affairs); and Trust (social trust).

[4] Alternative measures of social capital have been suggested. For example, Woolcock (1998) proposes four dimensions: communitarian, network, institutional and synergy.

2.2.2 Social interaction – *weak ties* and *strong ties*

In line with Granovetter's theory of social networks, investigations of the role of social interaction typically identify two channels of information diffusion: *weak ties,* i.e. ties with formal and informal organisations, and *strong ties,* i.e. ties with family, neighbours, and close associates (Granovetter, 1973; 1983; 2005). Studies that use proxies for *strong ties* show that knowing and visiting neighbours (Hong *et al.*, 2004), the likelihood of sharing consumption and investing information with neighbours (Brown *et al.*, 2008) and living in regions with high participation rates in elections, voting, and blood donation (Guiso *et al.*, 2004) increases the probability of stock market participation. Similarly, a *weak tie* such as involvement in social groups is positively associated with stock market participation (Brown *et al.*, 2008; Christelis *et al.*, 2010; Georgarakos and Pasini, 2011). Although these studies suggest a priori an association between the two channels of information diffusion and stock market participation, Granovetter (1983) argues that *weak ties* provide productive information and new ideas, which we conjecture are more relevant for stock market participation. In other words, social interaction through both *weak ties* and *strong ties* provide avenues for the transmission of costless information about the stock market through word-of-mouth or observational learning (Banerjee, 1992). Individuals can derive satisfaction from discussing market trends and patterns with friends (Becker, 1991) and talking to family members, neighbours, colleagues, and friends about investing (Nofsinger, 2005). However, *w*eak *ties* play the role of "transmitting unique and non-redundant information across otherwise largely disconnected segments of social networks" compared to *strong ties* (Granovetter, 2005). This suggests that effective transmission of financial information regarding investment opportunities, performance, and trends potentially occurs through *weak ties.*

In this study, I underscore the distinction between the two channels of information diffusion. The hypotheses to be tested are:

Hypothesis 1: Individuals who talk more frequently with their neighbours are more likely to participate in the stock market.

Hypothesis 2: Individuals who are active in social groups are more likely to participate in the stock market.

2.2.3 Trust and stock market participation

In the context of this study trust is the degree to which an individual believes that associates or institutions are likely to fulfil their part of a formal or informal contractual agreement (Guiso *et al.*, 2008). For individuals to participate in the stock market they must trust the entire financial system, including the investment process and the actors involved. In a study using a variety of individual and generalised trust measures across countries, Guiso *et al.* (2008) find that trust has a positive and statistically significant effect upon direct share ownership, the percentage of risky assets owned, the average rate of stock market participation, and the proportion of wealth invested in stocks. However, the use of the "level of trust" as a measure of social capital is debateable as it may be linked with other factors such as religiosity or sociability, making causality hard to determine (Guiso *et al.*, 2004).

In a recent study, Georgarakos and Pasini (2011) include trust and sociability measures in one model and find that both have independent effects on stock market participation. They also find that where trust levels are low, sociability may compensate. El-Attar and Poschke (2011) show that households with low trust levels tend to invest in housing rather than risky financial assets. Investigating the role of religion on household finance, Renneboog and Spaenjers (2012) also find a positive association between religiosity and trust. In related studies, Hong *et al.* (2004) use church attendance as a proxy for sociability, suggesting that both religious beliefs and social interaction are related. These findings underscore the links between trust, religion, and sociability. In this study, I further test the influence of trust on stock market participation while controlling for other social engagement measures. The hypothesis to be tested is

Hypothesis 3: Individuals who are more trusting are more likely to participate in the stock market.

2.2.4 Religion and stock market participation

Religion can affect the stock market participation decision as a direct result of theological beliefs or indirectly through its effect on factors such as trust and social interaction. The importance of thrift–being careful with money– is a common feature of religious doctrines (Keister, 2003). The long-term outperformance of stocks compared to other asset classes might therefore be expected to encourage stock market participation among those who have a religious affiliation. Guiso *et al*. (2003) find that religiosity is associated with a greater emphasis on the importance of thrift across countries, and also with a greater sense of individual responsibility. The latter may also incline households to invest in the stock market, given the higher rewards available from stocks in the longer term. Religious households are more likely to leave bequests and therefore to consider longer-term planning horizons, which favours stock market participation (Renneboog and Spaenjers, 2012).

Guiso *et al*. (2003) find that religion has a positive effect on trust towards others, mainly through regular attendance at religious services. They also find that it is positively associated with attitudes that are conducive to free markets. Therefore, religion may increase the likelihood of investing in stocks by raising both interpersonal trust and trust in market mechanisms. Attendance at religious services is also likely to increase social networking, which could positively affect stock market participation through increased opportunities for learning about investment choices; Hong *et al*. (2004) use a general religiosity measure, "attend church", to proxy for social interaction and find it to be positively associated with stock market participation.

Evidence on the role of religion on financial outcomes is mixed and its effect varies across countries. Using Dutch survey data, Renneboog and Spaenjers (2012) find Catholics to be more risk-averse compared to Protestants and those of other religious beliefs and that they are less likely to participate in the stock market. However, the level of significance varies considerably depending on the controls used and the findings are not significant when they bring together all variables in one model. Using church membership and attendance data for a demographically representative sample of the Dutch population, Noussair *et al*. (2012) report that more religious people are more risk-averse but their result is driven more by social aspects of church membership than by the religious beliefs themselves. León and Pfeifer (2013) use German survey data and also find religiously affiliated people to be more risk-averse, but they go a step further and consider a context-specific risk attitude, namely financial risk-taking. They discover that Christians are more willing to take financial risks compared to non-religious individuals and that they are more likely to hold risky assets such as stocks. This is consistent with the finding of Halek and Eisenhauer (2001) that Catholics and Jews, although more averse to pure risk, are more tolerant of speculative risk-taking.

The lack of consistency in findings across countries and studies about the impact of religion may be due to other characteristics of those holding religious beliefs, including alternative aspects of social capital, as alluded to by Gruber (2005). I test the influence of religion using a general question regarding whether respondents think religion makes a difference in their lives. In line with the direct and indirect arguments suggesting a positive influence of religion on stock market participation, the hypothesis to be tested is

Hypothesis 4: Religion is positively associated with stock market participation.

2.2.5 Political party identification and stock market participation

Existing evidence suggests that political preferences are associated with socio-economic outcomes and more specifically with the portfolio decisions of investors. In a Finnish study, Kaustia and Torstila (2011) find that both individual voters and members of parliament who have a more left-wing outlook are less likely to participate in the stock market. They attribute this to “value expressive” considerations, namely the idea that personal values dictate decisions. Negative perceptions about the stock market, for example that it is a source of greed or speculation or unethical behaviour, may make individuals less inclined to participate, even in the face of evidence that the stock market outperforms alternative asset classes. This feeling of discomfort when simultaneously holding two or more conflicting ideas is known as “cognitive dissonance” (Festinger, 1957). This can be regarded as an additional participation cost and some investors may stay out of the stock market to avoid it. Along similar lines, Hong and Kostovetsky (2012) find that political preferences influence the asset allocation decisions of relatively sophisticated US investors: mutual and hedge fund managers who donate to the Democratic Party underweight socially contentious firms, with the reverse pattern evident for fund managers who donate to the Republican Party.

The expressions of political preferences in elections are determined, at least in part, on the ideological positions of political parties (Sanders, 1999). However, this factor has declined in importance with voters placing more weight on the competitiveness of party policies (Clarke *et al.*, 2004). In the UK, evidence suggest that elections are generally determined by two competing sets of influences: “consumer voting” based on evaluations of political party competence (Clarke *et al.*, 2004; Green and Hobolt, 2008) and political party identification based upon ideological differences, albeit against a background of ideological convergence (Sanders, 2003). Despite the evidence that consumer voting has increased in the UK, Sanders (2003) argues that party identification is still an important consideration. We might therefore expect some potential investors with left-wing political leanings to stay out of the stock market to avoid the participation cost associated with cognitive dissonance.

Irrespective of political preferences, interest in politics generally may have a positive impact on stock market participation. Using US and European data, Bonaparte and Kumar (2013) find that politically active individuals, defined as those who say that they vote more often, are more likely to participate in the stock market. They attribute this to such individuals following political news more actively, thereby increasing their chance of being exposed to financial news. This lowers their information gathering costs and thus increases stock market participation. I extend my analysis to investigate the relationship between political party identification and stock market participation, and analyse how the relationship varies by political party allegiance and the impact of shifts in this allegiance over time. Based on the idea that information-gathering costs are lower for those who identify with a political party, the hypothesis that I test is

Hypothesis 5: Individuals who identify with political parties are more likely to participate in the stock market.

2.3 Data

2.3.1 Variables description

This study uses data from the BHPS that provides annual individual and household information about social and economic variables. The original sample of the BHPS was approximately 5,500 households consisting of 13,500 individuals from across the UK, subsequently increased by additional samples from Scotland and Northern Ireland.[5] The BHPS has three features that are relevant to this study. First, and most important, it provides data on both social engagement measures and stock market participation at the individual level. Second, it facilitates analysis of the impact of generational and age effects. This is important because levels of social engagement – the number of social groups, participation during elections, the frequency of reading newspapers, and social trust – have been found to be non-linear functions of age; they increase towards middle age, remain constant during middle age, and decline as individuals advance in age (Putnam, 1995). Further, it is arguable that social engagement is attributable to generational effects, so that belonging to a specific cohort is associated with increased/decreased levels of social engagement (Putnam, 1995). Most studies are restricted to specific cohorts (e.g. Hong *et al.*, 2004; Bogan, 2008), limiting the extent to which inferences can be made about the general population. Therefore, I use BHPS cohorts and ages ranging from 1900 to 1979 and 19 to 98 respectively. Third, by its structure the BHPS minimises the problem of sample attrition – respondents who participate in a few waves or completely drop out of the sample – by a process of re-

[5]The BHPS consists of 18 waves to 2008. Since 2010 (Wave 19), the BHPS has been replaced by, and incorporated into, the United Kingdom Household Longitudinal Study (UKHLS).

weighting the cases who gave full interviews at all waves (for a detailed explanation, see Taylor (2010)).

My use of the BHPS is limited to the years 1995, 2000 and 2005 because, to date, these are the only years in which investment questions were asked. For variables not observed during these three waves, I impute responses using the observations in either succeeding or preceding waves[6] and thus I assume that these imputed social engagement measures and controls do not vary in a manner that will materially affect my results.

Table 2.1 shows how each variable is constructed. In the survey individuals are first asked whether they have money in investments and, if they answer “yes”, they select the financial instruments in which the money is invested – national savings certificates, premium bonds, unit trusts, personal equity plans, shares (UK or foreign), national savings/building society, insurance bonds and other investments. I define the dependent variable, stock market participation 1 (SMP1), as a dummy variable taking the value one if the individual holds either unit trusts or shares. This definition provides the minimum degree of stock market participation because individuals may also invest indirectly through retirement plans and other financial instruments that include stocks.

An alternative dependent variable (SMP2), which includes investments in PEPs, Tessas and ISAs and, along with two further alternates, investment in fixed interest assets and the number of investment products, described in Table 2.1, are used for robustness checks, which confirm our key results.

[6] Access to the Internet from home – wave 6 and 10 onwards; social interaction – wave 7 onwards; social group membership – skipped annually after wave 2; religion – wave 1, 7, 9, 11, 14 and 18; trust – wave 8, 10, 13, 15 and 17; and life events – waves 2, 3, 4, 5, 9, 11 and 14.

Table 2.1 Variable descriptions

The table presents the variable descriptions used in the study. The sample is from three waves of the BHPS: 1995, 2000 and 2005.

Variable	Description	Value
Dependent Variables		
Stock market participation first definition (SMP1)	Do you currently have any money in any of the investments shown? Which one?	shares and/or unit trust = 1; other or none = 0
Stock market participation second definition (SMP2)	Do you currently have any money in any of the investments shown? Which one?	shares, unit trusts, personal equity plans and TESSA/ISA =1; other or none = 0
Fixed interest assets (FIA)	Do you currently have any money in any of the investments shown? Which one?	National savings certificate, premium bonds, national savings bonds, savings account, national savings bank, and other (investment, government or company security = 1 ; other or none = 0
Number of investment products (NIP)	Derived from the above categories	Number of the above held
Social engagement measures		
Talking to neighbours	How often do you talk to any of your neighbours?	Every day, once in a week, or once in month =1; rarely or never = 0
Active in social groups	Do you join in the activities of any of these organisations on a regular basis	yes = 1; no = 0
Trusts most people	Generally speaking, would say that most people can be trusted, or that you can't be too careful in dealing with people?	most people can be trusted = 1; can't be too careful = 0
Religion makes a difference	How much difference would you say religious beliefs make to your life?	some or a great difference = 1 ; a little or no difference = 0
Political party identification	Derived variable that combines responses to four questions regarding: support of particular party, closeness to one particular party than other, party which would vote for tomorrow and which political party closest to	none = 1 ; Scottish National, Plaid Cymru, Green Party or other party = 2 ; Liberal Democratic = 3; Labour Party = 4 ; Conservative Party = 5
Control variables		
Good neighbourhood	Is your neighbourhood a good place to live?	Good = 1; moderate or bad = 0

Table 2.1 Continued

Variable	Description	Value
Concentrated housing	What type of accommodation does the household live in?	Purpose built flats, converted flat, or other concentrated housing = 1 ; Detached, semi-detached, or terraced = 0
Housing	Derived variable: owned outright, owned with mortgage, local authority rent, housing association rented, rented from employer, rented private unfurnished, rented private furnished or other rented	all rented accommodation = 1; owned with a mortgage = 2 ; owned outright = 3
Received windfall income	Since Sept. 1st 1994 have you received any payments, or payment in kind? If answered yes, the amount received - life insurance, pension, personal accident claim, redundancy, employment bonus, inheritance/bequest, pools/lottery win or something else	yes = 1; no = 0
Has no debt	I would like to ask you now about any other financial commitments you may have apart from mortgages and housing related loans. Do you currently owe any money on the things listed on this card	yes =0; no = 1
Financial capability index		
Saves from current income	Do you save any amount of your income by putting away something in a bank, building society, or post office account other than to meet regular bills?	yes = 1; no = 0
Current financial situation	How well would you say you yourself are managing financially these days: living comfortably; doing alright; just about getting by; finding it quite difficult; and finding it very difficult.	living comfortably = 1 ; doing alright = 2 ; just about getting by = 3 ; finding it quite difficult = 4 ; or finding it very difficult = 5
Change in financial situation	Would you say that you yourself are better off, worse off or about the same financially than you were a year ago?	better off and about the same = 1 ; worse off = 0
Has housing problems	Many people these days are finding it difficult to keep up with their housing payments. In the last twelve months would you say you have had any difficulties paying for your accommodation?	no = 1 ; yes = 0
Problems required borrowing	Did you have to borrow in order to meet housing payments	no = 1 ; yes = 0

Table 2.1 Continued

Variable	Description	Value
Problems required cutbacks	Did you have to cutback in order to meet housing payments	no = 1 ; yes = 0
Been at least two months in housing arrears in last 12 months	In the last twelve months have you ever found yourself more than two months behind with your rent/mortgage?	no = 1 ; yes = 0
Computer user	Which item do you have? Home computer	yes = 1; no = 0
Health	Please think back over the last 12 months about how your health has been compared to people of your own age, would you say that your health has on the whole been ...	excellent and good = 1 ; fair, poor or very poor =0
Sex	Interviewer check sex of the respondent	male = 1 ; female = 0
Age	Derived variable: uses date of birth variables on survey database	age at date of interview
Marital status	Married, separated, divorced, widowed or never married	married = 1 ; separated, divorced, widowed or never married = 0
Has child(ren)	Number of own children derived from a set of questions	one, two, three or more kids = 1 ; none = 0
Education	Derived variable - yearly updated qualification of new entrants and existing panel members	no qualification = 1 ; commercial qualification, no o-levels, CSE grade 2-5 or Scotland grade 4-5 = 2 ; GCE A-levels, GCE o-levels or equivalent = 3; teaching , other higher or nursing qualifications = 4; and first or higher degree = 5
Economic activity	Please look at this card and tell me which best describes your current situation? Self-employed, in paid employment, unemployed, retired, family care, FT student, long term sick/disabled, on maternity leave, government training or other	Unemployed, maternity leave, family care, full time student, sick, disabled, government training scheme, or other = 1; retired = 2 ; self-employed = 3 ; and employed = 4
Government office region	Internally computed	North East = 1; North West = 2; Yorkshire and Humber = 3; East Midlands = 4; West Midlands = 5; East of England = 6; London = 7; South East = 8; South West = 9; Wales = 10; Scotland = 11; Northern Ireland = 12; and Channel Islands = 13
Income	Derived variable that sums up all sources of income indicated by the respondent including : labour income and non-labour income	

I generate five social engagement variables. Of these, two represent *strong* and *weak ties*. The proxy for s*trong ties* is the frequency of *talking to neighbours* and takes the value 1 if a respondent talks to neighbours "everyday", "once in a week" or "once in a month" (92.8%) and the value 0 if "rarely" or "never" (7.2%).[7] The proxy for *weak ties* is based on social group activity. I define the variable *active in social groups* as a dummy variable that takes the value 1 if a member is active and the value 0 otherwise. I also use four dummy variables derived from the number of organisations[8] respondents are members of as an alternative proxy for *weak ties.* To control for neighbourhood effects, which may contaminate these variables, I include two dummy variables. The first is the variable *good neighbourhood*, which takes the value 1 if a respondent thinks that her/his neighbourhood is a "good" place to live in and the value 0 if the response is "moderate" or "bad". The second is the variable *concentrated housing*, which takes the value 1 if the type of accommodation is "detached", "semi-detached", or "terraced" and the value 0 if it is a "converted flat", "purpose built flat" or any other type of housing.

Trust is a binary variable taking a value of 1 for positive responses to the question: "generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?" Religiosity is measured by the dummy variable *religion makes a difference.* This takes a value 1 if respondents answer: *a little difference*, *some difference* or a *great difference* to the question: "how much difference would you say religious beliefs make to your life?" It takes the value 0 if the answer is *no difference.*

[7] Alternative definitions of the *talking to neighbours* variable are also generated using different (0, 1) combinations of the five categories defined in Table 2.1. Using Wald type test, comparable results obtained for these other definitions result in high P-values.

[8] The organisations listed include political party, trade union, environmental group, parents association, tenants or residents group, religious group, voluntary service group, other community group, social group, sports club, women's institute, women's group, other organisation, professional organisation, pensioners organisation and scout/guides organisation.

Political party identification is derived using answers to four questions about interest in politics. First, all respondents are asked whether they support a particular political party to which the response is either “yes” or “no”. Second, If the response is “no”, the respondent is asked whether she/he is “closer to one political party than another”. Third, respondents who do not support or feel closer to one political party than another are asked to identify the political party they would vote for tomorrow. Finally, respondents who support a particular political party or feel closer to one political party than another are asked to identify the particular political party. By combining responses to these questions, a respondent is classified as having no political inclination if she/he does not support any political party; is not closer to one political party than another; or does not identify a political party he/she would vote for tomorrow. Otherwise, respondents are categorised as belonging to the Conservative Party, the Labour Party, the Liberal Democratic Party, or other parties[9] based on the party they would vote for tomorrow or that they identified in the last question. The variable therefore captures both political ideology and consumer voting. I generate five dummy variables for each category. Finally, I use a comprehensive set of socio-economic and demographic control variables, described in Table 2.1.

My proxy for the control variable *Financial Capability* uses the responses to seven BHPS questions about financial management, as reported in Table 2.1. It is similar to the approach of Hilgert *et al*. (2003) and Atkinson *et al*. (2007) and follows the method used by Taylor *et al.* (2009) in their construction of a financial *in*capability index. However, I invert my index so that positive values represent financial capability[10].

[9] The “other parties” category includes regional parties such as the Scottish National party, Plaid Cymru and other smaller parties.

[10] The response categories to the questions were recoded to remove missing values and standardized (to have a mean 0 and a variance of 1). The constructed index has a 0.7036 Cronbach’s alpha with a 0.2532

2.3.2 Descriptive Statistics

2.3.2.1 Summary statistics

Table 2.2 presents weighted summary statistics for the whole sample. The most popular investment vehicles among individuals in the sample are savings accounts (63%), premium bonds (22%) and ISAs (20%), and direct shareholding (18%). SMP1 and SMP2, respectively, represent 21% and 35% of money invested, while the proportion of those who invest in less risky assets is 28%. The figures for the type of investment do not add up to 100% since individuals may hold more than one instrument. On average, 92.8% of the respondents acknowledge that they talk to their neighbours. The other social engagement measures have lower averages but their standard deviations indicate a higher variation relative to the mean than the talking to neighbours variable. The financial capability index takes negative and positive values, with increasingly negative values representing declining financial capability and increasingly positive values representing improving financial capability. The mean of 0 implies that on average respondents are financially capable.

Table 2.3 presents weighted pairwise correlation coefficients for the variables used in the study across the whole sample. The reported levels of significance are derived using Bonferroni-adjusted p-values. From the outset, we see that stock market participation is positively correlated with the variables *active in social groups*, *trusts most people*, and memberships of the *Liberal Democratic Party* and the *Conservative Party*; however, it is negatively correlated with *religion makes a difference*, having *no party affiliation*, and memberships of *other smaller parties* and of the *Labour Party*.

average inter-item correlation. These values provide a satisfactory level of internal consistency (for a detailed discussion see Taylor *et al.*, 2009). The higher the index value the higher the financial capability.

Table 2.2 Summary statistics

Data are derived from three waves of the BHPS: 1995, 2000 and 2005. The reported statistics for the whole sample are weighted and are as defined in Table 2.1. Panel A presents the proportion of respondents who invest directly in the stock market; invest through unit trust; hold individual savings accounts; have personal equity plans; invest in national savings bank; and invest in premium bonds. Panel B presents proportion of respondents who: (1) invest directly in the stock market or through unit trusts (stock market participation definition 1(SMP1)); (2) invest directly in the stock market, through unit trusts, personal equity plans, or individual savings accounts (SMP2); (3) invest in national savings certificate, premium bonds, national savings bonds, savings account, national savings bank, or other investments; and number of these products; and (4) the number of these products held by a respondent (NIP). Panel C presents the fraction of respondents who talk to neighbours, are active in social groups, trust most people, do not have political party affiliation, belong to various political parties, and have shifted their political affiliation during the panel period. Panel D presents the proportion of respondents who rent, have a mortgage, or own outright their current accommodation; own a computer; received windfall income; have no debts; have good health, are male; are married; have child(ren); hold a first degree and above, other higher, GCE level, lower or no qualification; and who are employed, self-employed, retired or are unemployed. In addition, Panel D presents average income, age, cohort, and financial capability index.

Variable	Mean	Std. Dev.	Observ.	Variable	Mean	Std. Dev.	Observ.
Panel A: Type of investment				*Panel D: Control variables*			
Direct shareholding	0.183	0.387	22407	Rented	0.252	0.434	22492
Unit trusts	0.066	0.248	22407	Mortgaged	0.451	0.498	22492
Individual Savings Account	0.195	0.396	22583	Outright owner	0.297	0.457	22492
Personal Equity Plans	0.111	0.314	22583	Computer user	0.480	0.500	22515
Savings account	0.630	0.483	14171	Received windfall income	0.276	0.447	22515
National savings bank	0.048	0.214	14171	Has no debt	0.644	0.479	22507
Premium bonds	0.221	0.415	22407	Financial capability index	0.003	0.582	22583
Panel B: Dependent variables				Good health	0.684	0.465	22579
SMP1	0.212	0.408	22583	Male	0.447	0.497	22583
SMP2	0.351	0.477	22583	Cohort	1950	18.202	22583
Fixed interest assets (FIA)	0.280	0.449	22583	Age at date of interview	50	18.327	22583
Number of investment products (NIP)	3.951	3.464	22583	Married	0.582	0.493	22579
Panel C: Social engagement measures				Has child(ren)	0.270	0.444	22583
Talking to neighbours	0.928	0.259	21384	No qualification	0.262	0.440	22337
Active in social groups	0.487	0.500	22142	Lower qualification	0.088	0.283	22337
Most people can be trusted	0.378	0.485	21264	GCE level qualification	0.269	0.443	22337
Religion makes a difference	0.434	0.496	20441	Other higher qualification	0.262	0.440	22337
No party affiliation	0.115	0.319	20377	First degree and above	0.119	0.324	22337
Other smaller parties	0.045	0.207	20377	Unemployed	0.178	0.383	22579
Liberal Democratic	0.137	0.344	20377	Retired	0.258	0.438	22579
The Labour Party	0.410	0.492	20377	Self employed	0.072	0.258	22579
Conservative Party	0.293	0.455	20377	Employed	0.492	0.500	22579
Political party shift	0.381	0.486	22583	Income	13296	13731.40	22286

The measures of social engagement – *talking to neighbours*, *active in social groups*, *trusts most people*, *religion makes a difference* and political party identification – have moderate correlations ranging from -0.334 to 0.184. However, we see insignificant correlations between the variables *talking to neighbours* and *active in social groups* and between identification with *other smaller parties* and other social engagement measures. This suggests that the variables *talking to neighbours* and identification with *other smaller parties* may capture different effects or none at all.

Surprisingly, the variable *religion makes a difference* is negatively correlated with social engagement variables including *talking to neighbours*, *active in social groups* and *trusts most people*. Similarly, having *no party affiliation* is also negatively correlated with these variables but is positively correlated with *religion makes a difference*. A detailed analysis of the correlations between political party affiliation and other social engagement measures indicates a negative correlation with *other smaller parties* and positive correlations with affiliation to the *Liberal Democratic Party* and the *Conservative Party*. Generally, the correlations are low between most of the control variables and the variables of interest. Therefore, I expect each variable to provide independent information in relation to SMP.

2.3.2.2 Graphical analysis

A further analysis of these relationships are presented in Figure 2.1, which show rates of stock market participation conditional upon political party identification and trust, and by frequency of *talking to neighbours* (Panel A), *religion makes a difference* (Panel B); *involvement in social groups* (Panel C); and *housing tenure* (Panel D). Individuals who are affiliated with the *Labour Party* and the *Conservative Party* have high rates of stock market participation regardless of their opinion about trust, sociability, or religion.

Table 2.3 Pairwise correlation matrix

Table presents weighted pairwise correlations for the whole sample. Data are derived from three waves of the BHPS (1995, 2000 and 20050 and the variables are as defined in Table 2.1. For categorical variables the base levels used include political identity – no political affiliation; housing tenure – renter; education – has no education qualification; and occupation – unemployed. The reported levels of significance are based on Bonferroni-adjusted p-values and are given by * for significance levels of 0.05 or less.

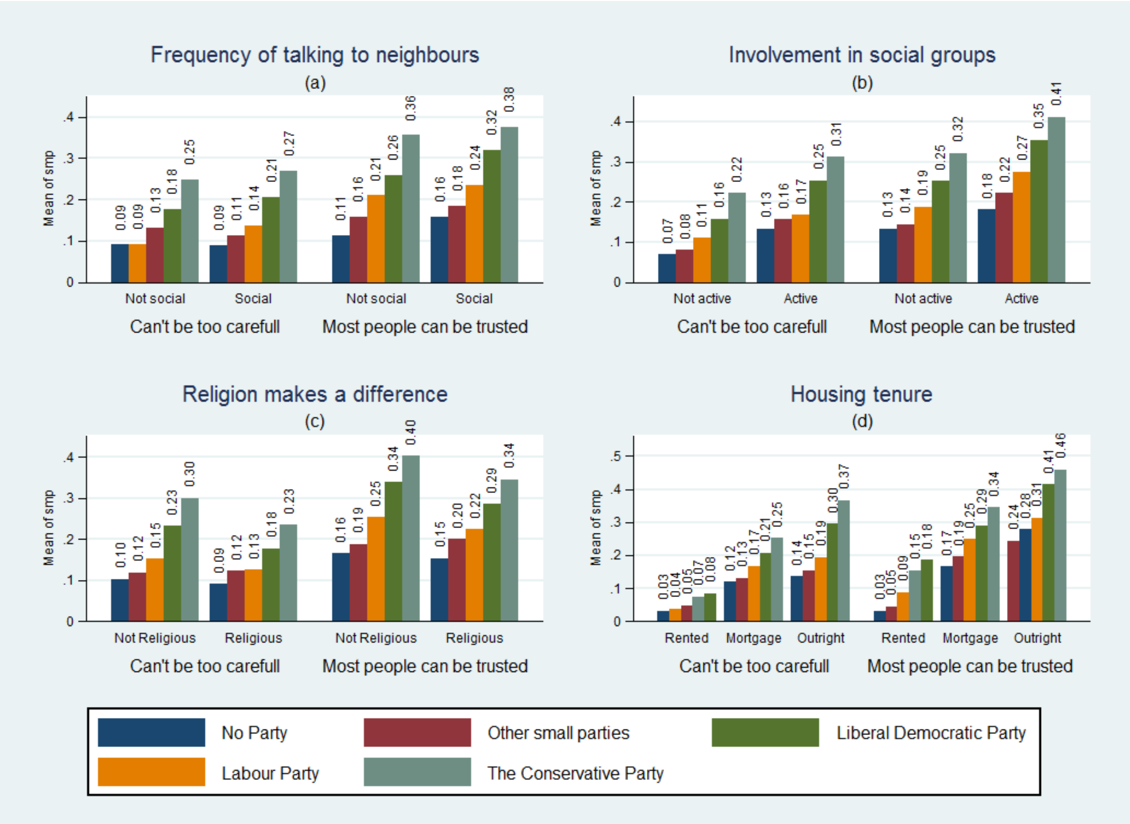
	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Stock market participation (dummy)	1											
(2)	Talking to neighbours	0.0283	1										
(3)	Active in social groups	0.1733*	0.0327	1									
(4)	Trusts most people	0.1289*	0.0469*	0.1541*	1								
(5)	Religion makes a difference	-0.0660*	-0.0371*	-0.1844*	-0.0663*	1							
(6)	No political affiliation	-0.0858*	-0.0515*	-0.0960*	-0.0957*	0.1291*	1						
(7)	Small parties	-0.0272	-0.0242	-0.002	-0.0056	0.0149	-0.0768*	1					
(8)	Liberal Democratic Party	0.0388*	0.0175	0.0368	0.0494*	-0.0448*	-0.1429*	-0.0872*	1				
(9)	Labour Party	-0.1071*	0.0332*	-0.0550*	-0.0031	0.0255	-0.2945*	-0.1797*	-0.3343*	1			
(10)	The Conservative Party	0.1574*	-0.0026	0.0962*	0.0344*	-0.0881*	-0.2301*	-0.1404*	-0.2611*	-0.5381*	1		
(11)	Good neighbourhood	0.0791*	0.0754*	0.0774*	0.1381*	-0.0199	-0.0538*	-0.02	0.0182	-0.0536*	0.0897*	1	
(12)	Concentrated housing	-0.0686*	-0.0459*	-0.03	-0.0406*	-0.014	0.0086	0.0396*	-0.0209	0.0246	-0.0345*	-0.1041*	1
(13)	Housing tenure	0.2193*	0.0573*	0.1240*	0.1064*	-0.1213*	-0.1249*	-0.0491*	0.0396*	-0.1138*	0.2010*	0.1411*	-0.2434*
(14)	Received windfall income	0.0708*	0.0285	0.0478*	0.0127	0.0142	-0.0338*	0.0015	0.0003	-0.0368*	0.0620*	0.026	-0.028
(15)	Has no debt	0.0599*	0.0177	0.0047	0.0026	-0.0911*	-0.0587*	-0.02	-0.0052	-0.0174	0.0723*	0.0175	0.0330*
(16)	Financial capability	0.1653*	0.0181	0.0732*	0.0946*	-0.0262	-0.0634*	-0.0283	0.0241	-0.0554*	0.0979*	0.1195*	-0.0795*
(17)	Computer user	0.0940*	-0.0233	0.0761*	0.0952*	0.0424*	0.0135	0.0341*	0.0383*	-0.0610*	0.0118	0.0584*	-0.1354*
(18)	Has good health	0.0777*	0.016	0.0898*	0.1183*	0.0251	-0.0184	0.003	0.0073	-0.0598*	0.0702*	0.1314*	-0.0800*
(19)	Male	0.0841*	-0.0012	0.0108	0.0310*	0.1192*	-0.0286	0.0101	-0.0340*	0.026	0.013	0.0148	-0.0165
(20)	Age	0.0841*	0.0780*	0.0617*	0.025	-0.2017*	-0.1578*	-0.1063*	0.0181	0.0007	0.1426*	0.029	0.0780*
(21)	Cohort	-0.0810*	-0.0841*	-0.0686*	-0.0298	0.2153*	0.1687*	0.1090*	-0.0117	-0.0146	-0.1412*	-0.0198	-0.0888*
(22)	Married	0.0901*	0.0684*	0.0726*	0.0781*	-0.0495*	-0.0630*	-0.0563*	0.0025	0.0004	0.0667*	0.0749*	-0.2455*
(23)	Has kids	-0.0475*	0.0184	0.0154	-0.0079	0.0695*	0.1036*	0.0003	-0.0284	0.0228	-0.0746*	-0.0129	-0.1320*
(24)	Education	0.1935*	-0.0244	0.2020*	0.1964*	-0.0387*	-0.0427*	0.0401*	0.0802*	-0.0824*	0.0392*	0.1023*	-0.0727*
(25)	Occupation	0.0674*	-0.011	0.0249	0.0735*	0.1028*	0.0335*	-0.0246	0.0145	-0.0213	-0.0001	0.0787*	-0.0905*
(26)	Region	0.0265	-0.0028	0.0500*	0.0504*	-0.0283	-0.026	0.1339*	0.0388*	-0.0907*	0.0255	0.0165	0.0821*
(27)	Income	0.2010*	-0.0196	0.1040*	0.1226*	0.0740*	-0.0187	-0.0165	0.0169	-0.0411*	0.0516*	0.0932*	-0.0751*

Table 2.3 Continued

	Variable	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
(13)	Housing tenure	1												
(14)	Received windfall income	0.0277	1											
(15)	Has no debt	0.1749*	-0.0726*	1										
(16)	Financial capability	0.2110*	0.0353*	0.1134*	1									
(17)	Computer user	0.0430*	-0.0066	-0.1427*	0.0686*	1								
(18)	Has good health	0.0605*	0.0244	-0.0441*	0.1402*	0.1022*	1							
(19)	Male	0.0237	0.0637*	-0.021	0.0267	0.0540*	0.0495*	1						
(20)	Age	0.2811*	-0.0653*	0.3495*	0.0758*	-0.2712*	-0.1556*	-0.0328*	1					
(21)	Cohort	-0.2602*	0.0243	-0.3444*	-0.0581*	0.3453*	0.1525*	0.0319*	-0.9731*	1				
(22)	Married	0.1714*	0.0576*	0.0104	0.0748*	0.1482*	0.0339*	0.0771*	0.1108*	-0.1037*	1			
(23)	Has kids	-0.1837*	-0.0089	-0.2024*	-0.1054*	0.2399*	0.0845*	-0.0310*	-0.4147*	0.4185*	0.2151*	1		
(24)	Education	0.0648*	0.0320*	-0.1771*	0.0912*	0.3510*	0.1902*	0.0935*	-0.3536*	0.3860*	0.0266	0.1691*	1	
(25)	Occupation	-0.0283	0.0820*	-0.2434*	0.1226*	0.2087*	0.2157*	0.1446*	-0.3284*	0.3441*	0.0818*	0.1306*	0.3070*	1
(26)	Region	0.0068	0.0011	-0.0111	-0.0293	0.0286	0.0396*	-0.0138	0.0033	-0.001	-0.002	0.0022	0.0573*	0.0126
(27)	Income	0.0359*	0.0560*	-0.1774*	0.1619*	0.2703*	0.1527*	0.3566*	-0.1651*	0.2225*	0.0358*	0.1045*	0.4205*	0.5091*

Figure 2.1 Stock market participation rates by trust and political party identification

The figure displays stock market participation rates by trust and by political identity for frequency of talking to neighbours (Panel A); involvement in social groups (Panel B); religion makes a difference (Panel C); and housing tenure (Panel D). Data are derived from three waves of the BHPS (1995, 2000 and 20050 and the variables are as defined in Table 2.1.



In addition, Panel A shows small differences in the rates of stock market participation between individuals who frequently talk to their neighbours (social) and those who do not (not social), especially among those who are also less trusting. As expected, there is a negative relationship between religion and stock market participation, reported in Panel B, which cuts across political identity and trust. Panel C demonstrate the role of *involvement in social groups* and shows that the rates of stock market participation increase by trust and categories of political identity. An indication of the relationship with the key control variable housing tenure is presented in Panel D. The rate of stock market participation increase across housing tenure categories (from rented to mortgage to outright ownership) and this pattern is consistent across the variables trust and political identity. Notably, renters have very low rates of participation especially among individuals who do not identify with any political party or who identify themselves with smaller parties. Overall, there is a clear pattern of left-to-right increase in participation rates, which depicts the left-right political spectrum and suggests that political ideology plays an important role on stock market participation.

2.4 Econometric strategy

From the summary statistics reported in Table 2.2, I observe variations in the key independent variables. Further, respondents do not substantially change their stock market participation status from one period to the other[11] and, across all the independent variables, the between variations are about double the within variations. This implies that if I were to use a fixed effects model, individuals who do not change participation status over the panel period will not contribute to the estimation, making the identification harder. This suggests that a pooled probit model is more appropriate for my data. I cluster standard errors at the individual level. I therefore estimate the general static binary response model given by

$$y_{it}^* = \delta_0 + X_{it}\beta + z_i\alpha + u_i + \varepsilon_{it},$$

$$y_{it} = 1 \; if \; y_{it}^* > 0, and \; y_{it} = 0 \; otherwise, \tag{1}$$

where y_{it}^* is a latent variable, y_{it} is the dummy for observed stock market participation, X_{it} are the time varying explanatory variables, z_i are the time invariant control variables, u_i is an error term, and ε_{it} a transitory error term.

[11] For example, among respondents who were out of the stock market in one period, 88% remained out of the stock market in the next period compared to 57% for those who participated in the stock market.

First, I investigate whether *strong* and *weak ties* are distinct measures of social interaction. As discussed in Section 2.2, my proposition is that *weak ties* provide sources of new information. This has three implications: (1) non-participants are more likely to participate in the stock market upon joining a social group; (2) the more social groups an individual is involved with, the higher the effects on participation; and (3) most important, in an equation that includes both channels, measures of *strong ties* should have insignificant effects. I estimate the following equations:

$$SMP_{it} = SI_{it}\beta_j + CV_{it}\alpha + u_i + \varepsilon_{it}, \tag{2}$$

$$SMP_{it} = TTN_{it}\beta_1 + ASG_{it}\beta_2 + CV_{it}\alpha + u_i + \varepsilon_{it}, \tag{3}$$

where SMP_{it} is a dummy for stock market participation for individual *i* in year *t.* The social interaction (*SI*) variable of interest in eq. (2) is either *talking to neighbours* (*TTN*) or *active in social group* (*ASG*) and both variables are combined in eq. (3). The control variables (*CV*) are *housing tenure*, *financial capability index*, *has no debt*, *received windfall income*, *computer user*, *cohorts*, *good health, male, age, married, has child(ren), highest qualification, economic activity, government office region,* and *income quintiles.* The error term u_i represents unobserved individual effects.

Second, I investigate whether each of the social engagement measures have independent effects on stock market participation. I should expect to see significant effects if each social engagement measure is analysed in isolation, as in

$$SMP_{it} = SEM_{it}\beta_{j1} + CV_{it}\alpha_{j4} + u_i + \varepsilon_{it}. \tag{4}$$

The social engagement measures (*SEM*) include the social interaction variables in eq. (3), *trusts most people* (*TMP*), and *religion makes a difference* (*RMD*). However, I contend that the measures may capture the same underlying information or affect the control variables, so I expect to see increased, diminished or insignificant effects in the equation that brings social engagement measures together, as in

$$SMP_{it} = TTN_{it}\beta_1 + ASG_{it}\beta_2 + TMP_{it}\beta_3 + RMD_{it}\beta_4 + CV_{it}\alpha + u_i + \varepsilon_{it}. \quad (5)$$

The variables are estimated in isolation in eq. (4) and are combined in eq. (5).

Third, I examine the role of political party identification. Two implications emerge from the literature: (1) if party identification matters, those who identify with right-wing parties are more likely to participate in the stock market; (2) otherwise, if policies are very similar and evaluation of political party competence is more important, party identification should have less influence on participation. The model is represented by

$$SMP_{it} = PI_{it}\delta_j + CV_{it}\alpha_j + u_i + \varepsilon_{it}. \quad (6)$$

Where the dependent and control variables are as described in equations 1 – 4 and the additional variable of interest is party identification (*PI*).

Finally, I pool all of these factors to estimate the determinants of stock market participation. Again, I contend that there may be correlations between social engagement measures and party identification, or with other variables such as housing (El-Attar and Poschke, 2011). The model is represented by:

$$SMP_{it} = SCM_{it}\beta_j + PI_{it}\delta_j + CV_{it}\alpha_j + u_i + \varepsilon_{it}. \tag{7}$$

The dependent variable and explanatory variables are as defined in equations 1 - 6.

2.5 Empirical results

Each of the results tables reports the effects of the independent variables on stock market participation separately and jointly. The results of the separate estimations broadly follow those for prior studies discussed in the literature review. In contrast, when all of the variables are brought together in a general specification the results provide the main contribution of this study by showing which independent variable associations remain significant. When the social engagement variables are combined together sequentially, the results suggest that more socially engaged respondents are more likely to participate in the stock market.

2.5.1 The role of social interaction, trust and religion

Table 2.4 presents the marginal effects from unbalanced panel probit estimates using seven specifications. Panel A shows the marginal effects at means (MEMs) whereas Panels B and C present the marginal effects at representative values (MERs). I calculate the joint effects of our social engagement measures in Panel D. In all the specifications I control for *good neighbourhood, concentrated housing, housing tenure, received windfall income, has no debt, financial capability, computer use, good health, male, age, age square, cohort, married, has child(ren), highest qualification, economic activity, government office region* and *income*, as defined in Table 2.1.

Table 2.4, Panel A, reports MEMs for each of the social capital measures, first separately and then together. In column (1), the variable of interest is *talking to* *neighbours* as used by Hong *et al.* (2004). In the second specification, column (2), I test the separate influence of the variable *active in social groups* as used by Georgarakos and Pasini (2011). In contrast to the findings of Hong *et al.* (2004) and hypothesis 1, when MEMs are estimated in isolation I do not find a correlation between *talking to neighbours* and stock market participation.[12] Consistent with the prior literature and hypothesis 2, I find that when MEMs are estimated in isolation, individuals who are active in social groups appear more likely to participate in the stock market. Similarly, column (3) indicates that trusting individuals are more likely to participate in the stock market (in line with hypothesis 3), while those who say that religion makes a difference in their lives, column (4), are less likely to participate (contrary to hypothesis 4). Control variables have the expected signs, are significant at the 1% level, and are stable across the four specifications.

In column (5) I use a single regression that includes both *talking to neighbours* and *active in social groups*. The effects remain insignificant for *talking to neighbours* but significant for *active in social groups*. When I combine all the social engagement measures in one regression, column (6), the variables *active in social groups*, *trusts most people*, and *religion makes a difference* have independent positive effects on stock market participation, but religion has a negative effect and *talking to neighbours* remains insignificant. This result suggests that the marginal utility of information provided by *strong ties* remains insignificant in the presence of other social engagement variables.

[12] When we run this regression and exclude the variables *good neighbourhood, concentrated housing, housing tenure, received windfall income*, *computer use*, *has no debt*, *financial capability* and *cohort*, the variable *talking to neighbours* becomes significant at the 5% level.

Table 2.4 Social engagement and stock market participation

The table presents marginal effects from pooled probit regressions estimates. The dependent variable in all the regressions is the stock market participation dummy variable. The explanatory variables are as defined in Table 2.1. Talking to neighbours equals one if respondent talks to neighbours every day, once in a week, or once in a month and the value zero if rarely or never. Active in social groups equals one for respondents who are active and zero otherwise. Trusts most people equals one if the response is 'most people can be trusted' and zero otherwise. Religion makes a difference equals one if response is 'some' or 'a great difference' and zero otherwise. Number of social groups is a categorical variable equal to 1 if respondent does not belong to any social group (base level); equals to 2, if respondent belongs to one number social groups; equals 3, if respondents belongs to two number social groups; and equals to 4, if respondent belongs to three number social groups or more. The control variables are good neighbourhood dummy; concentrated housing dummy; housing tenure indicators; received windfall income dummy; has no debt dummy; financial capability index; good health dummy; male dummy; age; age squared; cohort; married dummy; has children dummy; education qualification indicators; economic activity indicators; Government office region indicators; and income quintile indicators. Panel A presents marginal effects at means. Panel B presents marginal effects at base characteristics. Base characteristics represent an individual who: does not talk to neighbours; is not active in social groups; can't be too careful – does not trust others; believes that religion makes little or no difference in life; has no political identification; rents current accommodation; has not received windfall income; has debt; has a financial capability index value equal to the mean; is not a computer user; has bad health; is a female; is not married; does not have children; has no educational qualification; is unemployed; lives in the North East of England; and is categorised in the 1st income quintile. Panel C presents marginal effects using varied characteristics. Unlike base characteristics, varied characteristics take the maximum values of each variable, apart from region, which becomes East of England. Panel D shows the increasing/(decreasing) joint marginal effect on stock market participation as each social engagement measure is included in the calculation, keeping the remaining measures at their base levels. The reference person for our calculation of joint marginal effects exhibits the varied characteristics previously described for Panel C above and, in addition, cumulatively adds the four social engagement measures, beginning with talking to neighbours. For example, in specification (5) row (1), we first evaluate the effect of talking to neighbours and then evaluate the marginal effects of both talking to neighbours and active in social groups in row (2), holding the other social engagement measures at their base levels and using the reference person characteristics. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5% and *** for 1%.

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Marginal effects at means							
Talking to neighbours	-0.0001				-0.0031	-0.0056	0.0082
	(0.0104)				(0.0107)	(0.0112)	(0.0132)
Active in social groups		0.0403***			0.0405***	0.0377***	
		(0.0051)			(0.0051)	(0.0053)	
Trusts most people			0.0313***			0.0280***	0.0284***
			(0.0055)			(0.0057)	(0.0064)
Religion makes a difference				-0.0193***		-0.0132**	-0.0126*
				(0.0057)		(0.0057)	(0.0064)
No of social groups (Base=None)							
One							0.0291***
							(0.0068)
Two							0.0546***
							(0.0097)
Three							0.0889***
							(0.0134)

Table 2.4 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Good neighbourhood	0.0239***	0.0203**	0.0203**	0.0239***	0.0203**	0.0186**	0.0179*
	(0.0084)	(0.0085)	(0.0085)	(0.0089)	(0.0086)	(0.0090)	(0.0108)
Concentrated housing	-0.0032	-0.0051	-0.0033	-0.0017	-0.0053	-0.0031	-0.0066
	(0.0091)	(0.0092)	(0.0091)	(0.0096)	(0.0092)	(0.0096)	(0.0110)
Housing Tenure (Base=rented)							
Mortgaged	0.0878***	0.0885***	0.0879***	0.0948***	0.0888***	0.0947***	0.0751***
	(0.0070)	(0.0072)	(0.0070)	(0.0074)	(0.0071)	(0.0074)	(0.0083)
Outright owner	0.1615***	0.1625***	0.1606***	0.1686***	0.1627***	0.1670***	0.1437***
	(0.0083)	(0.0084)	(0.0083)	(0.0086)	(0.0084)	(0.0086)	(0.0096)
Received windfall income	0.0397***	0.0366***	0.0400***	0.0390***	0.0367***	0.0382***	0.0399***
	(0.0058)	(0.0058)	(0.0058)	(0.0061)	(0.0058)	(0.0061)	(0.0073)
Has no debt	0.0317***	0.0324***	0.0311***	0.0346***	0.0325***	0.0344***	0.0342***
	(0.0055)	(0.0056)	(0.0055)	(0.0058)	(0.0056)	(0.0058)	(0.0066)
Financial capability index	0.0958***	0.0961***	0.0952***	0.0988***	0.0963***	0.0977***	0.0855***
	(0.0085)	(0.0086)	(0.0085)	(0.0090)	(0.0086)	(0.0090)	(0.0101)
Computer user	0.0352***	0.0329***	0.0333***	0.0368***	0.0332***	0.0343***	0.0256***
	(0.0060)	(0.0061)	(0.0060)	(0.0063)	(0.0061)	(0.0064)	(0.0075)
Good health	0.0171***	0.0149**	0.0154***	0.0182***	0.0147**	0.0150**	0.0167**
	(0.0058)	(0.0059)	(0.0059)	(0.0061)	(0.0059)	(0.0061)	(0.0070)
Male	0.0166***	0.0168***	0.0169***	0.0215***	0.0169***	0.0221***	0.0270***
	(0.0061)	(0.0062)	(0.0061)	(0.0065)	(0.0062)	(0.0065)	(0.0070)
Age	0.0047***	0.0049***	0.0045***	0.0036***	0.0050***	0.0037***	0.0049***
	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.0013)	(0.0014)	(0.0015)
Age square	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
cohort	-0.0091***	-0.0088***	-0.0087***	-0.0095***	-0.0088***	-0.0090***	-0.0068***
	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Married	0.0161**	0.0155**	0.0150**	0.0133**	0.0155**	0.0118*	0.0049
	(0.0063)	(0.0064)	(0.0063)	(0.0067)	(0.0064)	(0.0067)	(0.0073)
Has child(ren)	-0.0216***	-0.0216***	-0.0214***	-0.0238***	-0.0212***	-0.0240***	-0.0176**
	(0.0066)	(0.0066)	(0.0066)	(0.0070)	(0.0066)	(0.0070)	(0.0078)
Education qualification (Base=None)							
Lower level	0.0486***	0.0492***	0.0482***	0.0522***	0.0489***	0.0500***	0.0479***
	(0.0100)	(0.0103)	(0.0101)	(0.0106)	(0.0103)	(0.0108)	(0.0120)
GCE level	0.1023***	0.0983***	0.1007***	0.1040***	0.0981***	0.0988***	0.0823***
	(0.0077)	(0.0079)	(0.0078)	(0.0082)	(0.0079)	(0.0083)	(0.0090)
Other higher	0.1179***	0.1108***	0.1147***	0.1172***	0.1107***	0.1085***	0.0870***
	(0.0081)	(0.0083)	(0.0082)	(0.0085)	(0.0083)	(0.0086)	(0.0093)
First degree and above	0.1737***	0.1640***	0.1644***	0.1733***	0.1636***	0.1558***	0.1419***
	(0.0112)	(0.0114)	(0.0113)	(0.0117)	(0.0114)	(0.0118)	(0.0130)

Table 2.4 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Economic Activity (Base=Unemployed)							
Retired	0.0577***	0.0589***	0.0544***	0.0613***	0.0593***	0.0589***	0.0466***
	(0.0121)	(0.0122)	(0.0121)	(0.0126)	(0.0122)	(0.0126)	(0.0139)
Self employed	0.0075	0.0087	0.0056	0.0071	0.0090	0.0071	0.0147
	(0.0118)	(0.0119)	(0.0118)	(0.0123)	(0.0119)	(0.0124)	(0.0138)
Employed	-0.0019	-0.0010	-0.0037	-0.0022	-0.0005	-0.0023	0.0012
	(0.0086)	(0.0087)	(0.0086)	(0.0091)	(0.0087)	(0.0091)	(0.0104)
Region (Base=North East)							
North West	0.0499***	0.0513***	0.0498***	0.0507***	0.0511***	0.0489***	0.0524***
	(0.0175)	(0.0176)	(0.0175)	(0.0182)	(0.0177)	(0.0184)	(0.0199)
Yorkshire & Humber	0.0490***	0.0536***	0.0509***	0.0523***	0.0526***	0.0524***	0.0413**
	(0.0183)	(0.0185)	(0.0183)	(0.0191)	(0.0185)	(0.0192)	(0.0208)
East Midlands	0.0498***	0.0534***	0.0507***	0.0521***	0.0533***	0.0523***	0.0575***
	(0.0189)	(0.0190)	(0.0189)	(0.0197)	(0.0191)	(0.0199)	(0.0214)
West Midlands	0.0319*	0.0308*	0.0323*	0.0337*	0.0306*	0.0302	0.0442**
	(0.0180)	(0.0181)	(0.0181)	(0.0188)	(0.0181)	(0.0189)	(0.0207)
East of England	0.1146***	0.1170***	0.1146***	0.1159***	0.1170***	0.1156***	0.1186***
	(0.0188)	(0.0189)	(0.0189)	(0.0197)	(0.0190)	(0.0198)	(0.0218)
London	0.1007***	0.1028***	0.1024***	0.1070***	0.1021***	0.1051***	0.1106***
	(0.0191)	(0.0193)	(0.0192)	(0.0200)	(0.0193)	(0.0202)	(0.0219)
South East	0.0758***	0.0779***	0.0747***	0.0791***	0.0777***	0.0764***	0.0814***
	(0.0172)	(0.0173)	(0.0171)	(0.0180)	(0.0173)	(0.0181)	(0.0198)
South West	0.0480***	0.0510***	0.0479***	0.0524***	0.0505***	0.0491**	0.0596***
	(0.0184)	(0.0186)	(0.0184)	(0.0193)	(0.0186)	(0.0194)	(0.0212)
Wales	0.0369**	0.0389**	0.0365**	0.0390**	0.0386**	0.0361**	0.0316*
	(0.0163)	(0.0164)	(0.0163)	(0.0170)	(0.0164)	(0.0172)	(0.0191)
Scotland	0.0565***	0.0596***	0.0548***	0.0596***	0.0595***	0.0556***	0.0581***
	(0.0164)	(0.0165)	(0.0164)	(0.0171)	(0.0166)	(0.0173)	(0.0193)
Northern Ireland	-0.0401**	-0.0389**	-0.0397**	-0.0430**	-0.0391**	-0.0437**	-0.0094
	(0.0169)	(0.0170)	(0.0169)	(0.0176)	(0.0170)	(0.0177)	(0.0192)
Income quintile (Base=1st quintile)							
2nd .Income quintile	0.0142*	0.0164**	0.0144*	0.0148*	0.0168**	0.0166**	0.0203**
	(0.0077)	(0.0078)	(0.0077)	(0.0082)	(0.0078)	(0.0082)	(0.0094)
3rd Income quintile	0.0401***	0.0436***	0.0405***	0.0410***	0.0436***	0.0422***	0.0355***
	(0.0081)	(0.0082)	(0.0082)	(0.0086)	(0.0082)	(0.0086)	(0.0097)
4th Income quintile	0.0690***	0.0699***	0.0691***	0.0683***	0.0700***	0.0677***	0.0606***
	(0.0090)	(0.0091)	(0.0090)	(0.0095)	(0.0091)	(0.0095)	(0.0106)
5th Income quintile	0.1279***	0.1277***	0.1261***	0.1278***	0.1275***	0.1243***	0.1092***
	(0.0106)	(0.0107)	(0.0106)	(0.0111)	(0.0107)	(0.0110)	(0.0122)
Pseudo R^2	0.1557	0.1575	0.1573	0.1538	0.1577	0.1576	0.1604
Observations	25810	25246	25676	24114	25235	23916	14993

Table 2.4 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: Marginal effects at base characteristics							
Talking to neighbours	-0.0000				-0.0002	-0.0004	0.0008
	(0.0005)				(0.0007)	(0.0009)	(0.0013)
Active in social groups		0.0021***			0.0021***	0.0024***	
		(0.0006)			(0.0006)	(0.0007)	
Trusts most people			0.0018***			0.0019***	0.0025**
			(0.0006)			(0.0006)	(0.0010)
Religion makes a difference				-0.0009***		-0.0011**	-0.0014*
				(0.0004)		(0.0005)	(0.0008)
No of social groups (Base=None)							
One							0.0015**
							(0.0006)
Two							0.0030**
							(0.0012)
Three							0.0057***
							(0.0022)
Panel C: Marginal effects at varied characteristics							
Talking to neighbours	-0.0002				-0.0046	-0.0081	0.0127
	(0.0159)				(0.0159)	(0.0161)	(0.0209)
Active in social groups		0.0623***			0.0625***	0.0569***	
		(0.0081)			(0.0081)	(0.0082)	
Trusts most people			0.0476***			0.0417***	0.0438***
			(0.0084)			(0.0086)	(0.0103)
Religion makes a difference				-0.0290***		-0.0192**	-0.0187*
				(0.0086)		(0.0084)	(0.0098)
No of social groups (Base=None)							
One							0.0506***
							(0.0118)
Two							0.0896***
							(0.0153)
Three							0.1359***
							(0.0187)
Observations	25810	25246	25676	24114	25235	23916	14993

Table 2.4 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel D: Joint Marginal effects at varied characteristics							
Talking to neighbours					-0.0026	-0.0045	0.0069
					(0.0090)	(0.0089)	(0.0112)
+ Active in social groups					0.0327***	0.0266***	
					(0.0103)	(0.0102)	
+ Three or more social groups							0.0823***
							(0.0173)
+ Trusts most people						0.0507***	0.1103***
						(0.0114)	(0.0190)
+ Religion makes a difference						0.0391***	0.0976***
						(0.0124)	(0.0197)
Observations	25810	25246	25676	24114	25235	23916	14993

In column (7), I replace the binary social group dummy with a categorical variable representing the number of social groups with which an individual is involved. The idea is that involvement in many social groups exposes an individual to a variety of sources that enhance the chances of encountering financial market information. The results indicate that individuals who are involved in three or more social groups are more likely to participate in the stock market than those involved in only one group.

Given that MEMs do not represent actual individual characteristics, these interpretations may be incorrect (Ai and Norton, 2003; Bartus, 2005; Williams, 2012). Therefore, I also use MERs to interpret the results in Panels B, C, and D. Panel B shows MERs calculated using base characteristics for all variables, apart from the social engagement variable of interest, in each specification. Base characteristics represent an individual who: does not talk to neighbours; is not active in social groups; cannot be too careful – does not trust others; believes that religion makes little or no difference in life; has no political identification; rents current accommodation; has not received windfall income; has debt; has a financial capability index value equal to the mean; is not a computer user; has bad health; is a female; is not married; does not have children; has no educational qualification; is unemployed; lives in the North East of England; and is categorised in the 1st income quintile. For example, in specification (1) I examine the marginal effect of *talking to neighbours* holding both the other social engagement measures and the control variables at their base levels. The results in panel B are consistent with those of panel A in that the effects for *active in social groups*, *trusts most people,* and *religion makes a difference* are significant at the 1% level in specifications (2) to (4), respectively, and at varying levels of significance when estimated in the combinations shown by specifications (5) - (7). Conversely, unlike base characteristics, varied characteristics take the maximum values of each variable, apart from region, which becomes East of England. Therefore, in Panel C, I consider an individual with varied characteristics and I replicate the marginal effects calculated in Panel B and find consistent results. Comparing the MERs in Panels B and C, I clearly see that social engagement can distinguish stock market participants from non-participants and that the measures have independent effects on stock market participation, thus confirming the results of our analysis using MEMs.

In Panel D, I cumulatively add the effects of the social engagement measures in specification (5), (6) and (7). The marginal effects reported show the increasing/decreasing joint marginal effect on stock market participation as each social engagement measure is included in the calculation, keeping the remaining measures at their base levels. The reference person for our calculation of joint marginal effects exhibits the varied characteristics previously described for Panel C above and, in addition, cumulatively acquires the four social engagement measures, beginning with *talking to neighbours*. For example, in specification (5) row (1), I first evaluate the effect of *talking to neighbours* and then evaluate the marginal effects of both *talking to neighbours* and *active in social groups* in row (2), holding the other social engagement measures at their base levels and using the reference person characteristics. Consistent with the previous results, *talking to neighbours* has an insignificant effect in all the specifications. When I consider a reference person that talks to neighbours and is active in social groups, row (2), the marginal effects on stock market participation are 3.3% and 2.7% in specifications (5) and (6) respectively. In specification (6), if he or she also *trusts most people*, the effects increase to 5.1%, but reduce to 3.9% if he or she also believes that *religion makes a difference*. Similarly, in specification (7), I see that the incremental marginal effect of *talking to neighbours* and involvement in three or more social groups is 8.2%; and that the incremental marginal effect of *talking to neighbours*, involvement in three or more social groups and *trusting most people*, is 11.0%, but falls back to 9.8% if *religion makes a difference*. The results in Panel D suggest that intensity of social engagement generally increases the likelihood of stock market participation.

2.5.2 The role of political party identification

In this section, I extend the analysis to include political party identification and report both MEMs (Panel A) and MERs (Panels B, C, and D) in Table 2.5. In specification (1), I regress stock market participation against political party identification together with the standard controls and I include the other social engagement measures in specification (2) and the categorical variable *number of social groups* in specification (3).

Panel A of Table 2.5, column (1) presents the estimates for the association between stock market participation and political party identification in isolation. The results show that individuals who identify themselves with a mainstream political party are more likely to participate in the stock market as compared to those who do not have a political affiliation, consistent with hypothesis 5. However, some party affiliations have a greater effect. For example, the effect of identification with the Conservative Party is about one and half times larger than that of Liberal Democratic Party membership and six times that of Labour Party identification.

Table 2.5 Party identification, social engagement and stock market participation

The table presents marginal effects from pooled probit regressions estimates. Panel A presents marginal effects at means, Panel B marginal effects at base characteristics; Panel C marginal effects using varied characteristics; and Panel D joint marginal effects. The dependent variable in all the regressions is the stock market participation dummy variable. Explanatory variables are as defined in Table 2.1. Political identification is a categorical variable and is equal to 1 if respondent has no political affiliation (base level); equals 2 if affiliated with other smaller parties; equals 3 if affiliated with the Liberal Democratic Party; equals 4 if affiliated with the Labour Party; and equal 5 if affiliated with the Conservative Party. Talking to neighbours equals one if respondent talks to neighbours every day, once in a week, or once in a month and the value zero if rarely or never. Active in social groups equals one for respondents who are active and zero otherwise. Trusts most people equals one if the response is 'most people can be trusted' and zero otherwise. Religion makes a difference equals one if the response is 'some' or 'a great difference' and zero otherwise. Number of social groups is a categorical variable equal to 1 if the respondent does not belong to any social group (base level); equal to 2, if the respondent belongs to one social group; equal to 3 if the respondent belongs to two social groups; and equal to 4 if the respondent belongs to three social groups or more. The control variables are good neighbourhood dummy; concentrated housing dummy; housing tenure indicators; received windfall income dummy; has no debt dummy; financial capability index; good health dummy; male dummy; age; age squared; cohort; married dummy; has children dummy; education qualification indicators; economic activity indicators; Government office region indicators; and income quintile indicators. Standard errors are clustered at the individual level and are reported in parentheses. The base characteristics, varied characteristics and the reference person are defined in the legend of Table 2.4. The levels of significance are given by * for 10%, ** for 5% and *** for 1%.

Independent variable	**(1)**	**(2)**	**(3)**
Panel A: Marginal effects at means			
Talking to neighbours		-0.0079	0.0092
		(0.0117)	(0.0137)
Active in social groups		0.0367***	
		(0.0055)	
Trusts most people		0.0279***	0.0277***
		(0.0059)	(0.0067)
Religion makes a difference		-0.0103*	-0.0100
		(0.0060)	(0.0067)
No of social groups (Base=None)			
One			0.0295***
			(0.0071)
Two			0.0531***
			(0.0101)
Three or more			0.0892***
			(0.0137)
Party identification (Base=None)			
Other smaller parties	0.0184	0.0159	0.0168
	(0.0115)	(0.0125)	(0.0141)
Liberal Democratic	0.0588***	0.0491***	0.0431***
	(0.0110)	(0.0116)	(0.0133)
The Labour Party	0.0196**	0.0152	0.0105
	(0.0089)	(0.0095)	(0.0112)
Conservative Party	0.0888***	0.0834***	0.0803***
	(0.0100)	(0.0106)	(0.0124)
Good neighbourhood	0.0165*	0.0111	0.0085
	(0.0088)	(0.0096)	(0.0115)
Concentrated housing	0.0004	0.0008	-0.0069
	(0.0094)	(0.0100)	(0.0115)
Housing Tenure (Base=rented)			
Mortgaged	0.0811***	0.0884***	0.0704***
	(0.0074)	(0.0078)	(0.0088)
Outright owner	0.1501***	0.1564***	0.1355***
	(0.0086)	(0.0090)	(0.0101)
Received windfall income	0.0361***	0.0348***	0.0350***
	(0.0061)	(0.0063)	(0.0075)
Has no debt	0.0318***	0.0333***	0.0337***
	(0.0058)	(0.0061)	(0.0069)
Financial capability index	0.0906***	0.0924***	0.0775***
	(0.0088)	(0.0093)	(0.0104)
Computer user	0.0366***	0.0350***	0.0253***
	(0.0063)	(0.0066)	(0.0078)

Table 2.5 Continued

Independent variable	(1)	(2)	(3)
Good health	0.0164***	0.0144**	0.0157**
	(0.0061)	(0.0064)	(0.0073)
Male	0.0217***	0.0278***	0.0314***
	(0.0063)	(0.0067)	(0.0073)
Age	0.0050***	0.0043***	0.0055***
	(0.0013)	(0.0015)	(0.0016)
Age square	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
cohort	-0.0083***	-0.0084***	-0.0063***
	(0.0007)	(0.0007)	(0.0008)
Married	0.0143**	0.0109	0.0046
	(0.0065)	(0.0069)	(0.0076)
Has child(ren)	-0.0198***	-0.0220***	-0.0187**
	(0.0069)	(0.0073)	(0.0082)
Education qualification (Base=None)			
Lower level	0.0501***	0.0513***	0.0452***
	(0.0104)	(0.0112)	(0.0125)
GCE level	0.0978***	0.0933***	0.0742***
	(0.0081)	(0.0087)	(0.0094)
Other higher	0.1173***	0.1084***	0.0847***
	(0.0085)	(0.0091)	(0.0098)
First degree and above	0.1687***	0.1529***	0.1368***
	(0.0116)	(0.0123)	(0.0136)
Economic Activity (Base=Unemployed)			
Retired	0.0556***	0.0581***	0.0458***
	(0.0125)	(0.0129)	(0.0144)
Self employed	0.0004	0.0017	0.0077
	(0.0122)	(0.0128)	(0.0142)
Employed	-0.0044	-0.0038	-0.0003
	(0.0090)	(0.0095)	(0.0108)
Region (Base=North East)			
North West	0.0443**	0.0420**	0.0529**
	(0.0184)	(0.0194)	(0.0207)
Yorkshire & Humber	0.0530***	0.0544***	0.0480**
	(0.0194)	(0.0203)	(0.0218)
East Midlands	0.0382*	0.0400*	0.0523**
	(0.0195)	(0.0205)	(0.0221)
West Midlands	0.0241	0.0217	0.0387*
	(0.0188)	(0.0198)	(0.0215)
East of England	0.0998***	0.1001***	0.1071***
	(0.0196)	(0.0207)	(0.0224)
London	0.0879***	0.0905***	0.1022***
	(0.0198)	(0.0209)	(0.0225)
South East	0.0629***	0.0639***	0.0737***
	(0.0180)	(0.0191)	(0.0205)
South West	0.0335*	0.0335*	0.0492**
	(0.0191)	(0.0202)	(0.0218)
Wales	0.0427**	0.0409**	0.0364*
	(0.0172)	(0.0182)	(0.0200)
Scotland	0.0643***	0.0621***	0.0687***
	(0.0174)	(0.0184)	(0.0204)
Northern Ireland	-0.0208	-0.0262	0.0091
	(0.0192)	(0.0203)	(0.0223)
Income quintile (Base=1st quintile)			
2nd .Income quintile	0.0133	0.0157*	0.0197**
	(0.0082)	(0.0087)	(0.0098)
3rd Income quintile	0.0384***	0.0405***	0.0375***
	(0.0085)	(0.0091)	(0.0102)
4th Income quintile	0.0628***	0.0614***	0.0588***
	(0.0093)	(0.0098)	(0.0110)
5th Income quintile	0.1215***	0.1181***	0.1065***
	(0.0111)	(0.0115)	(0.0127)
Pseudo R^2	0.1614	0.1637	0.1683
Observations	23350	21655	13708

Table 2.5 Continued

Independent variables	(1)	(2)	(3)
Panel B: Marginal effects at base characteristics			
Talking to neighbours		-0.0005	0.0003
		(0.0008)	(0.0005)
Active in social groups		0.0020***	
		(0.0007)	
Trusts most people		0.0016***	0.0008**
		(0.0006)	(0.0004)
Religion makes a difference		-0.0007	-0.0004
		(0.0005)	(0.0003)
No of social groups (Base=None)			
One			0.0013**
			(0.0006)
Two			0.0025**
			(0.0011)
Three or more			0.0049**
			(0.0021)
Party identification (Base=None)			
Other smaller parties	0.0009	0.0012	0.0007
	(0.0006)	(0.0011)	(0.0007)
Liberal Democratic	0.0034***	0.0044***	0.0020**
	(0.0011)	(0.0016)	(0.0010)
The Labour Party	0.0009*	0.0012	0.0004
	(0.0005)	(0.0008)	(0.0005)
Conservative Party	0.0057***	0.0084***	0.0045***
	(0.0016)	(0.0024)	(0.0017)
Panel C: Marginal effects at varied characteristics			
Talking to neighbours		-0.0108	0.0133
		(0.0156)	(0.0203)
Active in social groups		0.0528***	
		(0.0083)	
Trusts most people		0.0394***	0.0402***
		(0.0086)	(0.0102)
Religion makes a difference		-0.0141*	-0.0139
		(0.0082)	(0.0095)
No of social groups (Base=None)			
One			0.0496***
			(0.0120)
Two			0.0843***
			(0.0155)
Three or more			0.1302***
			(0.0187)
Party identification (Base=None)			
Other smaller parties	0.0326	0.0268	0.0301
	(0.0203)	(0.0209)	(0.0250)
Liberal Democratic	0.0958***	0.0771***	0.0716***
	(0.0184)	(0.0187)	(0.0231)
The Labour Party	0.0346**	0.0257	0.0192
	(0.0161)	(0.0164)	(0.0208)
Conservative Party	0.1364***	0.1222***	0.1213***
	(0.0169)	(0.0173)	(0.0219)
Observations	23350	21655	13708

Table 2.5 Continued

Independent variable	(1)	(2)	(3)
Panel D: Joint marginal effects at varied characteristics			
Talking to neighbours		-0.0078	0.0097
		(0.0114)	(0.0146)
+ Active in social groups		0.0289**	
		(0.0128)	
+ Three or more social groups			0.1003***
			(0.0198)
+ Trusts most people		0.0570***	0.1309***
		(0.0138)	(0.0207)
+ Identification with the Conservative Party		0.1406***	0.2173***
		(0.0171)	(0.0237)
+ Religion makes a difference		0.1299***	0.2063***
		(0.0187)	(0.0256)
Observations		21655	13708

In column (2), I combine other social engagement measures and party identification in a single equation. The results show that social group involvement, trust, religion, and identification with the Liberal Democratic Party and the Conservative Party have independent effects on stock market participation. The variables *talking to neighbours* and identification with the Labour Party are insignificant. Comparing these results with those in Table 2.4, column (6), the effects are comparable for the variables *active in social groups* and *religion makes a difference*, suggesting a minimal correlation with party identification. When I use the *number of social groups*, column (3), in place of the social group's dummy variable, the effects of *trusts most people*, identification with the Liberal Democratic Party and identification with the Conservative Party remain significant. The variable *religion makes a difference* now becomes insignificant. The results for the variable *number of social groups* remains virtually unchanged from the results reported in Table 2.4.

In Panels B and C of Table 2.5, I calculate MERs using base and varied characteristics, respectively. In Panel B, I see that the marginal effects are consistent and significant for party identification, social group involvement and trust (at levels varying between 1% and 5%). Further, as seen in the previous section, the magnitudes are small, in contrast to the results reported in Panel C where, across all specifications, the magnitudes are higher and significant at the 1% level for identification with the Liberal Democratic Party and the Conservative Party, involvement in social groups and trust.

Panel D presents the joint marginal effects of social engagement, which are evaluated using the reference person characteristics and by cumulatively adding the effects of social engagement variables. The results show that identification with the Conservative Party has an 8% effect on stock market participation when other social engagement variables are held at their base levels. When I consider that the reference person also *talks to neighbours*, is *active in social groups*, *trusts most people,* and believes that *religion makes a difference*, the joint effects are 13% for specification (2) and 20.6% for specification (3). In both specifications the variable *religion makes a difference* has a negligible impact. The results are consistent with those reported in Table 2.4, Panel D, and confirm that the variables *active in social groups*, *trusts most people*, and political party identification jointly increase the likelihood of stock market participation. Furthermore, considering that the mean rate of stock market participation is only 21%, the reported joint effects of social engagements are influential. Overall, the results suggest that socially engaged respondents are more likely to participate in the stock market with statistically and economically significant effects.

2.5.3 The conditional marginal effects of social interaction, trust, religion and political party identification

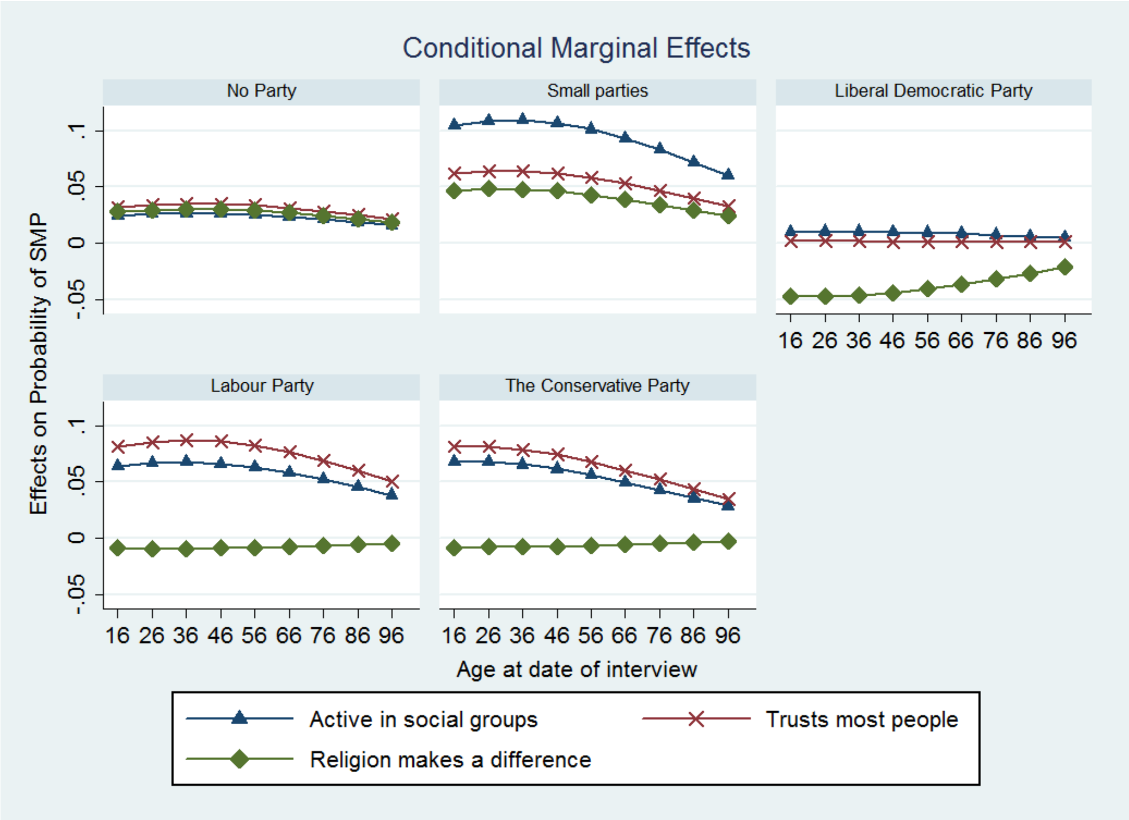
I now consider the conditional marginal effects of all of the social engagement measures. However, for limited dependent variable models in which marginal effects are calculated at means for an interaction term the sign, significance and magnitude may not reflect the true relationship between variables (Ai and Norton, 2003). In order to interpret the interaction term correctly, I calculate conditional marginal effects at representative values as suggested by Ai and Norton (2003). The marginal effects of the interaction term are then presented graphically, following Greene (2010).

Figure 2.2 shows the marginal effects by political party identity and across age when I interact the variables *trusts most people*, *active in social groups*, *religion makes a difference,* and political party identification. The effects and the levels of significance of these variables vary across party identification. For small parties, social group involvement is significant and positive; for the Labour party and the Conservative party, both social group involvement and trust are significant and positive; and for the Liberal Democratic Party, none of the variables is significant.

It is interesting to note that the effects of all the variables are insignificant among respondents who have no party identity, which suggests that these individuals are also disengaged from other social mechanisms and are thus less likely to invest in the stock market. This is consistent with the information-gathering costs hypothesis of Bonaparte and Kumar (2013). For those who identify with the Labour party, its left-of-centre political ideology, which might in theory restrain stock market investment, is compensated for by trust and involvement in social groups.

Figure 2.2 Conditional marginal effects with social engagement interaction terms

The figure displays the conditional marginal effects derived from a pooled probit regression using the specifications in Table 2.5, Column 2 and interaction terms for the variables active in social groups, trusts most people, and religion makes a difference. The marginal effects are calculated using varied characteristics as defined in the legend to Table 2.4. Other variables are evaluated at their average values: age square, cohort and financial capability. The plotted marginal effects for the variable active in social group are significant at the 5% level for identification with the Labour Party and at the 10% level for identification with both the Conservative Party and Small Parties, among individuals aged below the age of 86. For the variable trusts most people, the plotted marginal effects are significant at the 1% level for identification with the Labour Party and at the 5% level for identification with the Conservative party, among respondents aged 76 and below, and at 5% and 10% respectively among respondents above age 76. Religion is not significant.

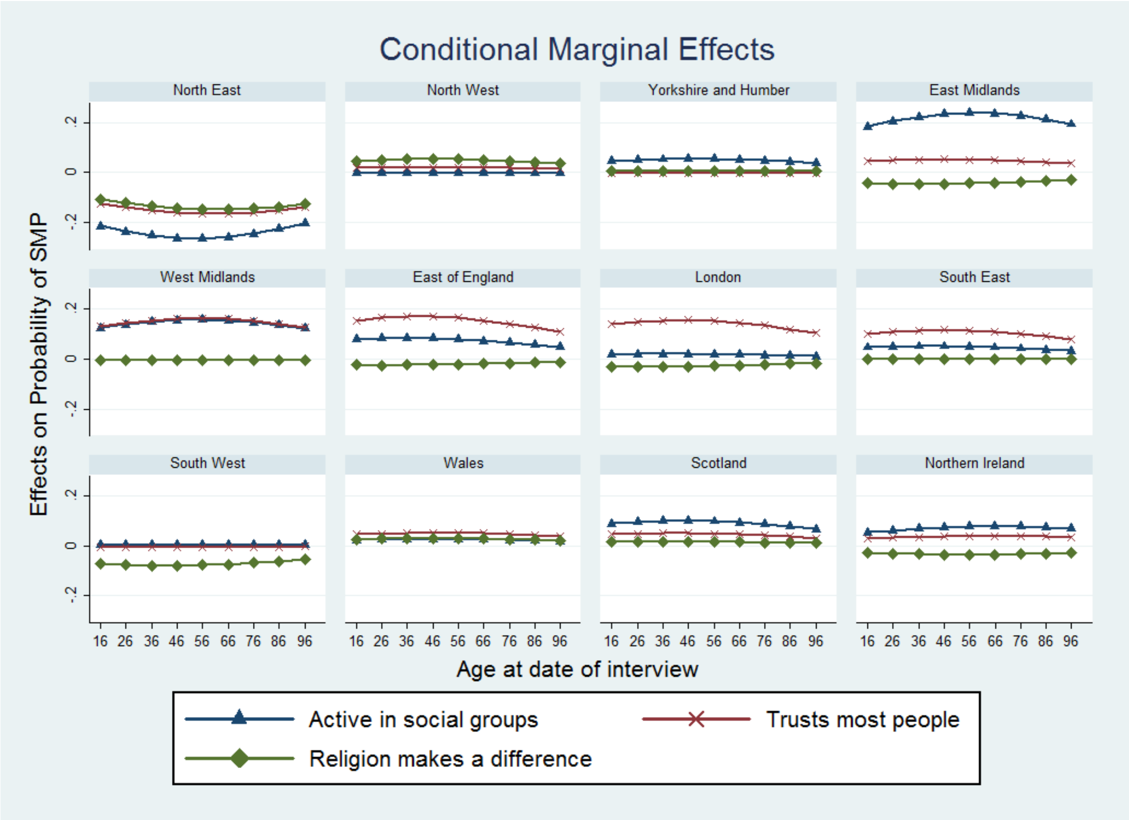


These same variables increase stock market participation for those who identify with the Conservative party. Religion has no impact on stock market participation for those who identify with both the Labour party and the right-of-centre Conservative party.

Figure 2.3 presents marginal effects by region, when region dummies are interacted with the variables *trusts most people*, *active in social groups*, and *religion makes a difference*. For the North East, these variables are all negatively associated with stock market participation. In particular, *active in social groups* is significant suggesting that social interaction increases stock market participation costs.

Figure 2.3 Conditional marginal effects by geographic region

The figure displays the conditional marginal effects, by geographic region, derived from a pooled probit regression using the specifications in Table 2.5, Column (2) and interaction terms for the variables geographic region, active in social groups, trusts most people, and religion makes a difference. The marginal effects are calculated using varied characteristics as defined in the legend to Table 2.4. Other variables are evaluated at their average values: age square, cohort and financial capability. Across all age groups, the plotted marginal effect for the variable active in social group is negative and significant at the 5% level for the North East; it is positive and significant at the 5% for the East Midlands and Scotland; and it is positive and significant at the 10% level for the West Midlands. For the variable trusts most people, the plotted marginal effects are positive and significant at the 5% level for the West Midlands, East of England, and South East whereas it is positive and significant at the 10% level for London. Across all regions, religion is not significant.



This is hardly unexpected given that the North East England is historically associated with the trade union movement and more left-wing political ideology, given the greater concentration of heavy industry in this part of the country. In contrast, social group involvement is positive and significant for the regions East Midlands, West Midlands and Scotland. Among regions that are considered to be affluent – including the West Midlands, the East of England, London and South East – the variable *trusts most people* is positive and significant. These findings underscore the presence of regional differences in the impact of social engagement variables.

2.5.4 The effect of a shift in political party identification

In this section, I investigate transitions in political party identification and their impact on stock market participation. Intuitively, if political parties' ideological and policy positions converge, individuals become indifferent in their party choices on these grounds and instead shift political affiliation in line with perceived party competence, principally in economic management. Thus, transitions from one party to the other may be correlated with stock market participation. Our findings partially support this hypothesis.

As discussed in section 2.2, if "consumer voters" are driven by the desire to protect their investments, I would expect them to penalize their own parties by voting for another party that they believe is more competent in economic management. Thus, I should expect to see a positive relationship between change in political party identification and stock market participation if economic management is a signal of pro-market policies. Alternatively, where "consumer voters" change party preferences in reaction to policy positions taken by a political party, not necessarily because of their views about competence in economic management, then I should expect a negative association. To explore this, I examine shifts in political party identification. From the data, the transitional probabilities for political party identification reveal substantial transitions between political parties during the three waves. In order to capture these shifts, I generate a dummy variable (*political party shift*) that takes the value 1 for those who change parties during the three waves and 0 otherwise. I find that 35% of the respondents changed their preferred political party during the three waves.

I first replace political party identification with the indicator of *political party shift* in the complete model. The results in Table 2.6, column (1) show that the variable has an insignificant effect on stock market participation. In column (2), I run a regression that includes the two variables to examine their independent effects on stock market participation. The negative *political party shift* coefficient becomes significant, but only at the 10% level, while the effects of political party identification retain the same levels of significance as seen before.

In column (3), I interact the two variables using the specifications in our complete model. The effect of *political party shift* is still significant at the 10% level. The interaction terms are positive and significant for the Conservative Party and the Liberal Democratic Party and insignificant for Small Parties and the Labour Party. When presented graphically, in line with Greene (2010), the true marginal effects of the interaction between political party shift and political identity have different signs to the MEMs reported in Table 2.6. The marginal effects of *political party shift* differ across both political party identification and age. Figure 2.4 presents MERs using base characteristics whereas Figure 2.5 is derived using varied characteristics. *Political party shift* has a negative and significant effect on stock market participation among those who identify with the Conservative Party. In contrast, the marginal effect of *political party shift* is not significant for those who identify with the Liberal Democratic Party, the Labour Party and for respondents with no party affiliations. In summary, those who identify with the Conservative or the Liberal Democratic Party and have not shifted allegiance from another party (Table 2.4 and Table 2.5) are more likely to participate in the stock market than an individual identifying with another party or no party.

Table 2.6 Effects of shift in political party identification

The table presents marginal effects from pooled probit regressions estimates. The dependent variable in all the regressions is the stock market participation dummy variable. The explanatory variables are as defined in Table 2.1. Talking to neighbours equals 1 if the respondent talks to neighbours every day, once in a week, or once in a month and the value 0 if rarely or never. Active in social groups equals 1 for respondents who are active and 0 otherwise. Trusts most people equals 1 if the response is 'most people can be trusted' and 0 otherwise. Religion makes a difference equals 1 if response is 'some' or 'a great difference' and 0 otherwise. Political party shift equals 1 if respondent changed party affiliation during the panel period and 0 otherwise. Political identification after the shift is a categorical variable equal to 1 if the respondent has no political affiliation (base level); equals 2 if affiliated with other smaller parties; equals 3 if affiliated with the Liberal Democratic Party; equals 4 if affiliated with the Labour Party; and equals 5 if affiliated with the Conservative Party. The interaction term is between political shift and political party identification. The control variables are good neighbourhood dummy; concentrated housing dummy; housing tenure indicators; received windfall income dummy; has no debt dummy; financial capability index; good health dummy; male dummy; age; age squared; cohort; married dummy; has children dummy; education qualification indicators; economic activity indicators; Government office region indicators; and income quintile indicators. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5% and *** for 1%.

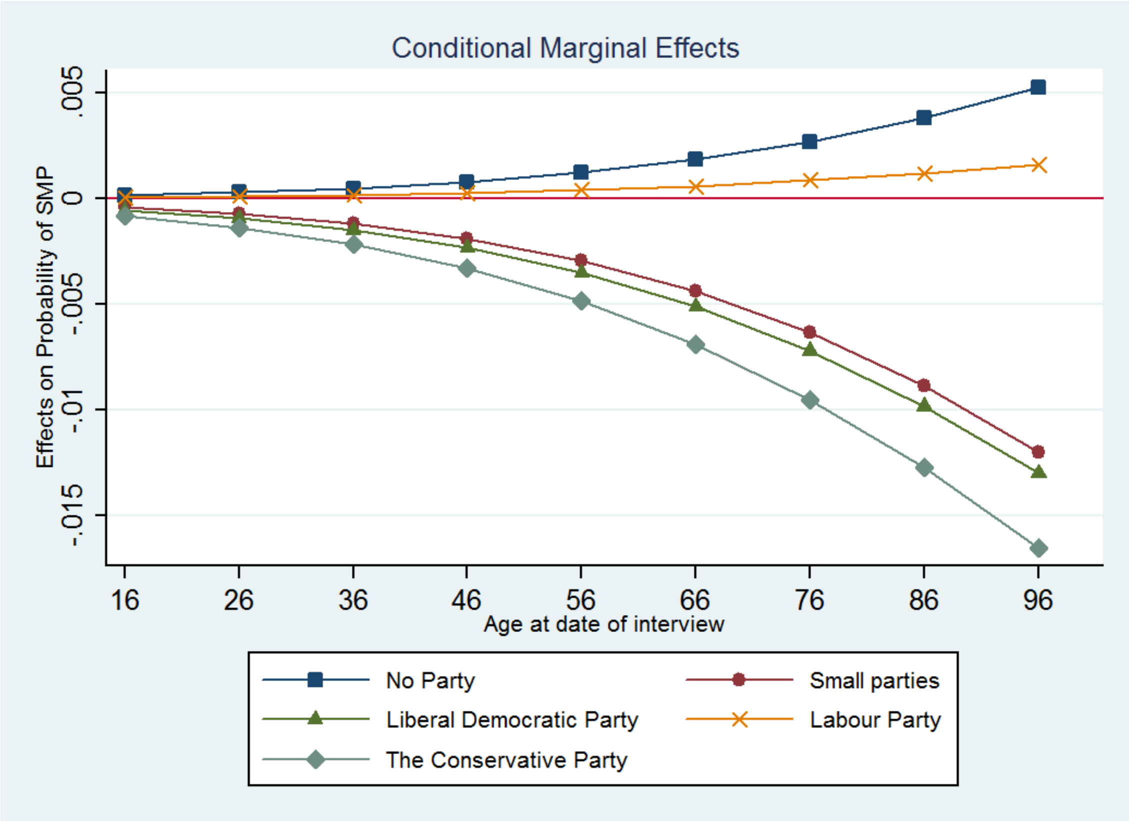
Independent variable	**(1)**	**(2)**	**(3)**
Talking to neighbours	-0.0056	-0.0081	-0.0079
	(0.0112)	(0.0117)	(0.0116)
Active in social groups	0.0377***	0.0367***	0.0363***
	(0.0053)	(0.0055)	(0.0055)
Trusts most people	0.0280***	0.0277***	0.0277***
	(0.0057)	(0.0059)	(0.0059)
Religion makes a difference	-0.0132**	-0.0102*	-0.0099*
	(0.0057)	(0.0060)	(0.0060)
Political party shift	-0.0005	-0.0116*	-0.0121*
	(0.0064)	(0.0067)	(0.0068)
Party identification (Base=None)			
Other smaller parties		0.0154	0.0206
		(0.0125)	(0.0131)
Liberal Democratic		0.0486***	0.0559***
		(0.0117)	(0.0131)
The Labour Party		0.0122	0.0180*
		(0.0097)	(0.0106)
Conservative Party		0.0802***	0.0847***
		(0.0107)	(0.0117)
Party identification * political party shift			
Other smaller parties			-0.0054
			(0.0173)
Liberal Democratic			0.0308**
			(0.0149)
The Labour Party			0.0122
			(0.0129)
Conservative Party			0.0569***
			(0.0141)
Good neighbourhood	0.0186**	0.0107	0.0107
	(0.0090)	(0.0096)	(0.0096)
Concentrated housing	-0.0031	0.0009	0.0009
	(0.0096)	(0.0100)	(0.0100)
Housing Tenure (Base=rented)			
Mortgaged	0.0947***	0.0881***	0.0882***
	(0.0074)	(0.0078)	(0.0078)
Outright owner	0.1670***	0.1560***	0.1557***
	(0.0086)	(0.0090)	(0.0090)
Received windfall income	0.0382***	0.0347***	0.0346***
	(0.0061)	(0.0063)	(0.0063)
Has no debt	0.0345***	0.0335***	0.0334***
	(0.0058)	(0.0061)	(0.0061)
Financial capability index	0.0977***	0.0922***	0.0923***
	(0.0090)	(0.0093)	(0.0093)
Computer user	0.0343***	0.0352***	0.0349***
	(0.0064)	(0.0066)	(0.0066)

Table 2.6 Continued

Independent variable	(1)	(2)	(3)
Good health	0.0150**	0.0144**	0.0145**
	(0.0061)	(0.0064)	(0.0064)
Male	0.0221***	0.0277***	0.0279***
	(0.0065)	(0.0067)	(0.0067)
Age	0.0037***	0.0043***	0.0043***
	(0.0014)	(0.0015)	(0.0015)
Age square	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
cohort	-0.0090***	-0.0084***	-0.0083***
	(0.0007)	(0.0007)	(0.0007)
Married	0.0118*	0.0110	0.0111
	(0.0067)	(0.0069)	(0.0069)
Has child(ren)	-0.0240***	-0.0217***	-0.0215***
	(0.0070)	(0.0073)	(0.0073)
Education qualification (Base=None)			
Lower level	0.0500***	0.0514***	0.0513***
	(0.0108)	(0.0112)	(0.0112)
GCE level	0.0988***	0.0933***	0.0931***
	(0.0083)	(0.0087)	(0.0087)
Other higher	0.1085***	0.1084***	0.1080***
	(0.0086)	(0.0091)	(0.0091)
First degree and above	0.1558***	0.1525***	0.1520***
	(0.0118)	(0.0123)	(0.0123)
Economic Activity (Base=Unemployed)			
Retired	0.0589***	0.0580***	0.0580***
	(0.0126)	(0.0129)	(0.0129)
Self employed	0.0071	0.0012	0.0006
	(0.0124)	(0.0128)	(0.0128)
Employed	-0.0023	-0.0040	-0.0041
	(0.0091)	(0.0095)	(0.0095)
Region (Base=North East)			
North West	0.0489***	0.0421**	0.0420**
	(0.0184)	(0.0194)	(0.0194)
Yorkshire & Humber	0.0524***	0.0542***	0.0545***
	(0.0192)	(0.0204)	(0.0203)
East Midlands	0.0523***	0.0401*	0.0399*
	(0.0199)	(0.0206)	(0.0206)
West Midlands	0.0302	0.0219	0.0218
	(0.0189)	(0.0199)	(0.0199)
East of England	0.1157***	0.1007***	0.0999***
	(0.0198)	(0.0207)	(0.0207)
London	0.1051***	0.0905***	0.0905***
	(0.0202)	(0.0209)	(0.0209)
South East	0.0764***	0.0641***	0.0637***
	(0.0181)	(0.0191)	(0.0191)
South West	0.0491**	0.0338*	0.0336*
	(0.0194)	(0.0203)	(0.0203)
Wales	0.0361**	0.0398**	0.0401**
	(0.0172)	(0.0182)	(0.0182)
Scotland	0.0555***	0.0612***	0.0610***
	(0.0173)	(0.0185)	(0.0185)
Northern Ireland	-0.0438**	-0.0309	-0.0329
	(0.0178)	(0.0204)	(0.0215)
Income quintile (Base=1st quintile)			
2nd .Income quintile	0.0166**	0.0159*	0.0159*
	(0.0082)	(0.0087)	(0.0087)
3rd Income quintile	0.0422***	0.0404***	0.0404***
	(0.0086)	(0.0091)	(0.0091)
4th Income quintile	0.0677***	0.0614***	0.0613***
	(0.0095)	(0.0098)	(0.0098)
5th Income quintile	0.1243***	0.1181***	0.1177***
	(0.0110)	(0.0115)	(0.0115)
Pseudo R^2	0.1576	0.1638	0.1642
Observations	23916	21655	21655

Figure 2.4 Conditional marginal effects of shift in political preferences – base characteristics

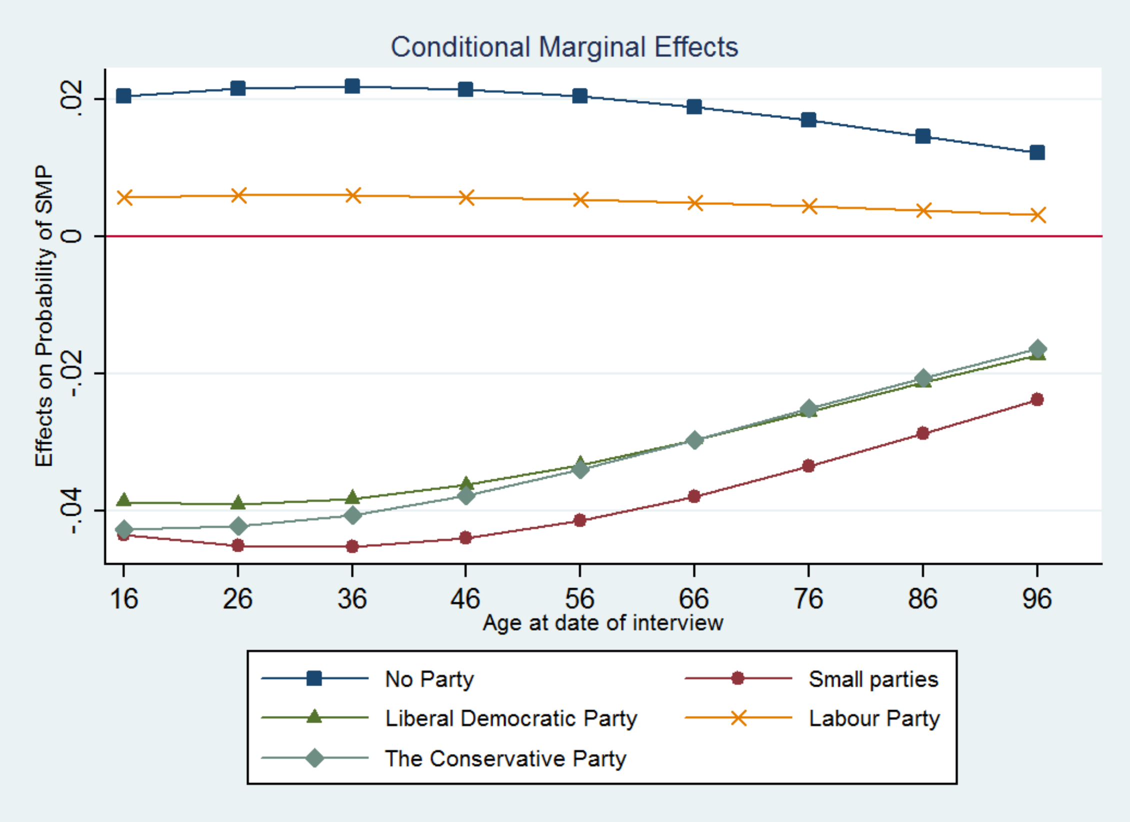
The figure displays the conditional marginal effects derived from a pooled probit regression using the specifications in Table 2.5, Column 4 and an interaction term between the variables political party shift and political party identification after the shift. The marginal effects are evaluated at base characteristics (see Table 2.4 legend) for each variable, apart from age square, cohort, and financial capability that take average values. The marginal effects are significant at the 10% level for identification with the Conservative Party among individuals aged between 46 and 86.



However, those who have recently shifted allegiance to the Conservative Party are less likely to participate in the stock market than those who have a longer-term allegiance to the Conservatives. As hypothesised in section 2.3, this suggests that both political party identification and consumer voting behaviour are associated with stock market participation.

Figure 2.5 Conditional marginal effects of shift in political preferences – varied representative values

The figure displays the conditional marginal effects of a shift in political identity. The marginal effects are evaluated using varied characteristics as defined in the legend to Table 2.4. Other variables are evaluated at their average values: age square, cohort and financial capability. For identification with the Conservative Party, the plotted marginal effects are significant at the 5% level among individuals aged 76 or below and at the 10% level for those aged above 76.



2.6 Robustness checks

I consider alternative specifications and definitions of stock market participation to examine whether my results are consistent. Table 2.7 presents marginal effects using the following four dependent variables: SMP1 with a lagged SMP1 as an additional independent variable (column (1)); the alternative stock market participation definition, SMP2 (column (2)); fixed income assets (column 3); and number of investment products (column (4)) using the specifications in Table 2.5, column (2)[13].

[13] In columns (1)–(3) we use pooled probit regressions but in column (4) we use a Poisson regression because (NIP) is not a binary variable.

2.6.1 Lagged value of stock market participation

In section 2.3 I note that transitions in (out) of the stock market are minimal, while most respondents tend to remain in the same state within the panel. This suggests that SMP1 in 2005 is likely to be influenced by participation in 2000 or 1995. To isolate the effects of state dependence I include a one period lag of the principal dependent variable as a control in Table 2.7, column (1). The lagged dependent variable enters with a value of 35% and is significant at the 1% level. Moreover, this specification appears to capture a lot of variation in the data as indicated by the pseudo R^2, which increases to 27% from the 16% value reported in Table 2.5 (Column (2)). Nevertheless, the social engagement variables–*active in social group*, *trusts most people,* and identification with the Liberal Democratic Party and the Conservative Party–remain significant at the 1% level. The variable *religion makes a difference* becomes insignificant.

2.6.2 Alternative asset categories

Saving money in personal equity plans, Individual Savings Accounts, and other forms of equity investments (SMP2) provides opportunities for both portfolio diversification and efficient tax management. Plausibly, individuals who are more informed about financial market operations and are aware of changes in government policy are more likely to take advantage of the opportunities such knowledge provides. Based on my propositions regarding social interaction, trust, and party identification, I should observe increased effects on the variables of interest when I use this broader definition of stock market participation as the dependent variable. The marginal effects presented in Table 2.7, column (2), show that the variables *active in social groups*, *trust most people*, and party identification increase by more than 50%.

Table 2.7 Marginal effects calculated using a lagged and alternative dependent variables

The table presents marginal effects from pooled probit regressions (column (1), (2), and (3)) and a pooled poisson regression in column (4). The dependent variables are stock market participation dummy (SMP1) (Column 1); dummy for the broadened definition of stock market participation (SMP2) (column 2); dummy for investment in fixed interest asset (FIA) (column 3); and number of investment products (NIP) (column 4). The samples consist of individuals in the British Household Panel Survey (BHPS) for the 1995, 2000 and 2005 waves. The explanatory variables are as defined in Table 2.1. Talking to neighbours equals 1 if the respondent talks to neighbours every day, once in a week, or once in a month and the value 0 if rarely or never. Active in social groups equals 1 for respondents who are active and 0 otherwise. Trusts most people equals 1 if the response is 'most people can be trusted' and 0 otherwise. Religion makes a difference equals 1 if response is 'some' or 'a great difference' and 0 otherwise. Political identification is a categorical variable equal to 1 if the respondent has no political affiliation (base level); equals 2 if affiliated with other smaller parties; equals 3 if affiliated with the Liberal Democratic Party; equals 4 if affiliated with the Labour Party; and equals 5 if affiliated with the Conservative Party. The control variables are good neighbourhood dummy; concentrated housing dummy; housing tenure indicators; received windfall income dummy; has no debt dummy; financial capability index; good health dummy; male dummy; age; age squared; cohort; married dummy; has children dummy; education qualification indicators; economic activity indicators; Government office region indicators; and income quintile indicators. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5% and *** for 1%.

Independent variable	**SMP1**	**SMP2**	**FIA**	**NIP**
	(1)	**(2)**	**(3)**	**(4)**
Stock market participation lagged	0.3489***			
	(0.0114)			
Talking to neighbours	0.0101	-0.0055	0.0001	-0.0043
	(0.0137)	(0.0131)	(0.0132)	(0.0266)
Active in social groups	0.0275***	0.0447***	0.0268***	0.0817***
	(0.0068)	(0.0062)	(0.0065)	(0.0122)
Trusts most people	0.0212***	0.0284***	0.0169**	0.0554***
	(0.0072)	(0.0066)	(0.0068)	(0.0134)
Religion makes a difference	-0.0048	-0.0160**	-0.0197***	-0.0328***
	(0.0068)	(0.0063)	(0.0065)	(0.0127)
Party identification (Base=None)	0.0000	0.0000	0.0000	0.0000
Other smaller parties	0.0095	0.0264*	0.0206	0.0338
	(0.0165)	(0.0138)	(0.0138)	(0.0298)
Liberal Democratic	0.0408***	0.0661***	0.0336**	0.1084***
	(0.0134)	(0.0131)	(0.0131)	(0.0268)
The Labour Party	0.0151	0.0235**	-0.0233**	0.0308
	(0.0115)	(0.0107)	(0.0108)	(0.0226)
Conservative Party	0.0634***	0.0995***	0.0581***	0.1733***
	(0.0122)	(0.0119)	(0.0119)	(0.0246)
Good neighbourhood	-0.0080	0.0306***	0.0334***	0.0366
	(0.0124)	(0.0104)	(0.0102)	(0.0231)
Concentrated housing	0.0103	-0.0066	0.0195*	0.0026
	(0.0120)	(0.0110)	(0.0103)	(0.0257)
Housing Tenure (Base=rented)				
Mortgaged	0.0761***	0.1172***	0.0620***	0.2144***
	(0.0104)	(0.0097)	(0.0099)	(0.0173)
Outright owner	0.1236***	0.2260***	0.1188***	0.3400***
	(0.0117)	(0.0106)	(0.0106)	(0.0204)
Received windfall income	0.0176**	0.0502***	0.0754***	0.0726***
	(0.0081)	(0.0072)	(0.0072)	(0.0129)
Has no debt	0.0154**	0.0517***	-0.0003	0.0744***
	(0.0076)	(0.0069)	(0.0070)	(0.0136)
Financial capability index	0.0760***	0.1386***	0.1264***	0.2538***
	(0.0118)	(0.0101)	(0.0075)	(0.0237)
Computer user	0.0209**	0.0363***	0.0262***	0.0624***
	(0.0084)	(0.0075)	(0.0076)	(0.0147)
Good health	0.0009	0.0321***	0.0224***	0.0237
	(0.0080)	(0.0071)	(0.0072)	(0.0147)
Male	0.0136*	-0.0107	-0.0476***	0.0528***
	(0.0076)	(0.0073)	(0.0072)	(0.0162)

Table 2.7 Continued

Independent variable	SMP1 (1)	SMP2 (2)	FIA (3)	NIP (4)
Age	-0.0158***	0.0277***	0.0260***	0.0182***
	(0.0022)	(0.0016)	(0.0016)	(0.0036)
Age square	-0.0001***	-0.0001***	-0.0000	-0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
cohort	-0.0242***	0.0115***	0.0225***	-0.0148***
	(0.0014)	(0.0008)	(0.0009)	(0.0013)
Married	-0.0113	0.0333***	0.0262***	0.0104
	(0.0082)	(0.0076)	(0.0077)	(0.0167)
Has child(ren)	0.0060	-0.0674***	-0.0197**	-0.0174
	(0.0090)	(0.0081)	(0.0081)	(0.0175)
Education qualification (Base=None)				
Lower level	0.0319**	0.0733***	0.0578***	0.1007***
	(0.0140)	(0.0129)	(0.0131)	(0.0276)
GCE level	0.0735***	0.1296***	0.0987***	0.1976***
	(0.0108)	(0.0102)	(0.0105)	(0.0203)
Other higher	0.0732***	0.1463***	0.1186***	0.2398***
	(0.0107)	(0.0105)	(0.0107)	(0.0211)
First degree and above	0.0923***	0.2262***	0.1674***	0.3193***
	(0.0135)	(0.0137)	(0.0134)	(0.0281)
Economic Activity (Base=Unemployed)				
Retired	0.0317*	0.0888***	0.0714***	0.1142***
	(0.0164)	(0.0136)	(0.0138)	(0.0312)
Self employed	0.0122	0.0421***	0.0201	-0.0175
	(0.0163)	(0.0145)	(0.0150)	(0.0296)
Employed	-0.0055	0.0203*	0.0326***	-0.0319
	(0.0124)	(0.0106)	(0.0105)	(0.0242)
Region (Base=North East)				
North West	0.0105	0.0501**	0.0292	0.1061**
	(0.0188)	(0.0217)	(0.0199)	(0.0517)
Yorkshire & Humber	0.0403**	0.0593***	0.0419**	0.1191**
	(0.0196)	(0.0222)	(0.0205)	(0.0548)
East Midlands	0.0194	0.0232	0.0280	0.1158**
	(0.0196)	(0.0227)	(0.0210)	(0.0543)
West Midlands	0.0090	0.0195	0.0339	0.0512
	(0.0192)	(0.0227)	(0.0209)	(0.0526)
East of England	0.0480**	0.0770***	0.0381*	0.2423***
	(0.0192)	(0.0230)	(0.0210)	(0.0538)
London	0.0667***	0.0545**	0.0556***	0.2341***
	(0.0206)	(0.0226)	(0.0207)	(0.0553)
South East	0.0394**	0.0624***	0.0526***	0.1465***
	(0.0183)	(0.0212)	(0.0194)	(0.0499)
South West	0.0297	0.0500**	0.0562***	0.1043*
	(0.0194)	(0.0224)	(0.0208)	(0.0537)
Wales	0.0142	0.0490**	0.0135	0.0141
	(0.0183)	(0.0203)	(0.0187)	(0.0470)
Scotland	0.0292	0.0537***	0.0392**	0.0600
	(0.0183)	(0.0204)	(0.0186)	(0.0480)
Northern Ireland		-0.0955***	-0.2029***	-0.1808***
		(0.0225)	(0.0223)	(0.0465)
Income quintile (Base=1st quintile)				
2nd .Income quintile	-0.0016	0.0284***	0.0190*	0.0261
	(0.0123)	(0.0102)	(0.0105)	(0.0186)
3rd Income quintile	0.0126	0.0597***	0.0427***	0.0928***
	(0.0122)	(0.0107)	(0.0109)	(0.0198)
4th Income quintile	0.0267**	0.0963***	0.0594***	0.1288***
	(0.0127)	(0.0115)	(0.0118)	(0.0212)
5th Income quintile	0.0700***	0.1562***	0.0855***	0.2335***
	(0.0140)	(0.0130)	(0.0129)	(0.0254)
Pseudo R^2	0.2665	0.2017	0.1358	0.1723
Observations	11111	21655	21655	21655

The variable *religion makes a difference* becomes significant at the 5% level. The effects of identification with smaller parties and the Labour Party are still lower than identification with the Liberal Democratic Party and the Conservative Party, but become significant at the 10% and 5% levels, respectively.[14]

Fixed Interest Assets (FIA) are both relatively safer and less information intensive than stocks, which make them attractive to less sophisticated investors as well as providing diversification opportunities to stock market participants. Characteristically, non-stock market participants in our model are less social, less trusting, and do not identify themselves with any political party and are therefore more likely to hold FIA. Thus, I should expect these factors to have a lesser, or negligible, effect on the decision to hold FIA. Table 2.7, column (3), presents marginal effects where the dependent variable is an indicator of ownership of *Fixed Interest Assets* (FIA) and the explanatory variables are as described in our final model. When compared to the results in column (2), the effect of trust declines in significance and the negative effect of religious beliefs increases in significance. For those who identify with other smaller parties the effect becomes insignificant, whereas for those who identify with the Liberal Democratic party the positive effect declines in significance from 1% to 5% and for the Labour Party the previously positive effect remains significant at the 1% level but the sign reverses. However, the effects of some of the control variables change substantially. The variable *has no debt* becomes insignificant whereas the variable *male* becomes negative and is significant at the 1% level. The effect of the variable received *windfall income* is more than double that reported in Table 2.5 and 50% more than that in Table 2.7, Column (2).

[14] A similar pattern is observed for most of the control variables though the effects of holding *other higher qualification*, a *first degree or above qualification*, and *financial capability* almost doubles.

Finally, I use the *Number of Investment Products* (NIP) owned by respondents as an alternative dependent variable. Here, the intuition is that individuals who are informed about financial market operations, investment products and government policy changes are more likely to hold a higher number of investment products. In Table 2.7, column (4), I report marginal effects from poisson estimates using the specifications in our final model. The findings confirm our previous results: individuals who are *active in social groups*, *trust most people*, and identify themselves with the Liberal Democratic Party and the Conservative Party are more likely to hold a higher number of investment products. Overall, our robustness tests confirm our conclusions derived from section 2.5.

2.7 Conclusion

Most previous studies report a positive association between stock market participation and social engagement measures when analysing each of these variables separately. Although some recent studies consider the presence of possible correlations between these factors, to the best of my knowledge none carry out a holistic analysis. The rich BHPS dataset enables me to address this gap. Using three waves in the BHPS I tackle four unresolved issues. First, recognising that social engagement can give rise to two distinct channels of social interaction, I disaggregate channels of social interaction using the categories *talking to neighbours* (strong ties) and *active in social groups* (weak ties). Second, I test the independent effects of all of my social engagement measures in the same model. Third, I use an integrated measure of political party identification to examine the role of political identity and shifts in political party preferences. I disaggregate the influence of social engagement, political ideology and shifts in political party preferences within the same model using interaction terms.

Finally, I calculate marginal effects at representative values for the independent and joint influences of social engagement.

I conclude that *weak ties* are more effective and productive channels of social interaction than *strong ties.* My measure of *strong ties,* frequency of *talking to neighbours*, seems only to capture the information in other social engagement and control variables. In addition, I show that, when modelled in isolation from other variables, individuals who have more *weak ties,* i.e. are involved in more social groups, are more trusting, and are members of either the Conservative or the Liberal Democratic parties are more likely to participate in the stock market. Contrary to prior literature, religiosity has a negative effect on stock market participation. When estimated together in one model, the effects of *strong ties* remain insignificant, whereas the effects of *weak ties,* trust, religion and alignment to the Conservative Party or the Liberal Democratic Party have independent effects on stock market participation.

When I interact my social engagement measures, for those who do not identify with a political party or who identify with the Liberal Democratic Party, social group involvement and trust have no impact on stock market participation. In contrast, these two variables influence stock market participation among those who identify with either the Labour Party or the Conservative Party, suggesting that their influence is independent of political ideology. Social group involvement influences stock market participation among those who identify with small parties. When I consider shift in political affiliation, I find that those who shift to the Conservative Party are less likely to participate in the stock market than those who consistently identify with the Conservatives. The net cumulative effect of my social engagement measures is that the probability of stock market participation increases by 21%.

An important consideration in interpreting these results is that the significant associations do not necessarily imply causality. The various social engagement measures analysed may be endogenous and thus my results may be driven more by correlated effects rather than by independent effects. Moreover, the short panel period and sample size limits the ability to examine endogeneity issues. Nevertheless, this study has potential policy implications. The findings suggest that policy makers and financial institutions wishing to enhance stock market participation should focus their attention on the provision of information to those who are least socially engaged. Of the low social engagement groups, particular emphasis should be placed upon those who have the fewest *weak ties* because they are likely to have the least access to productive information. Given our finding that individuals who are more trusting are more likely to participate in the stock market, policies that enhance trust in stock market investments and the investment process generally are likely to enhance participation. This will also lower the participation cost associated with the cognitive dissonance experienced by those whose political or religious leanings are inclined against stock market participation.

These results also have potential implications for the operations of financial markets and the wider economy. Although the finding that stock market participants (non-participants) remained in (out of) the market suggests that these participants have a minimal impact on stock market volatility, the stronger influence of social engagement on indirect stock market participation suggests that most individuals hold diversified portfolios which may impact market volatility. Heaton and Lucas (2000a) suggest that stock run-up, – i.e. periods when stock market prices are increasing, and thus expected returns are falling– may be partly explained by an increase in diversification arising from growth in indirect vehicles for stock market participation (such as mutual funds) which lower the risk premium demanded by investors. Furthermore, because individuals are more likely to be attracted to companies that they are familiar with, for example through employee share ownership schemes, or those whose directors are known to them through their social networks, as suggested by studies which examine the influence of home bias (Tesar and Werner, 1995), social engagement is likely to have a greater influence on ownership of small stocks and thereby have more influence on the performance of less liquid stock. In sum, social engagement could lead to an increase in wealth accumulation and thereby increase both household consumption and the development of financial markets.

Chapter 3 Mental accounting and portfolio choice

"People will always prefer black-and-white over shades of grey, and so there will always be the temptation to hold overly-simplified beliefs and to hold them with excessive confidence"

(Gilovich, 1991)

3.1 Introduction

A growing body of theoretical literature in behavioural finance documents the influence of mental accounting–the tendency of people to divide and manage their wealth in layers –on portfolio choice and its linkages with background risk and financial advice.[15] An important reason for the interest in this relationship is the finding that risk, as measured by both the probability of not meeting aspirations and risk attitudes, appear to vary by mental account categories and that asset allocation decisions are also segregated by mental accounts, which could lead investors to hold sub-optimal portfolios (Shefrin and Statman, 2000; Das *et al.*, 2010). Furthermore, recent theoretical models that examine the roles of delegated asset management (Alexander and Baptista, 2011) and background risk (Baptista, 2012), conditional on mental accounting, show that these factors can increase portfolio inefficiency. These new theoretical insights enrich existing knowledge concerning household behaviour and observed differences in portfolio choice. So far, the literature concerning mental accounting and portfolio choice mainly focuses on theoretical modelling and experimental evidence with little attention paid to the examination of real life circumstances. Whereas, an elaborate empirical literature addresses other determinants of portfolio choice, few studies examine mental accounting behaviour.[16]

[15] See, for example, Thaler (1980; 1985), Shefrin and Thaler (1988) Shefrin and Statman (2000), Alexandre and Baptista (2011), and Baptista (2012).

[16] The literature documents various additional factors that determine portfolio choice: financial literacy and cognitive ability (e.g. Christelis *et al.*, 2010; Van Rooij *et al.*, 2011; Klapper *et al.*, 2013); general health, physical health and mental health (e.g. Rosen and Wu, 2004; Fan and Zhao, 2009; Love and Smith, 2010; Atella *et al.*, 2012; Bogan and Fertig, 2013); background risks (e.g. Guiso and Jappelli, 2000; Cocco, 2005); and entrepreneurial risk (e.g. Bertaut and Starr-McCluer, 2000; Heaton and Lucas, 2000c).

Motivated by behavioural portfolio theory (BPT), which refers to the tendency of investors to design their portfolios based upon personal aims and goals, and its extensions, this Chapter focuses on the effect of mental accounting behaviour (measured using self-reported reasons for saving money) on portfolio choice. I contribute to the literature in several ways. First, I investigate whether differences in mental accounting behaviour can explain differences in portfolio choice. This is the first study to document this relationship using self-reported investment goals and the entire household portfolio. Previous studies use different mental frames and subsets of household portfolios (Benartzi and Thaler, 2007; Choi *et al.*, 2009). Specifically, I distinguish between households that have a single mental account and those that have multiple mental accounts–in line with Shefrin and Statman (2000)–and examine their portfolio choices across three asset classes (risky asset, fairly safe asset and safe asset). In addition, I introduce the case of households that do not readily identify a reason for saving and compare their portfolio choices with those who have a single mental account or multiple mental accounts. Second, unlike previous studies, I investigate whether risk tolerance, time preference and cognitive ability influence portfolio choice and whether these variables have an indirect influence through mental accounting. Third, I examine whether, conditional on mental accounting behaviour, differences in portfolio choice can be explained by background risk/assets and financial advice. Fourth, I examine the effect of specific mental accounts (such as saving for a holiday, a home purchase, home improvements, a bequest, and education) on the probability of owning, and the portfolio share in, the three asset classes.

A number of reasons have been advanced to explain why mental accounting might influence portfolio choice. First, mental accounting distorts risk attitudes so that an individual may be willing to take risk in one mental account and be risk-averse in another (Pan and Statman, 2012). Pan and Statman (2012) suggest that, for an investor who exhibits mental accounting behaviour, assessing her/his level of risk-tolerance using a single dimension could be misleading. Indeed, Zhou and Pham (2004) show that risk attitudes vary across financial products implying that investor goals may be determined a priori by financial products availability. Second, mental accounting may be associated with time preferences– choice between current consumption and future consumption (discount rates)–which are connected with portfolio choice. Becker and Mulligan (1997) and Uzawa (2006) link time preferences with financial planning and asset holdings, suggesting a connection with mental accounting. For example, by splitting income into different mental accounts (such as salary income, asset income, and future income) households can easily plan for consumption and investment (Shefrin and Thaler, 1988).

Third, mental accounting is linked with cognitive ability, which implies that people who have low cognitive ability are more likely to exhibit mental accounting behaviour (Thaler, 1999b). The basic idea is that those of lower IQ can carry less information and so are more likely to segregate decision-making into mental accounts. Thaler (1999a) argues that mental accounting enables households to organize, evaluate, and keep track of their financial activities. Therefore, mental accounting provides an easy and convenient way of managing wealth, simplifies financial decisions and instils self-control (Thaler, 2004). Fourth, mental accounting may be associated with financial advice and its influence may be determined by the nature of the service provided, information asymmetries, and the characteristics of the financial products available. Put differently, asset management delegated to financial advisors may result in investor-agent-advisor conflicts of interest (Georgarakos and Inderst, 2011; Inderst and Ottaviani, 2012) while different financial products may be assigned to different mental accounts (Zhou and Pham, 2004). Finally, mental accounting behaviour is connected to background risks that are associated with assets such as housing and self-owned enterprises (Baptista, 2012).[17]

To investigate these issues, I use two waves from a new, comprehensive UK dataset, the Wealth and Assets Survey (WAS). The survey consists of detailed information about household and individual characteristics. In particular, the data includes comprehensive information about financial wealth, pension wealth, physical wealth, property wealth and a proxy for mental accounting behaviour. I use detailed information about financial wealth to classify financial assets into three asset classes: risky, fairly safe and safe assets. I find that average ownership in the three asset classes are 16%, 53% and 88%, respectively, which are similar to the estimates reported in other surveys. This provides reassurance that the WAS provides a representative sample of the UK population.

Taken together, the results show that mental accounting behaviour explains variations in ownership of and portfolio share in risky assets, fairly safe assets and safe assets. I find that households that have a single mental account are less likely to own and have a low share of investments in, risky assets, when compared to those that have no mental account or have multiple mental accounts. In addition, having a single mental account or multiple mental accounts, when compared to having no mental account, increases both ownership of and investment share in fairly safe assets but decreases portfolio share in safe assets. Portfolio share in the three asset classes are statistically different among households that have no mental account, have a single mental account and those that have multiple mental accounts. Regarding financial advice, households that have

[17] Mental accounting is also associated with, and increases the net effects of, other behavioural biases such as the disposition effect and loss aversion (Barberis and Huang, 2001).

multiple sources of advice are more likely to own and have a high share of investment in risky assets, when compared to those who have a single source or those who do not seek financial advice. Households that have a single source or multiple sources of advice are more likely to own and have a high share of investments in fairly safe assets, and a low share in safe assets. Surprisingly, I find that housing tenure has no direct relationship with both ownership of and portfolio share in risky assets, as suggested in the literature. This result suggests that housing only influences portfolio choice through mental accounting. Nonetheless, homeownership through a mortgage increases portfolio share in fairly safe assets but decreases the share in safe assets, while outright homeowners are more likely to own and have a high share in fairly safe assets and a low share in safe assets. Further, risk tolerance increases the probability of owning and the portfolio share in risky assets while time preference has a weak influence on ownership of a fairly safe asset. However, cognitive ability influences ownership of and portfolio share in both risky assets and fairly safe assets and decreases the portfolio share in safe assets.

Most importantly, I find that the influence of mental accounting is magnified, reduced, eliminated or the direction of its influence (sign) is reversed when it is interacted together with the other variables. For example, I find that financial advice reduces the share of fairly safe assets among households that exhibit no mental account or multiple mental accounts but increases their share of safe assets. The effects are higher among households that exhibit multiple mental accounts regardless of whether they seek a single source or multiple sources of financial advice. Similarly, outright homeownership reduces the influence of mental accounting especially among households that exhibit multiple mental accounts. Among households that exhibit a single mental account, risk tolerance reduces the share of risky assets and the effects are higher than for individuals with multiple mental accounts.

Because the WAS data consists of only two panels and I observe low transitions in asset ownership, it is hard to control for unobserved individual effects and the problem of endogenous variables. Hence, the direction of the links between both asset ownership and the proportion of money invested, and mental accounting behaviour, background risk and financial advice are unclear. This notwithstanding, the findings in this study have important implications for investors, fund managers and policy makers. Investors should be aware of the potential impact of assigning different financial products to different investment goals as this could lead to them holding sub-optimal portfolios. Regarding financial advisors, they should be aware of the benefits and pitfalls of mental accounting so as to be able to design optimal portfolios for their clients. The finding that mental accounting has a substantial association with ownership and the proportion of money invested in fairly safe assets is of interest to governments in their efforts to encourage savings and the development of innovative financial products which will deepen financial markets.

The rest of the Chapter is organised as follows. In Section 3.2, I discuss the theoretical literature and review the empirical literature. Section 3.3 describes the data and the key variables, while the empirical strategy employed is discussed in Section 3.4. In Section 3.5, I present the findings for the main analysis and the robustness checks employed are presented in Section 3.6. I conclude in Section 3.7 with a brief discussion of the implications of the study.

3.2 Prior literature and hypotheses development

3.2.1 Mental accounting

In their development of BPT, Shefrin and Statman (2000) compare "mean-variance investors" with investors who have BPT single mental accounts (BPT-SA) and those who have BPT multiple mental accounts (BPT-MA). They argue that portfolios constructed by mean-variance investors, in line with the rules of portfolio theory, are similar to BPT-SA investors' portfolios. Further, they show that BPT-SA investors hold optimal portfolios that lie on Markowitz's (1952) mean variance efficient frontier while BPT-MA investors' portfolios do not lie on the efficient frontier. For BPT-MA investors, risk aversion varies by mental account and investors ignore covariance between accounts. In other words, mental accounting contradicts the basic assumption in standard portfolio theory that people have one aggregate portfolio and a single measure of risk – overall portfolio risk. Recognising the important features of mean-variance theory and BPT, Das et al. (2010) combine the features of the two theories and introduce 'mental accounting portfolio theory' in which investors weight their wealth across mental accounts using BPT and derive optimal portfolios using mean-variance theory. In this framework, they argue that both mental accounting sub-portfolios and the aggregate portfolio *can* lie on the Markowitz mean-variance efficient frontier.

However, recent extensions to BPT show that, under certain conditions, mental accounting sub-portfolios and aggregate portfolios lie below the mean-variance efficient frontier. Alexandre and Baptista (2011) show that, when individuals delegate asset allocation decisions to a financial adviser, mental accounting sub-portfolios are mean-variance efficient but aggregate portfolios are not. The authors argue that, although investors are able to construct mean-variance efficient sub-portfolios through mental accounting, financial advisers seek to beat their set benchmarks and thus an investor's aggregate portfolio will not be efficient. Similarly, Baptista (2012) points out that in addition to portfolio risk, as assumed in Das et al. (2010), investors also face background risks (from human capital and real estate). In their model, the presence of background risk shifts the aggregate portfolio away from the mean-variance efficient frontier. Most importantly, they argue that, portfolio compositions will vary depending on probability of achieving goals and background risks within each mental account. In a related study, Jiang *et al.* (2013) demonstrate the impact of exchange rate risk (another form of background risk) on international portfolio selection based on BPT. They show that both the optimal BPT portfolio for a local investor and the aggregate BPT portfolio for multiple markets are not mean-variance efficient.

Although the theoretical literature that underpins the relationship between mental accounting and portfolio choice is now well established, not much is known about its application in real life situations. As discussed below, a few studies use different mental accounting frames to examine their influence on sub-sets of household portfolios. These studies do not examine investment goals per se or the entire household portfolio. Below, I review this group of studies, other related mental accounting empirical literature and the well-established literature concerning the determinants of portfolio choice.

3.2.2 Mental accounting and portfolio choice

A number of studies directly link mental accounting with asset allocation and asset pricing decisions. Shefrin and Thaler (1988) who propose a Behavioral Life-Cycle (BLC) model suggest that, by splitting income into different mental accounts (such as salary income, asset income, and future income) households can plan consumption and investment. They argue that the probability of spending from salary income is higher compared to future income and that households' use mental accounting as a self-control mechanism. In support of this finding, Benartzi and Thaler (2007) show that participants in US retirement plans tend to separate funds into two mental accounts: funds already invested, "old money"; and future funds available for investment, "new money". They find that participants were more likely to vary asset allocation for new money rather than old money and they attribute this to regret avoidance and reference dependence.[18] In a related study, Choi *et al.*, (2009) find that most employees in a large US firm failed to re-balance their portfolios after a change in the firm's 401(k) matching rules, thus overweighting their investment in equities.[19,20] They associate this with mental accounting because individuals view the two regimes (before and after the change in matching rules) as separate mental accounts. Although these studies suggest a possible relationship between mental accounting and portfolio choice, they only examine specific assets and not the entire individuals' portfolios. Moreover, these studies do not consider investment goals, which I investigate in this Chapter.

Existing evidence also suggests that mental accounting is associated with asset pricing. Rockenbach (2004) examines the relationship between mental accounting and the pricing of financial options using a laboratory experiment. She finds that subjects do not take advantage of arbitrage opportunities because they are unable to link different mental accounting investments: namely, financial options and stock, financial options and bonds, and financial options alone. This inability to take advantage of arbitrage

[18] In addition, they find that employees consider company stock to be a special type of investment – a different mental account – as they tended to overweight equity investment in their aggregate portfolios, when compared to portfolio compositions of employees who do not have access to company stock.
[19] 401 (k) is a US retirement savings plan, which is funded by employee contributions which may be matched by employer contributions.
[20] Employees who enrolled before the regime change had 56% allocation to the firm's stock compared to 23% for those who enrolled after the change.

opportunities can be associated with mental accounting as a means of self-control, as discussed earlier. In a study of life insurance contracts with a lending option, Warshawsky (1987) finds that households do not take advantage of arbitrage opportunities that arise from discrepancies between policy loan rates and the treasury bills yield rate. In other fields, experimental and empirical studies, for example, demonstrate how mental accounting explains variations in consumer choices. Ranyard et al. (2006) show how individuals elicit different sets of information regarding credit in two mental accounting frames: total account or recurrent budget period account. They find that for total account, people seek information about duration and total cost while for the recurrent budget period account they seek information regarding the repayment amount and the flexibility of the credit terms. Milkman and Beshears (2009) demonstrate how a $10 online grocery discount coupon increases spending, in general, and on goods that are usually not purchased.

In line with BPT, I posit that investors simplify financial management tasks by splitting their investment decisions into goals (mental accounts) such as going on holiday, buying a house, buying a car, saving for education and bequest motives. I use a general question in the WAS concerning reasons for saving money to generate a categorical variable, mental accounting, with three dummies. Following Shefrin and Statman (2000), I assume that those who identify one reason have a single mental account ("BPT-SA investors") while those who identify more than one reason have multiple mental accounts ("BPT-MA investors"). Although, Shefrin and Statman (2000) do not consider the case of an individual who does not readily identify a reason for saving money, I posit that such individuals might behave differently from the other two categories. Thus the third category, no mental account, includes these individuals. As pointed out earlier, because mental accounting may be correlated with risk tolerance, time preferences and cognitive ability, I control for the effects of all of these variables. The hypotheses to be tested are:

Hypothesis 1a: Households that exhibit mental accounting behaviour will make different portfolio choices from similar households that do not exhibit mental accounting behaviour i.e. ownership and portfolio share in different asset classes will be statistically different across mental accounts.

Hypothesis 1b: Households that exhibit similar mental accounting behaviour and have different time preferences, risk tolerance or cognitive ability will make different portfolio choices i.e. conditional on mental accounting behaviour, ownership and portfolio share in different asset classes will be statistically different across time preferences, risk tolerance and cognitive ability.

3.2.3 Mental accounting and financial advice

BPT theory predicts that investors who delegate asset allocation hold inefficient aggregate portfolios (Alexander and Baptista, 2011). The question as to whether financial advisers act in the interest of investors or their own interests remains a subject of debate in the literature. Inderst and Ottaviani (2012) use various theoretical models to show how provider–adviser–consumer relationships could lead to biased recommendations owing to the nature of advisers' compensation and information asymmetries between the provider and consumer. Empirical studies have also found evidence that support this prediction. Bhattacharya *et al.* (2012) find that among investors who seek financial advice, without any inducement to do so, a majority do not follow the recommendations given and so their portfolios do not perform any better than portfolios for individuals who do not seek financial advice. The authors note that those who sought financial advice were typically, male, older, wealthier, more financially capable, and had longer connections with the adviser. Georgarakos and Inderst (2011) suggest that financial advice matters more among households that have low levels of financial capability and trust in advice. Hackethal *et al.* (2012) find a negative effect on net returns for investors who choose either an independent financial adviser or a bank advisor. This effect was more pronounced among investors who were guided by a bank advisor. Overall, previous studies report similar findings.[21] However, these studies do not examine the relationship between financial advice and mental accounting.

In this study, I assume that financial advice can be proxied by either the source from which an individual received financial advice or the institutions or individuals whom investors trust for financial advice regarding saving for retirement. This variable represents the variety of sources of financial information which might influence investment decisions. In line with the findings in Alexander and Baptista (2011), Bhattacharya *et al.* (2012), Zhou and Pham (2004), I use the WAS question regarding financial advice to generate the categorical variable, *financial advice*, with three dummies; no advice, single advice and multiple advisors. The hypotheses to be tested are:

Hypothesis 2a: Households that have a single source or multiple sources of financial advice will make different portfolio choices from those households that do not receive financial advice i.e. ownership and portfolio share in different asset classes will be statistically different across financial advice categories.

Hypothesis 2b: Households that exhibit similar mental accounting behaviour, and that

[21]For example, Bergstresser *et al.* (2009) compare broker-sold with direct -sold funds and find an insignificant difference in performance while Chen *et al.* (2013), compare the performance of outsourced funds with internally-run funds and find that the former underperform other funds.

either have a single source or have multiple sources of financial advice, will make different portfolio choices i.e. conditional on mental accounting behaviour, ownership and portfolio share in different asset classes will be statistically different across financial advice categories.

3.2.4 Mental accounting and background assets

A number of studies explore the role of background assets, which are considered to be important sources of background risks and have been associated with portfolio choice. These include housing, self-owned enterprises and human capital; I focus on housing, which could be owned outright or through a mortgage. Heaton and Lucas (2000b) find a positive relationship between mortgage refinancing and risky asset investment, as a proportion of both financial assets and total assets. They attribute this to the use of money raised from mortgage refinancing for investment in risky assets, which is, in turn, associated with higher human capital. This could explain why younger and poorer homeowners are less likely to invest in risky assets, as suggested by Cocco (2005). Similarly, Hu (2005) demonstrates the crowding effect of homeownership on stock market participation using a partial equilibrium model. Concurring with Cocco (2005), he argues that young and middle aged homeowners (including potential homeowners) tend to invest more in less risky assets such as bonds to mitigate income shocks and thus guarantee mortgage payments. Examining different risk profiles and risk-return expectations, Flavin and Yamashita (2002) use a mean-variance efficiency framework and find that, despite households having identical risk and return characteristics, their portfolios differ considerably due to housing constraints. I might therefore expect mental accounting to explain differences in the way people respond to housing as a source of background risk and its influence on asset allocation.

Using the WAS variable, housing tenure, I examine households that rent their current accommodation, own outright or own through a mortgage. The hypotheses to be tested are:

Hypothesis 3a: Households that are exposed to different background risks will make different portfolio choices i.e. ownership and portfolio share in different asset classes will be statistically different among renters, mortgage holders and outright home owners.

Hypothesis 3b: Households that exhibit similar mental accounting behaviour and are exposed to different background risks will make different portfolio choices i.e. conditional on mental accounting behaviour, ownership and portfolio share in different asset classes will be statistically different across housing tenure categories.

3.2.5 Other related literature on portfolio choice

A series of studies investigate the correlation between different forms of ill-health and asset allocation. Love and Smith (2010) use a comprehensive set of techniques to control for unobserved heterogeneity and find a weak relationship between health and portfolio choice for married households and an insignificant relationship for single households. Bogan and Fertig (2013) analyse the effects of various forms of mental health including depression, anxiety, phobias, and alcoholism, and show that they result in a reduction of risky asset investment. In a European cross country study, Atella *et al.* (2012) find that future health conditions has an independent influence on portfolio choice, over and above current health status, and they find marked differences between countries with and without a national health service. These findings are consistent with mental accounting because people who face health risk are more likely to segregate a health account from other investment goals. Moreover, as pointed out by Atella *et al.*

(2012), different aspects of health may represent separate sources of background risk. I control for health using a general question regarding health well-being and also examine specific health conditions.

An emerging strand of literature is devoted to investigating the impact of financial crises on attitudes and household financial decisions. It is estimated that during the global financial crisis that started in 2008 households' net financial wealth in the UK dropped by 12% (financial assets declined by 9% while debt rose by 5%) and that the market value of residential property fell by 9%.[22] The effects of these shocks, however, appear to vary across households depending on, for example, income distribution, the proportion of wealth tied up in housing, and demographic factors (Bricker *et al.*, 2012; 2012). Further, the relationship between households and financial advisers has also come into focus after the global financial crisis. Financial crises negatively impact on investors' trust in financial institutions (Gärling *et al.*, 2009) and have drawn attention to the need for more consumer protection initiatives (Weber *et al.*, 2013). However, financial advisers are also in a better position to help investors navigate through the impact of financial crises. Therefore, individuals respond differently to financial crises and this could affect mental accounting behaviour and portfolio choices. For example, people who are forced to retire earlier than they had anticipated may reconsider their growth or speculative goals and instead focus on retirement goals, thereby altering asset allocations. Second, financial shocks may alter risk attitudes. Weber *et al.* (2013) find that changes in risk tolerance are correlated with subjective risk and return expectations and suggest that the changes are driven by psychological judgements. Third, financial shocks may exacerbate background risks, which will influence risk attitudes. In this

[22] In the US, median households' net wealth shrunk by 26%, the value of directly held stock dropped by 35%, and that of primary residence declined by 1.5% while at the same time the ratio of total debt to assets rose by 3% (Bricker *et al.*, 2011).

study, I use time dummies to control for, and examine the impact of, the global economic crisis on household portfolios.

3.3 The data

3.3.1 Variables description

I use two waves of the WAS, which surveys private households[23] and individuals aged 16 and above, and excludes those in full-time education aged 16-18. The WAS is a representative survey using randomly selected quarterly and monthly samples[24] covering the period July 2006 to June 2008 for wave 1 (32,000 households and 55,000 individuals) and July 2008 to June 2010 for wave 2 (20,000 households and 37,000 individuals). The first part of the questionnaire is completed by the head of the household and consists of household level information including: number of occupants, relationships, details of property and mortgages, and household assets. Each adult in the household then completes the second part of the questionnaire, which collects comprehensive economic well-being information such as the level of savings and debt, financial and non-financial assets, and attitudes regarding financial planning. The dataset provides two unique opportunities for this study. First, it contains comprehensive information about ownership of and the values of different financial assets held by respondents as well as proxies for mental accounting, financial advice, background risk, cognitive ability, time preference and risk attitudes. Further, the two waves coincide with the period immediately surrounding the 2008 global financial crisis; wave 1 being pre-crisis period and wave 2 being post-crisis. This enables me to

[23] The sample does not include homeless people or those living in communal establishments like retirement homes, prisons, barracks, halls of residence and hotels.
[24] The sample was drawn from the Royal Mail's database of addresses, the Postcode Address File, leaving out Scotland north of the Caledonian Canal, the Scottish Islands and the Isles of Scilly. A stratified sample was first drawn for each year in wave 1 and randomly allocated to quarters and months (Economic and Social Data Service, 2010).

examine the influence of the crisis on portfolio choices. However, the data set does not contain information about social engagement measures, which have been found to influence portfolio choice.

I begin by describing how each variable is constructed, as summarized in Table 3.1. For the dependent variables, I use responses to several questions regarding the type of financial asset an investor has invested in and the estimated value of each. In this study, I use three asset categories: (1) *safe asset*, includes savings and current accounts, or national savings products; (2) *fairly safe asset,* includes fixed-term investment bonds, unit or investment trusts, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, Individual Savings Accounts (ISAs), or other financial assets; and (3) *risky asset,* includes shares or stocks in listed or unlisted companies, located overseas or in the UK (Atella *et al.*, 2012).[25,26]

These definitions allow for robustness checks, given that financial assets such as mutual funds, unit trusts, and individual savings accounts are increasingly considered to be relatively risky assets. For each asset class, I generate a binary variable for ownership which equals 1 if a household owns at least one type of asset and 0 otherwise, while for portfolio share I calculate the fraction of wealth invested in each asset class as a proportion of total financial assets.

[25] Atella *et al*. (2012) use three categories: bank, transactions or savings accounts (SAFE); stocks or shares (listed or unlisted) (RISKY); government or corporate bonds; individual retirement accounts; contractual savings for housing; and term or whole life insurance policies (FAIRLY SAFE).

[26] Guiso *et al.*, (2000) use the categories Clearly safe financial assets – transaction accounts and certificate of deposit; Fairly safe financial assets – treasury bills and cash value of life insurance; Risky financial assets – stocks, long-term government bonds, other bonds, mutual funds, managed investment accounts, and defined contribution pension plans; non-financial assets – primary residence, investment in real estate, business, stock of durable goods, and other non-financial assets; and total risky assets – risky real estate and risky financial assets. A similar asset description is used by Bertocchi *et al.* (2011)

Table 3.1: Variable descriptions

The table presents the variable descriptions used in the study. The sample is from the Great Britain Wealth and Assets Survey (WAS) covering the period June 2006 to July 2010.

Variable	Description	Value
Dependent Variables		
Safe asset	Various questions regarding holding and amount saved or invested in financial instrument	individual savings and current accounts, or national savings products = 1 ; and none = 0
Fairly safe asset	Various questions regarding holding and amount saved or invested in financial instrument	fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, Individual Savings Accounts (ISAs), or other financial assets =1 ; none = 0
Risky asset	Various questions regarding holding and amount saved or invested in financial instrument	shares or stocks in listed or unlisted companies (overseas or UK) = 1 ; none = 0
Key independent variables		
Mental accounts	What are the main reasons why you have saved this particular money? Respondents who identify a reason may choose one main reason and also list other reasons for saving money. I generate a categorical variable with three dummies.	no mental account = 1 and zero otherwise; one reason identified = 1 and zero otherwise; more than one reason =1 and zero otherwise
Mental account type	I generate dummies for each reason for saving money identified regardless of its ranking. For example, if reason for saving money is for family members the variable equals one if this is identified as either the main reason, the second reason and so on, and zero otherwise.	Dummies include unexpected expenditures; for family members (gifts or inheritance); to provide regular income; to provide income for retirement; to cover planned expense in the future; for deposit to buy property; for holidays or other leisure; as speculation; and to see my money grow.

Table 2.1 Continued

Variable	Description	Value
Financial advice	I use three questions (1) asks respondents whether they had received financial advice; (2) asks of respondents to identify who they have received advice from? This question was asked for interviews carried out between July 2006 and June 2007; and (3) which of these would you trust for advice about saving for retirement? is asked after July 2007. I combine these questions and generate a categorical variable with three dummies.	No financial advice = 1 and zero otherwise; single source of financial advice - 1 and zero otherwise; and multiple sources of financial advice =1 and zero otherwise.
Financial advice source	I generate five dummies that distinguish the various sources of financial advice identified by respondents. I generate five dummy variables: (1) trust close associates equals one if respondent identifies a partner, spouse, friends, family, or work colleagues and zero otherwise; (2) trusts print and social media; (3) trust professional agents equals one if bank or building society, insurance company, accountant, solicitor, insurance broker, mortgage adviser or stockbroker, and zero otherwise; (4) trusts independent financial advisors; and (5) trusts other independent advisor equals one if employer, trade union, the pension service, financial services authority (FSA), other consumer bodies e.g. citizens advice bureau (CAB).	
Independent financial advice (dummy variable)	In the last five years, have you received any professional advice about planning your personal finances	yes = 1; no = 0
Housing tenure	In which of these ways do you occupy this accommodation?	renting = 1 ; under a mortgage = 2 ; own outright =3
Control variables		
Time preference	If you had a choice of receiving a thousand pounds today or one thousand one hundred pounds in a year's time, which would you choose?	£1,000 today = 0; £1,100 next year = 1
Risk tolerance	If you had a choice between a guaranteed payment of one thousand pounds and a one in five chance of winning ten thousand pounds, which would you choose?	Guaranteed payment of £1K =0; One in five chance of £10K = 1
Cognitive ability	If you were to rate your mathematical skills for daily life, would you say they are	excellent or good = 1; moderate, poor, or no opinion = 0
Age	Derived variable: uses date of birth variables on survey database	age at date of interview

Table 2.1 Continued

Variable	Description	Value
Male	Interviewer check sex of the respondent	male = 1 ; female = 0
Couple	Marital status is represented by married, separated, divorced, widowed or never married from which I generate categorical and dummy variables	married or cohabiting = 1 ; single , widowed, divorced, or separated =0
Degree level or above	Derived variable - yearly updated qualification of new entrants and existing panel members	no qualification, commercial qualification, no o-levels, CSE grade 2-5 or Scotland grade 4-5, GCE A-levels, GCE o-levels or equivalent, teaching , other higher or nursing qualifications = 0; and first or higher degree = 1
Employed or self-employed	Please look at this card and tell me which best describes your current situation? Self-employed, in paid employ, unemployed, retired, family care, FT student, long term sick/disability, on maternity leave, government training or other	unemployed, maternity leave, family care, full time student, sick, disabled, government training scheme, or other, retired =0 ; self-employed or employed = 1
Has child(ren)	Number of own children derived from a set of questions	one, two, three or more kids = 1 ; none = 0
Lives in urban area	An indicator that shows whether the households lives in a rural area or urban area	urban = 1 ; rural = 0
Christian	I generate a categorical variable and dummy variables from the question asking of respondents about their religious identity to which the response could be Christian, Buddhist, Hindu, Jewish, Muslim, Sikh, any other religion, and no religion.	no religion or other religious identity = 0 ; Christian = 1
Has good health	How is your health in general would you say it was	fair, bad, or very bad = 0 ; very good or good = 1
White British	Ethnicity of household representative	African, Asian and others = 0 ; White British = 1
Government office region	Internally computed	north east = 1 ; north west = 2 ; Yorkshire and Humber = 3 ; east midlands = 4 ; west midlands = 5 ; east of England = 6 ; London = 7 ; south east = 8 ; south west = 9 ; wales = 10 ; Scotland = 11
Net financial wealth	Represents the net value of all financial assets excluding endowments	
Net household wealth	Represents the net household wealth including both financial and non-financial wealth	

Table 2.1 continued

Variable	Description	Value
long-standing ill-health	Do you have any long-standing illness, disability or infirmity	yes = 1; no = 0
physical health	I group physical health if response is mobility (moving about); lifting, carrying or moving objects; manual dexterity (using your hands to carry out everyday tasks); Continence (bladder and bowel control); and physical co-ordination (e.g. balance).	Physical health = 1 ; otherwise = 0
Mental health	I group mental health if health difficulties include communication (speech, hearing or eyesight); memory or ability to concentrate, learn or understand; recognising when you are in physical danger; other health problem or disability; and for spontaneous responses.	mental health = 1 ; otherwise = 0

The key independent variables are mental accounts, background risk, and financial advice. Mental accounts are constructed from the question – *people save money for different reasons. Looking at this card, what are the main reasons why you have saved money in the last two years*? – out of which respondents rank the reasons based upon a list that includes: “for unexpected expenditures”, “for family members (gifts or inheritance)”, “to provide regular income”, “to provide income for retirement”, “to cover planned expense in the future”, “for deposit to buy property”, “for holidays or other leisure”, “as speculation, or to see my money grow”. I generate a categorical variable, mental accounts, with three dummies: *no mental account* equals 1 if no reason is identified and 0 otherwise; *single mental account* equals 1 if one reason is identified and 0 otherwise; and *multiple mental accounts* equals 1 if more than one reason is identified and 0 otherwise. I also generate dummies for each reason for saving money regardless of its ranking. For example, if the reason for saving money is *for family members* the variable equals 1 if this is identified as either the main reason, the second reason and so on and 0 otherwise.

Financial advice variables are generated from three questions. First, I use the question – *in the last five years, have you received any professional advice about planning your personal finances*[27] – to generate a dummy variable that equals 1 if the response is yes and the value 0 otherwise. Second, a subsequent question – *who have you received advice from* – is asked if the response to the previous question is “yes” and respondents rank the different sources of financial advice.[28] The two questions were asked of

[27] In this question, respondents are reminded that advice could include planning for retirement, tax planning, or investing money and not advice relating to running a business or mortgages.

[28] These include independent financial adviser (IFA), partner/ spouse/ friends/ family/ work colleagues, bank or building society, insurance company, accountant, solicitor, insurance broker, mortgage adviser, stockbroker, employer, trade union, the pension service, financial services authority (FSA), other consumer bodies e.g. citizens advice bureau (CAB), internet, newspapers/ other media, other sources.

respondents interviewed between July 2006 and June 2007. From July 2007 and onwards, the question – *which of these would you trust for advice about saving for retirement* – is asked of respondents and they identify from a similar list (previous question) the advisor that they trust most. I combine the three questions to generate a categorical variable, *financial advice*, with three dummies: *no advice* equals 1 if respondent does not identify any source of advice and 0 otherwise; *single source*, equals 1 if respondent identifies a single source of financial advice and 0 otherwise; and *multiple sources*, equals 1 if respondent identifies more than one source and 0 otherwise.

Further, motivated by the finding in Bhattacharya *et al.* (2012) that, among bank financial advisors, financial advice had a higher negative effect on portfolio returns compared to independent financial advisors, I generate five dummies that distinguish the various sources of financial advice identified by respondents. For each category, I assign the source identified regardless of its ranking: (1) *trust close associates* equals 1 if respondents identify a partner, spouse, friends, family, or work colleagues and 0 otherwise; (2) *trusts print and social media* equals 1 if this source is selected and 0 otherwise; (3) *trust professional agents* equals 1 if bank or building society, insurance company, accountant, solicitor, insurance broker, mortgage adviser or stockbroker, and 0 otherwise; (4) *trusts independent financial advisors* equals 1 if this option is selected and 0 otherwise; and (5) *trusts other independent advisor* equals 1 if employer, trade union, the pension service, financial services authority (FSA), and other consumer bodies e.g. citizens advice bureau (CAB), and 0 otherwise.

For background risk, I focus on housing wealth because housing is considered as the most significant asset among households (Black *et al.*, 2006) and, as previously mentioned, most households experienced housing wealth shocks following the global financial crisis. I use the question – *in which of these ways do you occupy this accommodation?* – to generate a categorical with three dummy variables: *rents* if response is "rent it", "live here rent-free" or "squatting"; *under a mortgage* if response is "buying it with the help of a mortgage or loan" or "pay part rent and part mortgage" and own outright if response is "own outright".

Previous studies document a number of factors that determine asset allocation decisions among individuals and households, which I control for in my analysis. First, I include a proxy for *cognitive ability*, which represents respondents' self-assessed mathematical ability.[29] This is a crucial control in this study because, apart from the direct influence of cognitive ability on portfolio choice, I might expect cognitive ability to be correlated with mental accounting. Intuitively, people with low cognitive ability may tend to simplify financial management using mental accounting. From the question – "*if you were to rate your mathematical skills for daily life, would you say they are…"* – I generate a dummy variable that equals 1 if the response is "excellent" or "good" and equal to 0 if the response is "moderate", "poor", or "no opinion". Second, I take account of self-reported attitudes towards both risk and the time value of money as these might influence portfolio choice and could also vary by mental accounts. I generate two dummy variables from two questions: (1) from the question – *If you had a choice between a guaranteed payment of one thousand pounds and a one in five chance of winning ten thousand pounds, which would you choose?* – the variable *risk tolerance* equals 1 if respondent chooses the option "one in five chance of £10K" and 0 if response is "guaranteed payment of £1K"; and (2) from the question – *If you had a*

[29] Christelis *et al.* (2010) using self-reported ability to perform numerical operations, planning and executive functions, and memory, show that these variables determine portfolio choice across eleven European countries.

choice of receiving a thousand pounds today or one thousand one hundred pounds in a year's time, which would you choose? – I generate the variable *time preference* equals 1 if respondent chooses "£1,100 next year" and 0 if respondent selects "£1,000 today".

Third, the various dimensions of health which influence portfolio choice, as documented in the literature, include both physical health (e.g. Love and Smith, 2010) and mental health (e.g. Bogan and Fertig, 2013). Although the WAS dataset does not contain comprehensive information about health, I nevertheless use three general questions to generate proxies for health. The variable *general health* is generated from the question – *how is your health in general would you say it was* – and I generate a dummy variable that takes the value 1 if the response is very good or good and the value 0 if the response is fair, bad, or very bad. To capture possible long term health problems, I use the question – *do you have any long-standing illness, disability or infirmity* – to generate a dummy variable, *long-standing ill-health,* which equals to 1 for "yes" responses and 0 otherwise. Finally, to distinguish physical health and mental health, I generate two variables from a subsequent question – *does this health problem(s) or disability(ies) mean that you have substantial difficulties with any of these areas of your life.* The variable *physical health* equals 1 if the area of difficulty impairs mobility, dexterity or continence and 0 otherwise; *mental health* equals 1 if the area of difficulty includes memory, concentration and communication and 0 otherwise.[30]

[30] We group under the physical health category if the response is mobility (moving about); lifting, carrying or moving objects; manual dexterity (using your hands to carry out everyday tasks); continence (bladder and bowel control); and physical co-ordination (e.g. balance). The response is coded as mental health if health difficulties include communication (speech, hearing or eyesight); memory or ability to concentrate, learn or understand; recognising when you are in physical danger; other health problem or disability; and for spontaneous responses.

Finally, I control for a number of socio-economic and demographic factors that are considered to be correlated with mental accounting and financial advice but also associated with portfolio choice. These include age, education, gender, marital status, wealth, having children, occupation and geographic region.

3.3.2 Descriptive statistics

3.3.2.1 Summary statistics

Table 3.2 presents weighted summary statistics for the whole sample of the WAS households for the variables described in Table 3.1. Panel A presents summary statistics for the different asset classes; Panel B presents statistics for the key variables; Panel C presents statistics for the control variables; and Panel D presents transitional probabilities for ownership of the three asset classes by mental accounts. The participation rates for the three asset classes are risky asset (16%), fairly safe asset (53%), and safe asset (88%). These estimates are similar to the rates of participation across these asset classes reported in other UK surveys.[31] However, the share of wealth invested in a risky asset as a proportion of net financial assets is 3% while the proportion of money invested in fairly safe assets is 32% and for safe assets it is 64%.

When evaluated as a proportion of net total household wealth, the share of wealth invested in the three asset classes are substantially lower; risky asset (0.5%), fairly safe asset (5%), and safe asset (8%). This indicates that housing wealth, as previously mentioned, takes up a high proportion of total wealth and is thus an important background asset.

[31] For example, the British Household Panel Survey (BHPS) average investment in risky asset is 15%; fairly safe asset, 52%; safe assets, 68% (as discussed in Chapter Two). Similar estimates are reported from the Family Resources Survey (FRS)

Table 3.2 Summary statistics

Data are derived from two waves of the WAS covering the period June 2006 to July 2010. The reported statistics are weighted and are as defined in Table 3.1. Panel A presents summary statistics for the total value of financial wealth, household wealth and the value of different asset classes; the participation rates; proportion of amount invested by asset class to total financial assets; the proportion of amount invested by asset class to total household wealth; and proportion of amount invested by asset class to total financial assets by mental account. Panel B present the summary statistics for the key variables including mental accounts, financial advice and housing tenure. Panel c presents statistics for the control variables while Panel D presents transitional probabilities for ownership of the three asset classes over the panel period.

Variable description		**Mean**	**Std. Dev.**	**Observ.**		**Mean**	**Std. Dev.**	**Observ.**
Panel A: Asset, ownership and portfolio share					***Panel B. Key explanatory variables***			
Asset class					Mental account behaviour			
Total financial wealth (GB £)		58,936	186,104	40345	No mental account	0.544	0.498	50765
Total household wealth (GB £)		394,842	781,410	49250	Single mental account	0.189	0.392	50765
Risky asset (GB £)		4,216	48,664	50765	Multiple mental accounts	0.267	0.442	50765
Fairly safe asset (GB £)		22,479	104,579	50765	Mental accounting type			
Safe asset (GB £)		17,051	55,872	46859	For unexpected expenditure	0.273	0.446	50765
Participation rates					For other family members	0.086	0.280	50765
Risky asset		0.158	0.365	50765	Provide regular income during year	0.027	0.163	50765
Fairly safe asset		0.533	0.499	50765	Provide income for retirement	0.094	0.292	50765
Safe asset		0.967	0.179	50765	Planned future expense	0.147	0.354	50765
Proportion to financial wealth					Deposit for property	0.028	0.164	50765
Risky asset		0.030	0.115	48086	Holiday or recreation	0.213	0.410	50765
Fairly safe asset		0.315	0.358	48086	Speculation and sport recreation	0.028	0.164	50765
Safe asset		0.641	0.365	45365	See money grow or good interest	0.076	0.265	50765
Proportion to total wealth					Financial advice			
Risky asset		0.005	0.030	49092	No advisor	0.353	0.478	50765
Fairly safe asset		0.047	0.183	49092	Single advisor	0.284	0.451	50765
Safe asset		0.077	0.508	45657	Multiple advisors	0.364	0.481	50765
Proportion to financial wealth by mental account					Financial advice source			
Multiple mental accounts:	Risky asset	0.040	0.121	14355	Spouse, relative, friends or colleagues	0.214	0.410	50765
	Fairly safe asset	0.424	0.339	14355	Internet, newspapers or media	0.071	0.257	50765
	Safe asset	0.530	0.342	14030	Service providers	0.306	0.461	50765
Single mental account:	Risky asset	0.031	0.115	9787	Other independent advisors	0.273	0.446	50765

Table 2.2 Continued

Variable description		Mean	Std. Dev.	Observ.		Mean	Std. Dev.	Observ.
Panel A: Asset, ownership and portfolio share					***Panel B. Key explanatory variables***			
	Fairly safe asset	0.339	0.354	9787	Independent financial advisors	0.310	0.463	50765
	Safe asset	0.622	0.360	9453	Housing tenure			
No mental account:	Risky asset	0.024	0.111	23944	Rents	0.316	0.465	50762
	Fairly safe asset	0.247	0.353	23944	Under mortgage	0.379	0.485	50762
	Safe asset	0.713	0.363	21882	Outright owner	0.305	0.46	50762
Panel C: Control variables								
Time preference		0.210	0.408	45839	Couple	0.578	0.494	50765
Risk taker		0.207	0.405	45839	Degree and above qualif.	0.237	0.425	50765
Cognitive ability		0.707	0.455	44904	Employed or self-employed	0.609	0.488	50687
Good health		0.699	0.459	46040	Has child(ren)	0.302	0.459	50765
Age		52	17	50765	Lives in urban area	0.804	0.397	50746
Cohort		1956	17	50765	Christian	0.778	0.415	50737
Male		0.613	0.487	50765	White British	0.878	0.328	50732

Panel D: Transitional probabilities

			Probability of ownership during wave 2					
			No mental account		Single mental account		Multiple mental accounts	
	Asset Class		No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
Probability of ownership during wave 1	Risky asset	No	96.00	4.00	92.05	7.95	87.87	12.13
		Yes	32.00	68.00	19.11	80.89	17.76	82.24
		Total	89.76	10.24	75.08	24.92	61.67	38.33
	Fairly safe asset	No	82.67	17.33	60.29	39.71	50.38	49.62
		Yes	15.32	84.68	6.00	94	3.07	96.93
		Total	58.89	41.11	25.65	74.35	10.17	89.83
	safe asset	No	31.54	68.46	0.00	100.00	0.00	100.00
		Yes	2.13	97.87	0.42	99.58	0.12	99.88
		Total	4.36	95.64	0.41	99.59	0.12	99.88

An early indicator of the role of mental accounting behaviour is perhaps seen in the calculation, by mental account, of the proportions of total financial assets invested in the three asset classes. The proportion of money invested in both risky assets and fairly safe assets increases across mental accounts, with households that exhibit no mental account having a low proportion of wealth invested in the two risky asset classes and a high proportion invested in safe assets.

For the key independent variables presented in Panel B, I note that 54% of households exhibit no mental accounting behaviour while 19% have a single mental account and 27% have multiple mental accounts. Regardless of whether a household has a single mental account or multiple mental accounts, I find that the reasons for saving money which households mainly identify are to meet unexpected expenditure (27%), for planned future expenses (15%), and for a holiday or for recreation (21%). These goals represent short-term investment horizons and I should expect such households to invest money in relatively secure assets, for these purposes. Although a lower fraction of households identify saving money for retirement (9%), to see it grow or for good interest (8%), and for speculation or sport recreation (2%), I could expect such households to be more inclined to invest in risky assets. For households who save money for other family members (9%), to provide regular income (9%), or for deposit for purchase of property (3%), I might expect these goals to be connected with investment in safe assets.

The proxies for financial advice include a categorical variable and dummies for households that do not seek such advice (35%), that have a single source of advice (28%) and those that have multiple sources of advice (36%). Among household that seek financial advice, 21% trust close associates (such as their spouses, relatives and friends); 7% trust the Internet, newspapers, or media; 31% trust providers of professional services (such as accountants, banks, insurers and solicitors); 27% trust other independent advisors (such as the FSA, trade unions and pensions services); and 31% trust independent financial advisors. These statistics suggest that most households trust financial intermediaries (independent financial advisors) as well as their agents (professional service providers) and this could induce them to invest (or increase the proportion of money invested) in risky assets and/or fairly safe assets. Perhaps most important, as previously discussed, is the question as to whether households delegate asset allocation decisions to financial advisors, in which case the proportion of money invested in different asset classes could vary for such households compared to those that do not, as argued in Alexandre and Baptista (2011) and Bhattacharya *et al.* (2012).

Regarding the nature of current accommodation, I find that 32% of the respondents rent, 38% own through a mortgage, and 30% own outright their current accommodation. This implies that housing could be an important source of background risk in our sample, as suggested in the literature (e.g. Cocco, 2005). Another source of background risk, health, appears not to be so influential given that about 70% of respondents believe that their general health condition is either good or very good. This finding is consistent with two alternative health measures, physical and mental health problems, which show that only about 20% and 5% of individuals, respectively, identify a health-related problem. Attitudes toward risk and the time value of money, as proxied by the variables *risk tolerance* and *time preference*, respectively, indicate that for both variables a small fraction of households, 21%, say that they are willing to take a one to five chance of getting £ 10,000 in a years' time rather than a guaranteed payment of £ 1,000 now and/or choose to receive £ 1,100 next year rather than to receive £ 1,000 today. About 71% of the households consider themselves to have excellent or good mathematical ability. Overall, the sample consists mainly of males (61%), married or cohabiting couples (58%) and individuals who are either employed or self-employed (61%).

Further evidence of the role of mental accounting can be seen in Panel D, which presents transitional probabilities; that is, the probability of transiting from ownership (non-ownership) in one period to non-ownership (ownership) in the next period. For example, households that exhibit no mental accounting have low levels of ownership (10%) and tended to opt out of risky assets (32%) in the next period while those that exhibit multiple mental accounts have high levels of ownership (38%) and few opt out of risky assets (18%) in the following period. This pattern is also replicated for ownership of a fairly safe asset and I see more households owning fairly safe assets across mental accounts.

Table 3.3 presents weighted pairwise correlations for the key variables and control variables. The proportions of financial wealth invested in risky assets and fairly risky assets are both negatively correlated with exhibiting no mental account and are positively correlated with single and multiple mental accounts. In contrast, the proportion of financial wealth invested in safe assets is negatively correlated with both a single mental account and multiple mental accounts but is positively correlated with exhibiting no mental account. In addition, having no financial advisor, a single financial advisor and renting a home are all negatively correlated with the proportion of financial wealth invested in both risky assets and fairly safe assets but are positively correlated with the proportion of wealth in safe assets.

Table 3.3 Pairwise correlation matrix

Table presents weighted pairwise correlations among variables from the two waves of the WAS. The variables are as defined in Table 3.1. The reported levels of significance are based on Bonferroni-adjusted p-values and are given by * for significance levels of 0.05 or less.

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	Risky asset (proportion)	1													
(2)	Fairly safe asset (proportion)	-0.0426*	1												
(3)	Safe asset (proportion)	-0.2643*	-0.9266*	1											
(4)	No mental account	-0.0546*	-0.1987*	0.1988*	1										
(5)	Single mental account	0.0043	0.0336*	-0.0256*	-0.5276*	1									
(6)	Multiple mental accounts	0.0568*	0.1910*	-0.1958*	-0.6591*	-0.2911*	1								
(7)	No financial advisor	-0.0191*	-0.0840*	0.0897*	0.1947*	-0.0649*	-0.1618*	1							
(8)	Single financial advisor	-0.0154*	-0.0062	0.0172*	-0.0129*	0.0665*	-0.0444*	-0.4645*	1						
(9)	Multiple financial advisors	0.0332*	0.0885*	-0.1047*	-0.1813*	0.0021	0.2023*	-0.5581*	-0.4755*	1					
(10)	Rents	-0.1077*	-0.2862*	0.3170*	0.2034*	-0.0568*	-0.1787*	0.0511*	0.0094	-0.0595*	1				
(11)	Under mortgage	0.0210*	0.0680*	-0.0852*	-0.0651*	-0.0047	0.0774*	-0.0267*	-0.0834*	0.1046*	-0.5311*	1			
(12)	Outright owner	0.0831*	0.2080*	-0.2149*	-0.1369*	0.0623*	0.0990*	-0.0234*	0.0783*	-0.0501*	-0.4506*	-0.5171*	1		
(13)	Time preference	0.0389*	0.0982*	-0.1004*	-0.1355*	0.0233*	0.1279*	-0.0417*	-0.0307*	0.0678*	-0.0760*	0.0358*	0.0397*	1	
(14)	Risk taker	0.0406*	0.0458*	-0.0578*	-0.0647*	0.0132*	0.0593*	-0.0039	-0.0283*	0.0303*	-0.0646*	0.0745*	-0.0116	0.0615*	1
(15)	Good numerical ability	0.0620*	0.1043*	-0.1252*	-0.1219*	0.0155*	0.1209*	-0.0379*	-0.0435*	0.0773*	-0.1473*	0.1260*	0.0185*	0.0757*	0.0411*
(16)	Age	0.0540*	0.0960*	-0.0879*	-0.0498*	0.0704*	-0.0063	0.0188*	0.1543*	-0.1632*	-0.1464*	-0.3749*	0.5428*	-0.0573*	-0.0663*
(17)	Sex	0.0387*	0.0660*	-0.0780*	-0.0399*	0.0064	0.0392*	0.0390*	-0.0518*	0.0098	-0.1578*	0.1338*	0.0184*	0.0755*	0.0956*
(18)	Couple	0.0395*	0.1251*	-0.1513*	-0.0393*	-0.0237*	0.0652*	0.0383*	-0.0628*	0.0208*	-0.2886*	0.2631*	0.0144*	0.0470*	0.0675*
(19)	Degree and above qualification	0.0923*	0.1236*	-0.1507*	-0.1625*	0.0192*	0.1660*	-0.0684*	-0.0777*	0.1408*	-0.1578*	0.1904*	-0.0412*	0.1474*	0.0645*
(20)	Employed or self-employed	0.0113	0.0450*	-0.0647*	-0.1021*	-0.0096	0.1234*	-0.0366*	-0.1290*	0.1572*	-0.1861*	0.5003*	-0.3392*	0.0860*	0.0844*
(21)	Has child(ren)	-0.0305*	-0.0762*	0.0690*	0.1280*	-0.0785*	-0.0747*	0.0384*	-0.0639*	0.0217*	0.0406*	0.2666*	-0.3219*	-0.0132*	0.0127*
(22)	Lives in urban area	-0.0376*	-0.0628*	0.0718*	0.0285*	-0.007	-0.0260*	0.0034	-0.0088	0.0049	0.0781*	0.0059	-0.0851*	-0.0238*	-0.0242*
(23)	Christian	0.0189*	0.0549*	-0.0537*	-0.0359*	0.0178*	0.0247*	0.0052	0.0338*	-0.0368*	-0.0751*	-0.0502*	0.1287*	-0.0400*	-0.0366*
(24)	Good health	0.0508*	0.0934*	-0.1183*	-0.1656*	0.0390*	0.1470*	-0.0853*	-0.0600*	0.1358*	-0.1671*	0.2246*	-0.0626*	0.0804*	0.0586*
(25)	White British	0.0280*	0.1130*	-0.1201*	-0.0580*	0.0197*	0.0479*	-0.0332*	0.0083	0.0252*	-0.1388*	0.0276*	0.1112*	0.0139*	0.0171*
(26)	Total wealth	0.1634*	0.3532*	-0.3963*	-0.2537*	0.0534*	0.2362*	-0.0834*	-0.0123*	0.0940*	-0.6836*	0.2340*	0.4188*	0.1168*	0.0800*
(27)	Financial wealth	0.1965*	0.4591*	-0.5083*	-0.2792*	0.0482*	0.2571*	-0.0986*	-0.0288*	0.1250*	-0.4558*	0.0899*	0.3137*	0.1615*	0.1007*

Table 3.3 Continued

	Variables	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
(15)	Good numerical ability	1												
(16)	Age	-0.0700*	1											
(17)	Sex	0.1546*	-0.0410*	1										
(18)	Couple	0.1486*	-0.1371*	0.3995*	1									
(19)	Degree and above qualification	0.1917*	-0.1819*	0.0520*	0.1076*	1								
(20)	Employed or self-employed	0.1545*	-0.5857*	0.1514*	0.2714*	0.2268*	1							
(21)	Has child(ren)	0.0166*	-0.4547*	0.0092	0.2390*	0.0432*	0.2873*	1						
(22)	Lives in urban area	-0.0193*	-0.0826*	-0.0323*	-0.0734*	-0.0189*	-0.0021	0.0193*	1					
(23)	Christian	-0.007	0.2514*	-0.0438*	0.0006	-0.1110*	-0.1095*	-0.0917*	-0.0459*	1				
(24)	Good health	0.1483*	-0.2839*	0.0525*	0.1341*	0.1808*	0.3753*	0.1438*	-0.0220*	-0.0548*	1			
(25)	White British	-0.0054	0.1498*	0.0038	0.0048	-0.1003*	-0.0604*	-0.1286*	-0.1345*	0.1057*	-0.0056	1		
(26)	Total wealth	0.1944*	0.2296*	0.1754*	0.3143*	0.2319*	0.1482*	-0.0776*	-0.1319*	0.0936*	0.1603*	0.1509*	1	
(27)	Financial wealth	0.1927*	0.1295*	0.1573*	0.2522*	0.2485*	0.1065*	-0.0626*	-0.1144*	0.0533*	0.1694*	0.1228*	0.6800*	1

As expected I see a high negative correlation among the categories of mental accounting behaviour, especially between having *no mental account* and both *single mental account* (0.52) and *multiple mental accounts* (0.66). Similarly, I find a high negative correlation between having no financial advisor and both *single advisor* (0.46) and *multiple advisors* (0.56). To avoid possible multicollinearity issues in my analysis, I use a categorical variable for these variables, with the categories having *no mental account* and *no financial advisor* as the base levels because, as observed in the summary statistics, the two categories have high fractions of households. The correlation between mental accounting behaviour and financial advice shows that having *no mental account* and *no financial advice* or *multiple mental accounts* and *multiple financial advice* are positively correlated, with both sets being approximately 0.20. These relationships suggest that the combined effects of either set could affect portfolio choice.

Examining the correlation between *risk tolerance* and *time preference*, I find that both are negatively correlated with *no mental account* and with both *no financial advice* and *single financial advice*. Both variables are also positively correlated with a *single mental account* and *multiple mental accounts*, *multiple financial advisors*, and the control variables apart from age. These findings suggest that the variables might have conditional and unconditional influences on the probability of ownership of, and the proportion of assets invested in, the different asset classes.

3.3.2.2 Graphical analysis

In this section, I present graphical evidence concerning the relationship between ownership and portfolio share in the three asset classes by mental accounts and by time preference, risk tolerance, cognitive ability, financial advice, and housing tenure. Figure 3.1 presents ownership rates and share invested by mental account and by *time preference*, *risk tolerance* and *cognitive ability*. Panel (a), (c) and (e) show that ownership rates increase in accordance with both the number of mental accounts and the degrees of *time preference*, *risk tolerance* and *cognitive ability*. Interestingly, apart from the pattern displayed across *cognitive ability,* mental accounting appears to dominate both *time preference* and *risk tolerance*. For example, ownership rates among households that exhibit a *single mental account* and have short-run *time preference* (or are risk-averse) are higher than the rates for household who exhibit *no mental account* and have long-run *time preference* (or are risk-tolerant).

Panels (b), (d) and (f) present portfolio share by mental account and by *time preference, risk tolerance* and *cognitive ability*. A similar pattern is observed, although for the share invested in a safe asset ownership rates decrease. Again I see a similar pattern for share of money invested in fairly safe assets and risky assets. These findings suggest that, while mental accounting and risk attitudes are important determinants of portfolio choice in the three assets, mental accounts dominate the effect of *time preference, risk tolerance* and *cognitive ability*. Furthermore, among respondents who exhibit *multiple mental accounts* and have long-run *time preference*, are risk tolerant or have good cognitive ability, they invest approximately the same share of wealth in both fairly safe assets and safe assets.

Figure 3.1 Portfolio choice by mental accounts, time preference and risk tolerance

The figures display ownership rates (Panel (a) and (c)) and portfolio share (Panel (b) and (d)) in three asset classes (risky asset, fairly safe asset and safe asset) for households in two waves of the WAS by mental accounts, time preference and risk tolerance. The variables are as defined in Table 3.1.

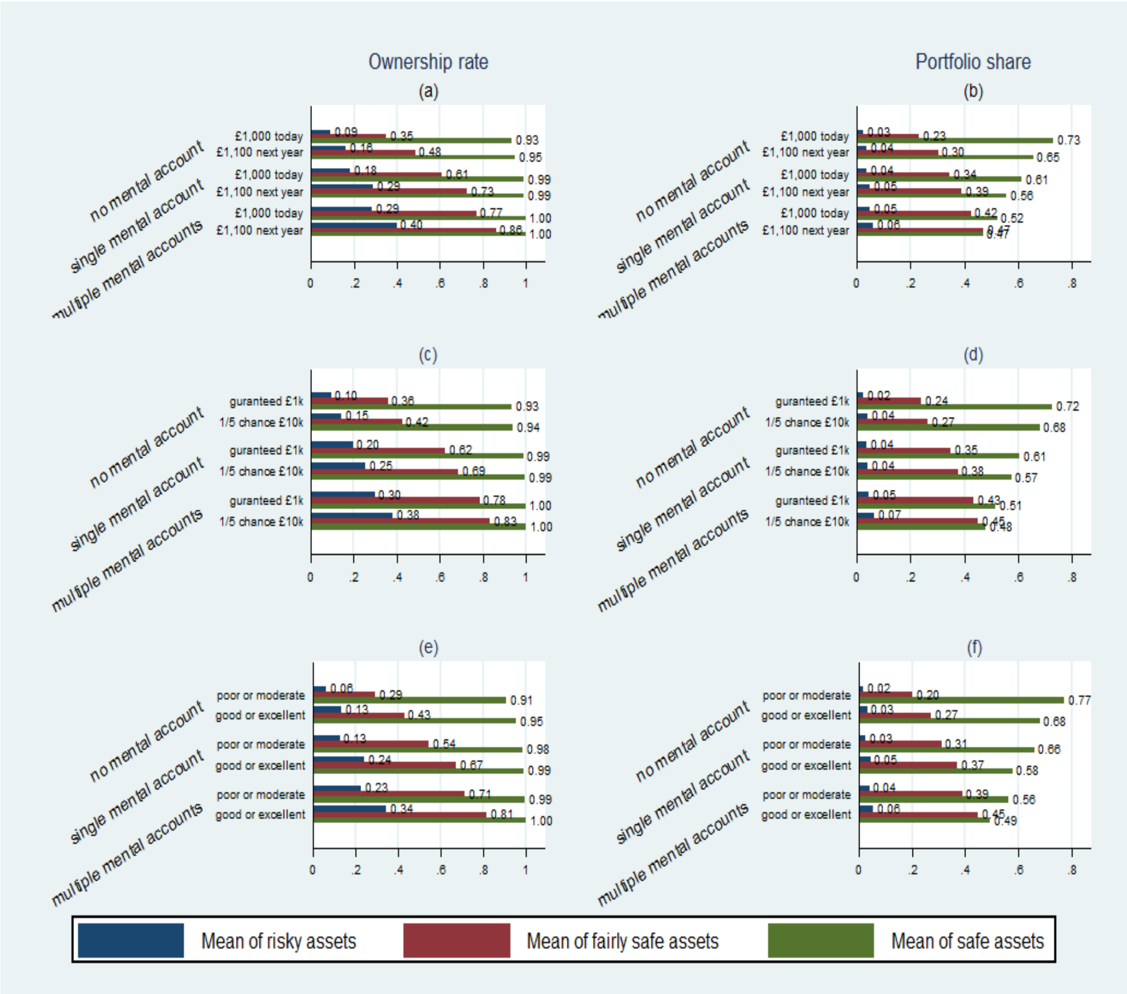
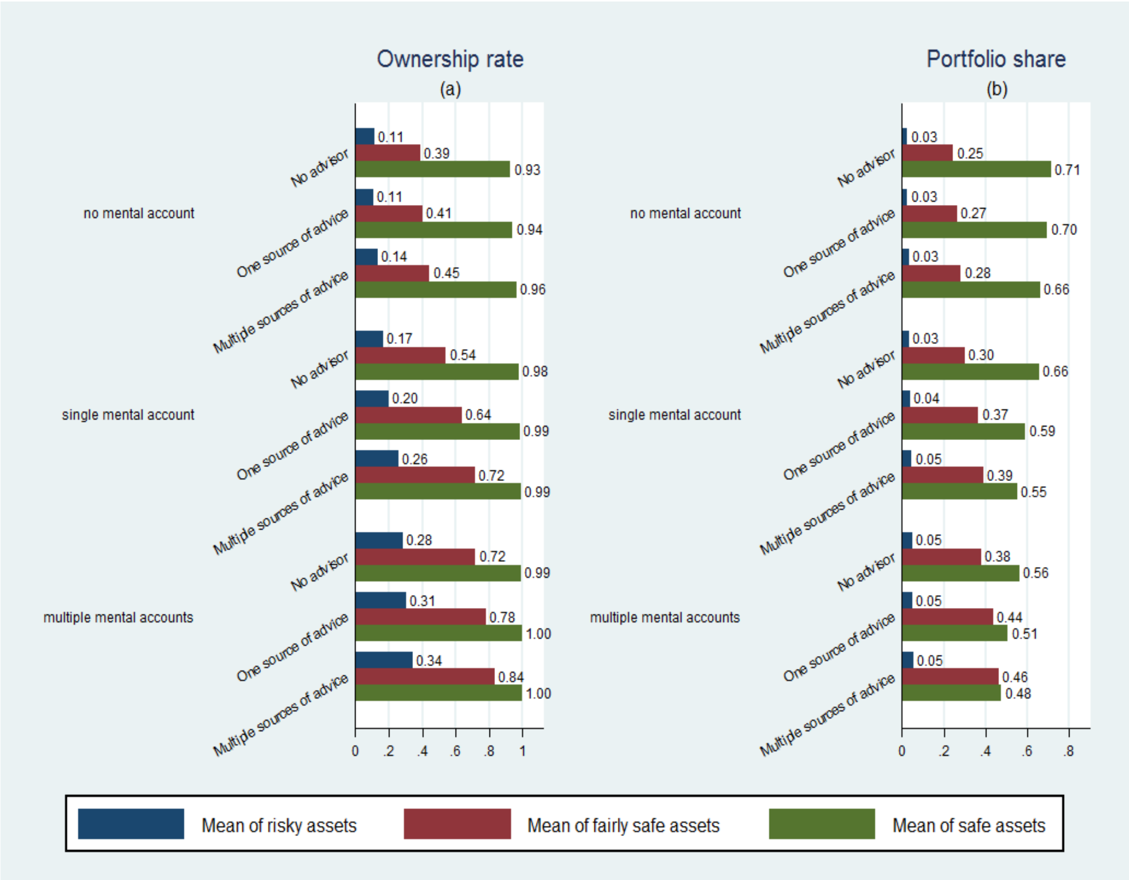


Figure 3.2 Panel (a), (c) and (d) present ownership rates of different asset classes by mental accounts and financial advice. Across mental accounts and financial advice, I observe that ownership rates increase and households that exhibit *multiple mental accounts* and those with *multiple sources* of financial advice have higher rates of participation. However, ownership of a safe asset, though low among households that exhibit *no mental account*, appears to be approximately the same across the different categories of financial advice.

Figure 3.2 Portfolio choice by mental accounts and financial advice

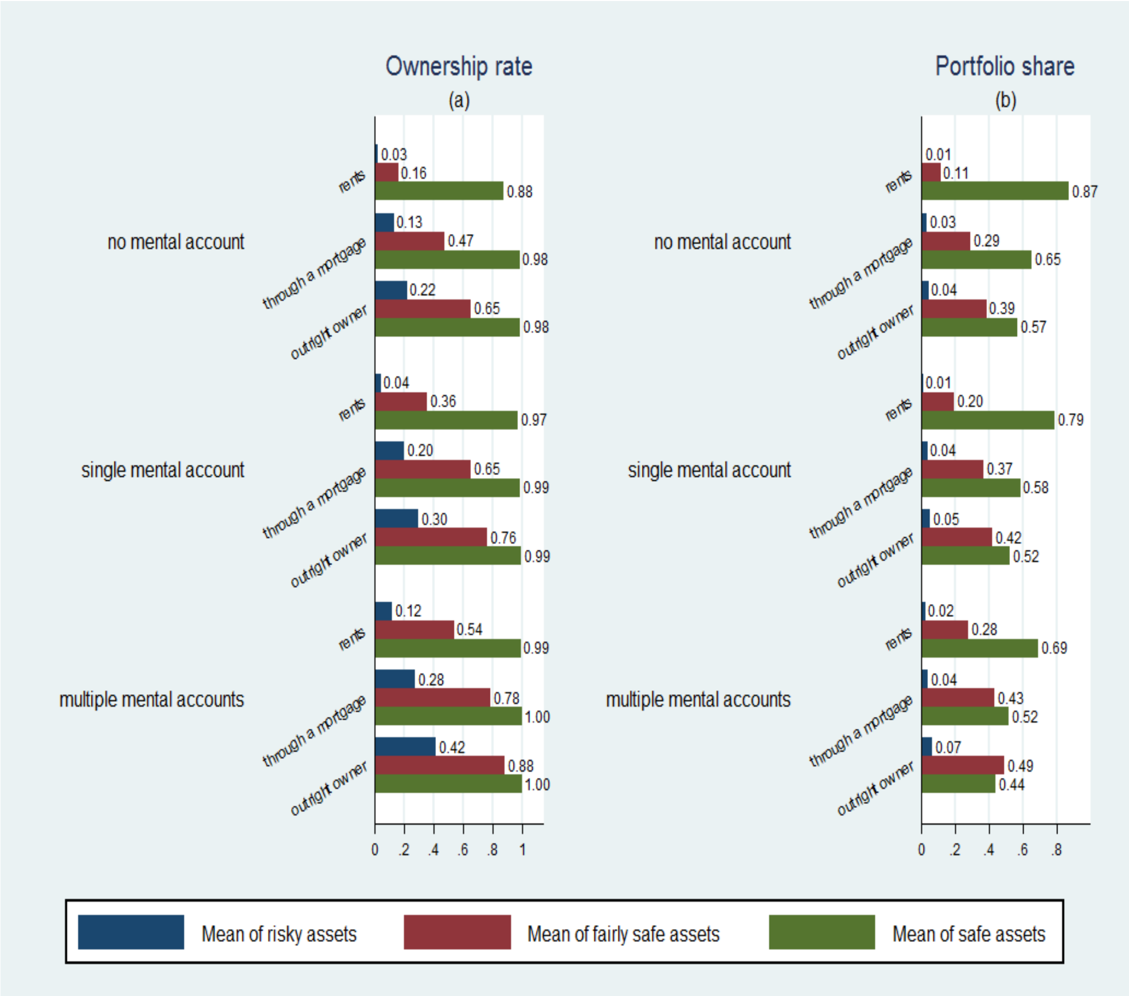
The figures display ownership rates (Panel a) and proportion of financial wealth invested (Panel b) in three asset classes (risky asset, fairly safe asset and safe asset) for households in two waves of the WAS by mental accounts and financial advice. The variables are as defined in Table 3.1: Variable description.



For the share invested in different asset classes, Panel (b), (d) and (e), I observe a reversal of the pattern for share invested in a safe asset. Further, although the pattern for the share invested in risky assets and fairly safe assets increases across mental accounts and financial advice categories, the differences are smaller when compared to ownership rates. For example, the share invested in risky assets is constant for those who exhibit multiple mental accounts regardless of financial advice category.

Figure 3.3 Portfolio choice by mental accounts and housing

The figures display ownership rates (Panel a) and proportion of financial wealth invested (Panel b) in three asset classes (risky asset, fairly safe asset and safe asset) for households in two waves of the WAS by mental accounts and housing tenure. The variables are as defined in Table 3.1



In addition, I also examine portfolio choice in the different asset classes by housing tenure. From Panel (a) of Figure 3.3 I observe that ownership rates for all asset classes increase across categories of mental accounts and housing tenure. Within mental accounts, I find that ownership rates for a safe asset are stable among households that exhibit a *single mental account* and *multiple mental accounts*. With regard to the share invested in each asset class, Panel (b) again I see a reversal of the pattern for safe assets, which decreases across mental accounts and housing tenure. Unlike our observations in Figure 3.1 and Figure 3.2, the ownership rates and share invested do not increase uniformly across both mental accounts and housing tenure; mental accounting thus does not appear to dominate housing tenure.

In summary, the summary statistics and graphical analysis suggest that mental accounting can explain variations in portfolio choice in the WAS data.

3.4 Empirical strategy

This study focuses on the effect of mental accounting on asset allocation decisions and the embedded effect of background risk and financial advice. I posit that, holding other determinants of portfolio choice constant, mental accounting behaviour can explain additional variations in asset allocation decisions among individuals and households. Previous studies only consider the direct influence of factors such as background assets, financial advice, health, and cognitive ability, which I conjecture might be capturing the effects of mental accounting. Furthermore, I suspect that the impact of these factors on portfolio choice could be exacerbated by mental accounting. For example, if low cognitive ability is negatively associated with investment in a risky asset and is also associated with mental accounting, then I might expect to see increased effects if the two variables are interacted together. Otherwise, the two factors may have independent effects on portfolio choice and not related to each other; or one factor may subsume the effect of the other.

In the empirical analysis, I examine both the probability of holding and the share of net financial wealth invested in three asset classes. For the probability of holding a specific asset class, I use the general static probit model discussed in Chapter Two Section 2.4. I estimate various specifications of my key independent variables using a pooled probit model and I cluster standard errors at the individual level. These regressions, also allow me to examine whether there are any year effects that are peculiar to the global financial crisis. For each asset class, I first investigate the role of mental accounting, *risk tolerance*, *time preference*, *cognitive ability* and their interactions using the following equations:

$$AC_{it} \ = \ MA_{it}\beta_1 + \ CV_{it}\alpha + \ u_i + \varepsilon_{it}, \tag{1}$$

$$AC_{it} \ = \ MA_{it}\beta_1 + RT_{it}\beta_2 + \ TP_{it}\beta_3 + \ CA_{it}\beta_4 + CV_{it}\alpha + \ u_i + \varepsilon_{it}, \tag{2}$$

$$AC_{it} \ = \ MA_{it}\beta_1 + RT_{it}\beta_2 + \ PT_{it}\beta_3 + CA_{it}\beta_4 + \ IT_{it} + \ CV_{it}\alpha + \ u_i + \varepsilon_{it}. \tag{3}$$

The dependent variable, AC_{it}, asset class, is a binary variable that represents ownership of a specific asset class for household i in year t. In Equation (1), the key independent variable is MA_{it}, a categorical variable representing three mental accounting dummies with *no mental account* as the base level. CV_{it} is a set of control variables and represents other behavioural attitudes, and socioeconomic and demographic characteristics of a household. Unobserved effects are captured by the error term, u_i, and ε_{it} is a transitory error. Equation (2) includes three additional variables: RT_{it}, representing *risk tolerance*; TP_{it}, representing *time preference*; and, CA_{it}, representing *cognitive ability*. Equation (3) includes interaction terms, IT_{it}, which consist of different combinations of mental accounting interacted with the measures of *risk tolerance, time preference* and *cognitive ability*.

To examine the role of financial advice and background risk, I extend Equation (2) and separately include these variables and their interactions with mental accounts using the following equations:

$$AC_{it} = MA_{it}\beta_1 + FA_{it}\beta_2 + RT_{it}\beta_3 + RP_{it}\beta_4 + CA_{it}\beta_5 + CV_{it}\alpha + u_i + \varepsilon_{it}, \quad (4)$$

$$AC_{it} = MA_{it}\beta_1 + FA_{it}\beta_2 + RT_{it}\beta_3 + RP_{it}\beta_4 + CA_{it}\beta_5 + IT_{it} + CV_{it}\alpha + u_i + \varepsilon_{it}, \quad (5)$$

$$AC_{it} = MA_{it}\beta_1 + BR_{it}\beta_2 + RT_{it}\beta_3 + RP_{it}\beta_4 + CA_{it}\beta_5 + CV_{it}\alpha + u_i + \varepsilon_{it}, \quad (6)$$

$$AC_{it} = MA_{it}\beta_1 + BR_{it}\beta_2 + FA_{it}\beta_3 + RT_{it}\beta_4 + RP_{it}\beta_5 + CA_{it}\beta_6 + IT_{it} + CV_{it}\alpha + u_i + \varepsilon_{it}, \quad (7)$$

where the additional variables are financial advice, FA_{it}; background risk, BR_{it},; and interaction terms between mental accounts and financial advice or background risk, IT_{it}. All other variables are as earlier defined.

Beyond the choice to invest or divest in a specific asset class, however, I might expect that individuals could instead increase (reduce) the amount of funds invested in a specific asset category in response to exogenous factors such as wealth shocks, which force them to revise their mental accounts, change their attitudes towards financial advisors, or their willingness to take risk. Thus, for portfolio share invested in a specific asset class, I run pooled tobit regressions, censored at zero and one, and with standard errors clustered at the individual level. I replicate our analysis in Equation (1) to (7) using portfolio share as the dependent variable in place of the asset ownership binary variable. For example, Equation (1) is transformed as follows:

$$PA_{it} = MA_{it}\beta_1 + CV_{it}\alpha + u_i + \varepsilon_{it}. \quad (8)$$

Where the dependent variable, PA_{it}, represents the proportion of total assets invested in a specific type of asset by individual i in year t and the explanatory variables are as described before.

3.5 Empirical results

I estimate pooled probit and tobit regressions where the dependent variables are ownership and portfolio share, respectively, of either risky assets, fairly safe assets or safe assets. Marginal effects are reported from all regression estimates apart from conditional probit regressions estimates, for which I report raw coefficients. As previously discussed in Chapter Two, conditional probit estimates are not automatically generated for interaction terms because the interpretation of marginal effects could be misleading (Ai and Norton, 2003). Therefore, I use probit raw coefficients for comparison with marginal effects from tobit estimates and I present graphical analysis for meaningful interpretation of the probit marginal effects. Standard errors are clustered at the individual level. For categorical variables and their interactions terms, I carry out Wald-type tests which test the hypothesis that the levels are not significantly different. The key independent variables are mental accounts, financial advice and housing tenure. The control variables in all regressions are *time preference*, *risk tolerance*, *cognitive ability*, *age*, *age square*, *male*, *couple*, *degree level or above*, *employed or self-employed*, *has children*, *lives in urban area*, *Christian*, *has good health*, *White British*, *log of net financial wealth*, *log of net household wealth*, regional, and year dummies.

3.5.1 Mental accounts, time preference, risk tolerance and cognitive ability

I begin by examining the role of mental accounts together with *time preference*, *risk tolerance* and *cognitive ability* on portfolio choice. Table 3.4 reports marginal effects from pooled probit regressions for probability of ownership (Panel A) and marginal effects from tobit regressions for portfolio share (Panel B).

Table 3.4 Panel A reports the results for probability of ownership in which I first enter mental accounts as the only independent variable in Columns (1), (4), and (7); I then include the variables *risk tolerance, time preference* and *cognitive ability* in Columns (2), (5), and (8); and the set of control variables are added in Columns (3), (6), and (9). When mental accounting is the only explanatory variable, I find that mental accounting behaviour enhances the probability of holding each of the three types of assets and captures variations in data with a pseudo R^2 ranging from 5% to 9%. When I include the variables, *risk tolerance, time preference and cognitive ability* the variables are highly significant for ownership of the three asset classes apart from *risk tolerance* which is significant at the 10% level for ownership of a safe asset. Mental accounting remains virtually unchanged across the asset types. In the regressions that include mental accounting, *risk tolerance, time preference, cognitive ability* and control variables, I find that having a *single mental account* has an insignificant effect on ownership of a risky asset and a weak effect on ownership of a safe asset when compared to having *multiple mental accounts*. However, for ownership of fairly safe assets, a *single mental account* and *multiple mental accounts* remain highly significant, albeit with lower magnitudes.

Table 3.4 Effects of mental accounting, time preference, risk tolerance and cognitive ability

The table presents marginal effects from both pooled probit regressions in Panel A and from pooled tobit regressions in Panel B. The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK), Column (1) to (3). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets, Column (4) to (6). Safe asset include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products, Column (7) to (9). Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Time preference equals one if respondent would prefer GBP £ 1,100 next year and zero if GBP £ 1,000 today. Risk tolerance equals one if respondent would prefer a one in five chance of winning GBP £ 10,000 and zero if response is guaranteed GBP £ 1,000. Cognitive ability equals one if response is excellent or good and zero if response is moderate or poor. The control variables as described in Table 1 are age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, expects good financial situation, understands pensions, shops for competitive interest, white British, outright home owner, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
Mental accounts (Base=none)									
Single mental account	0.091***	0.093***	0.002	0.227***	0.245***	0.034***	0.045***	0.048***	0.002*
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.002)	(0.002)	(0.001)
Multiple mental account	0.200***	0.186***	0.033***	0.385***	0.390***	0.087***	0.053***	0.057***	0.007***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)	(0.001)
Time preference		0.081***	0.016***		0.109***	0.021***		0.006***	-0.001
		(0.005)	(0.005)		(0.006)	(0.005)		(0.002)	(0.001)
Risk tolerance		0.054***	0.015***		0.047***	0.000		0.004*	0.002*
		(0.005)	(0.005)		(0.006)	(0.005)		(0.002)	(0.001)
Cognitive ability		0.088***	0.026***		0.114***	0.011**		0.024***	0.001
		(0.005)	(0.006)		(0.006)	(0.005)		(0.002)	(0.001)
Age			-0.001			-0.001			0.000**
			(0.001)			(0.001)			(0.000)
Age square			0.000			-0.000			-0.000
			(0.000)			(0.000)			(0.000)

Table 3.4 Continued

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
Male			0.009			-0.046***			0.001
			(0.006)			(0.005)			(0.001)
Couple			0.002			0.034***			0.003***
			(0.006)			(0.005)			(0.001)
Degree level or above qualification			0.034***			0.021***			0.000
			(0.006)			(0.006)			(0.001)
Employed or self-employed			0.008			-0.010			0.003**
			(0.007)			(0.006)			(0.001)
Has children			-0.022***			-0.068***			-0.010***
			(0.007)			(0.007)			(0.002)
Lives in urban area			-0.005			0.012**			-0.001
			(0.006)			(0.006)			(0.001)
Christian			0.023***			0.020***			0.002*
			(0.006)			(0.006)			(0.001)
Has good health			0.020***			0.011**			-0.002
			(0.005)			(0.005)			(0.001)
White British			0.018*			0.064***			-0.000
			(0.009)			(0.009)			(0.002)
Log of net household wealth			0.042***			0.022***			0.000*
			(0.003)			(0.002)			(0.000)
Log of net financial wealth			0.069***			0.094***			0.001***
			(0.002)			(0.001)			(0.000)
Region dummies (Base = North East)									
North West			0.011			0.018			-0.003
			(0.014)			(0.012)			(0.003)
Yorkshire & Humber			0.026*			0.034***			-0.003
			(0.014)			(0.013)			(0.003)
East Midlands			0.031**			0.041***			0.001
			(0.014)			(0.013)			(0.003)
West Midlands			-0.008			0.030**			-0.001
			(0.014)			(0.013)			(0.003)
East of England			0.033**			0.027**			-0.003
			(0.014)			(0.012)			(0.003)

Table 3.4 Continued

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
London			0.044***			-0.007			0.003
			(0.014)			(0.013)			(0.003)
South East			0.060***			0.021*			0.001
			(0.013)			(0.012)			(0.003)
South West			0.039***			0.037***			0.002
			(0.014)			(0.013)			(0.003)
Wales			-0.011			0.007			-0.002
			(0.016)			(0.014)			(0.003)
Scotland			0.011			0.010			-0.001
			(0.014)			(0.012)			(0.003)
Year dummies (Base = 2006)									
2007			-0.014**			-0.010*			0.001
			(0.006)			(0.006)			(0.001)
2008			-0.016***			0.027***			0.002
			(0.006)			(0.006)			(0.001)
2009			-0.002			0.059***			0.007***
			(0.007)			(0.007)			(0.002)
2010			-0.015*			0.062***			0.006***
			(0.008)			(0.008)			(0.002)
Pseudo R^2	0.048	0.081	0.241	0.088	0.127	0.370	0.078	0.110	0.143
Observations	50765	43842	34207	50765	43842	34207	50765	43842	34207

Table 3.4 Continued

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
Mental accounts (Base=none)									
Single mental account	0.104***	0.107***	-0.014*	0.195***	0.219***	0.022***	-0.175***	-0.199***	-0.010
	(0.007)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)
Multiple mental account	0.202***	0.192***	0.007	0.338***	0.346***	0.058***	-0.317***	-0.324***	-0.044***
	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)
Time preference		0.084***	0.004		0.098***	-0.004		-0.091***	0.009
		(0.006)	(0.006)		(0.007)	(0.006)		(0.006)	(0.006)
Risk tolerance		0.072***	0.020***		0.038***	-0.019***		-0.054***	0.009
		(0.007)	(0.006)		(0.007)	(0.006)		(0.007)	(0.006)
Cognitive ability		0.119***	0.024***		0.123***	0.009		-0.136***	-0.014**
		(0.008)	(0.008)		(0.008)	(0.007)		(0.008)	(0.007)
Age			-0.005***			0.001			0.000
			(0.002)			(0.001)			(0.001)
Age square			0.000***			-0.000***			0.000*
			(0.000)			(0.000)			(0.000)
Male			0.014**			-0.058***			0.047***
			(0.007)			(0.007)			(0.006)
Couple			-0.018**			0.038***			-0.029***
			(0.007)			(0.007)			(0.007)
Degree level or above qualification			0.039***			-0.017**			0.002
			(0.007)			(0.007)			(0.006)
Employed or self-employed			0.023***			0.001			-0.002
			(0.008)			(0.008)			(0.008)
Has children			-0.021**			-0.058***			0.048***
			(0.009)			(0.008)			(0.008)
Lives in urban area			-0.009			0.035***			-0.026***
			(0.007)			(0.007)			(0.006)
Christian			0.026***			0.036***			-0.032***
			(0.008)			(0.008)			(0.008)
Has good health			0.029***			0.015**			-0.025***
			(0.007)			(0.007)			(0.006)

Table 3.4 Continued

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
White British			0.010			0.082***			-0.073***
			(0.012)			(0.012)			(0.011)
Log of net household wealth			0.057***			0.024***			-0.033***
			(0.004)			(0.003)			(0.003)
Log of net financial wealth			0.078***			0.121***			-0.123***
			(0.003)			(0.002)			(0.002)
Region (Base = North East)									
North West			0.008			0.014			-0.019
			(0.018)			(0.017)			(0.016)
Yorkshire & Humber			0.017			0.036**			-0.032*
			(0.019)			(0.018)			(0.017)
East Midlands			0.008			0.037**			-0.031*
			(0.018)			(0.018)			(0.017)
West Midlands			-0.036*			0.019			-0.011
			(0.019)			(0.018)			(0.017)
East of England			0.031*			0.012			-0.018
			(0.018)			(0.018)			(0.016)
London			0.032*			-0.075***			0.055***
			(0.019)			(0.018)			(0.017)
South East			0.055***			-0.026			0.008
			(0.017)			(0.017)			(0.016)
South West			0.038**			0.017			-0.027*
			(0.018)			(0.018)			(0.016)
Wales			-0.019			0.000			0.002
			(0.021)			(0.020)			(0.018)
Scotland			0.023			0.026			-0.034**
			(0.019)			(0.018)			(0.017)

Table 3.4 Continued

Independent variable	Risky asset			Fairly safe asset			Safe asset		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
Year (Base = 2006)									
2007			-0.013			-0.010			0.008
			(0.008)			(0.008)			(0.008)
2008			-0.036***			0.042***			-0.026***
			(0.007)			(0.007)			(0.007)
2009			-0.033***			0.072***			-0.048***
			(0.009)			(0.009)			(0.008)
2010			-0.044***			0.094***			-0.069***
			(0.010)			(0.010)			(0.010)
Constant	-0.425***	-0.554***	-1.732***	0.033***	-0.110***	-1.334***	0.869***	1.025***	2.369***
	(0.007)	(0.010)	(0.053)	(0.005)	(0.008)	(0.042)	(0.005)	(0.008)	(0.039)
sigma									
Constant	0.385***	0.382***	0.326***	0.542***	0.534***	0.434***	0.513***	0.506***	0.408***
	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Pseudo R^2	0.036	0.066	0.265	0.040	0.059	0.227	0.040	0.063	0.278
Observations	48086	41454	33990	48086	41454	33990	45365	39205	33455

The variables *risk tolerance, time preference,* and *cognitive ability* are all highly significant for ownership of a risky asset; *time preference* and *cognitive ability* are significant for ownership of a fairly safe asset; and *risk tolerance* has a weak and significant effect at the 10% level for ownership of a safe asset. These extended specifications increase the variations captured by the data.

The control variables have the expected signs. For example, the variables *degree level or above qualification*, *has good health,* and *Christian* are positively associated with ownership of both risky and fairly safe assets while the variable *has children* is negatively correlated with the two asset classes. Further, as seen in the descriptive statistics section, the year dummies show opposite and significant effects for ownership of risky assets and fairly safe assets, which demonstrates the impact of the global financial crisis on households. The results clearly show that there was a significant negative impact on ownership of risky assets in 2008 and 2010 in contrast to the significant positive effect on ownership of fairly safe assets in 2009 and 2010. This result suggests that, owing to the persistent global economic crisis, households may have shifted their investment in risky assets to fairly safe assets. As expected, year dummies have no effect on ownership of a safe asset.

Panel B of Table 3.4 presents estimates where portfolio share in the three asset classes is the dependent variable. As observed in Panel A, when mental accounting is the only explanatory variable (Columns (1), (4), and (7)) or is analysed together with *risk tolerance, time preference* and *cognitive ability* (Columns (2), (5) and (8)), I find a significant association with the portfolio share in the three asset classes. However, the effects of these variables are negative for portfolio share in safe assets. When mental accounting, *risk tolerance, time preference* and *cognitive ability* are analysed together with the control variables (Columns (3), (6) and (9)) I find that, for portfolio share in risky assets, *single mental account* has a weak negative effect while *risk tolerance* and *cognitive ability* are both highly significant. For portfolio share in fairly safe assets, *single mental account* and *multiple mental accounts* are positive and significant at the 1% level; *risk tolerance* has a negative and significant effect at the 1% level; and both *time preference* and *cognitive ability* are insignificant. While for portfolio share in safe assets, *multiple mental accounts* and *cognitive ability* both have negative and significant effects.

The results for control variables are generally comparable with the results in Panel A. However, the levels of significance and signs change for some variables. For example, households that are led by males, when compared to female-led households, have high proportions of financial assets invested in both risky and safe assets, and a low proportion in fairly safe assets. On the other hand, households that live as couples, when compared to households with singles, have a low proportion of financial assets invested in both risky and safe assets, and a high proportion of fairly safe assets. Further, I also see a consistent pattern for the impact of the global economic crisis on households between 2008 and 2010 which, unlike the results in Panel B, spills over to safe assets. During this period, the results show that the crisis had a negative impact on the proportion of money invested in risky assets and safe assets while it had a positive effect on the proportion of money invested in fairly safe assets.

Finally, I examine whether the effects of mental accounts vary with *time preference*, *risk tolerance* and *cognitive ability* by including interaction terms in our analysis. Table 3.5 reports raw coefficient estimates for ownership using pooled probit regressions and marginal effects from tobit estimates for portfolio share. In all the regressions I include control variables. I find that the main effects of mental accounting are consistent with the results in Table 3.4 and in fact the effects become significant for portfolio share in a risky asset and a safe asset for households that exhibit *multiple mental accounts* and a *single mental account*, respectively. The results for the variables *time preference*, *risk tolerance* and *cognitive ability* are also consistent with the results in Table 3.4, with two exceptions: *time preference* becomes insignificant for ownership of risky assets; and *cognitive ability* becomes significant for portfolio share in fairly safe assets but becomes insignificant for the probability of ownership of fairly safe assets and risky assets. This result indicates that the choice to invest in a fairly safe or a safe asset may not require exceptional ability; instead, the amount to invest in a specific asset class involves a more technical balancing process which is associated with numerical skills.

With regard to the interactive effects, I see a differential impact of the variables *time preference*, *risk tolerance,* and *cognitive ability* on mental accounting across ownership and portfolio share in the three asset classes. *Time preference* reduces portfolio share of a fairly safe asset and its effect is not statistically different between households that exhibit a *single mental account* and *multiple mental accounts*; however it increases portfolio share in a safe asset among households that exhibit *multiple mental accounts.* The combinations of *risk tolerance* and mental accounting have negative effects on portfolio share in a risky asset and positive effects on portfolio share in a safe asset. These effects are statistically different between households that exhibit a *single mental account* and those that exhibit *multiple mental accounts*. The interaction term between *cognitive ability* and *multiple mental accounts* is negative and significant for portfolio share in both a risky asset and a fairly safe asset but the effect is positive for portfolio share in a safe asset.

Table 3.5 Conditional effects of mental accounting, time preference, risk tolerance and cognitive ability

The table presents raw coefficient estimates from pooled probit regressions, Column (1), (3) and (5), and marginal effects from pooled tobit regressions, Column (2), (4) and (6). The dependent variables are, risky asset, fairly safe asset, and, safe asset: ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK), Column (1) to (3). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets, Column (4) to (6). Safe asset include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products, Column (7) to (9). Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Time preference equals one if respondent would prefer GBP £ 1,100 next year and zero if GBP £ 1,000 today. Risk tolerance equals one if respondent would prefer a one in five chance of winning GBP £ 10,000 and zero if response is guaranteed GBP £ 1,000. Cognitive ability equals one if response is excellent or good and zero if response is moderate or poor. The interaction terms are for mental accounting with time preference, risk tolerance and cognitive ability. The control variables as described in Table 1 are age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Mental account (Base=none)						
Single mental account	-0.029	-0.013	0.148***	0.050***	0.032	-0.038***
	(0.054)	(0.018)	(0.042)	(0.015)	(0.109)	(0.014)
Multiple mental account	0.166***	0.037**	0.353***	0.100***	0.443***	-0.090***
	(0.049)	(0.016)	(0.043)	(0.014)	(0.149)	(0.013)
Time preference	0.043	0.000	0.082**	0.021*	-0.011	-0.009
	(0.038)	(0.012)	(0.035)	(0.012)	(0.084)	(0.011)
Risk tolerance	0.094**	0.046***	0.023	-0.010	0.030	-0.009
	(0.038)	(0.012)	(0.035)	(0.012)	(0.082)	(0.011)
Cognitive ability	0.114***	0.033**	0.042	0.029**	0.039	-0.035***
	(0.041)	(0.014)	(0.031)	(0.012)	(0.064)	(0.011)
Single mental account * time preference	0.051	0.014	-0.003	-0.035**	0.008	0.022
	(0.054)	(0.016)	(0.054)	(0.016)	(0.151)	(0.015)
Multiple mental account * time preference	0.028	0.000	0.036	-0.036**	-0.121	0.026**
	(0.047)	(0.014)	(0.050)	(0.014)	(0.159)	(0.013)

Table 3.5 Continued

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Single mental account * risk tolerance	-0.087	-0.059***	-0.021	-0.005	0.479**	0.034**
	(0.055)	(0.017)	(0.055)	(0.017)	(0.212)	(0.016)
Multiple mental account * risk tolerance	-0.020	-0.026*	-0.045	-0.020	-0.063	0.024*
	(0.048)	(0.015)	(0.051)	(0.015)	(0.167)	(0.013)
Single mental account * cognitive ability	0.059	0.011	-0.002	-0.028*	0.022	0.023
	(0.059)	(0.019)	(0.048)	(0.017)	(0.125)	(0.016)
Multiple mental account * cognitive ability	-0.037	-0.029*	0.028	-0.038**	0.030	0.046***
	(0.053)	(0.017)	(0.048)	(0.015)	(0.163)	(0.014)
Age	-0.006	-0.005***	-0.006	0.001	0.018**	-0.000
	(0.005)	(0.002)	(0.004)	(0.001)	(0.008)	(0.001)
Age square	0.000	0.000***	-0.000	-0.000***	-0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.037	0.014**	-0.207***	-0.058***	0.056	0.047***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.052)	(0.006)
Couple	0.009	-0.018**	0.146***	0.038***	0.185***	-0.028***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.058)	(0.007)
Degree level or above qualification	0.141***	0.039***	0.090***	-0.016**	0.023	0.001
	(0.024)	(0.007)	(0.026)	(0.007)	(0.070)	(0.006)
Employed or self-employed	0.036	0.022***	-0.043	0.001	0.173**	-0.002
	(0.028)	(0.008)	(0.028)	(0.008)	(0.068)	(0.008)
Has children	-0.095***	-0.021**	-0.289***	-0.057***	-0.415***	0.048***
	(0.029)	(0.009)	(0.027)	(0.008)	(0.059)	(0.008)
Lives in urban area	-0.019	-0.009	0.050**	0.035***	-0.064	-0.027***
	(0.024)	(0.007)	(0.024)	(0.007)	(0.068)	(0.006)
Christian	0.101***	0.026***	0.086***	0.036***	0.116*	-0.032***
	(0.028)	(0.008)	(0.027)	(0.008)	(0.060)	(0.008)
Has good health	0.087***	0.028***	0.047**	0.015**	-0.098	-0.024***
	(0.023)	(0.007)	(0.021)	(0.007)	(0.061)	(0.006)
White British	0.076*	0.011	0.269***	0.083***	-0.019	-0.073***
	(0.040)	(0.012)	(0.035)	(0.012)	(0.082)	(0.011)
Log of net household wealth	0.178***	0.057***	0.097***	0.024***	0.026*	-0.033***
	(0.014)	(0.004)	(0.009)	(0.003)	(0.014)	(0.003)

Table 3.5 Continued

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Log of net financial wealth	0.294***	0.078***	0.412***	0.121***	0.055***	-0.123***
	(0.008)	(0.003)	(0.008)	(0.002)	(0.014)	(0.002)
Region (Base = North East)						
North West	0.045	0.008	0.079	0.013	-0.138	-0.019
	(0.059)	(0.018)	(0.053)	(0.017)	(0.137)	(0.016)
Yorkshire & Humber	0.112*	0.018	0.149***	0.036**	-0.148	-0.032*
	(0.061)	(0.019)	(0.056)	(0.018)	(0.140)	(0.017)
East Midlands	0.132**	0.009	0.180***	0.037**	0.038	-0.032*
	(0.061)	(0.018)	(0.057)	(0.018)	(0.153)	(0.017)
West Midlands	-0.033	-0.036*	0.130**	0.018	-0.063	-0.011
	(0.061)	(0.019)	(0.055)	(0.018)	(0.141)	(0.017)
East of England	0.141**	0.031*	0.117**	0.012	-0.170	-0.018
	(0.059)	(0.018)	(0.055)	(0.018)	(0.139)	(0.016)
London	0.189***	0.033*	-0.030	-0.074***	0.135	0.055***
	(0.061)	(0.019)	(0.057)	(0.018)	(0.153)	(0.017)
South East	0.256***	0.056***	0.093*	-0.026	0.036	0.007
	(0.056)	(0.017)	(0.053)	(0.017)	(0.144)	(0.016)
South West	0.168***	0.039**	0.164***	0.017	0.102	-0.028*
	(0.060)	(0.018)	(0.056)	(0.018)	(0.162)	(0.016)
Wales	-0.047	-0.018	0.032	0.001	-0.115	0.001
	(0.067)	(0.021)	(0.059)	(0.020)	(0.154)	(0.018)
Scotland	0.047	0.023	0.045	0.026	-0.040	-0.035**
	(0.060)	(0.019)	(0.055)	(0.018)	(0.140)	(0.017)
Year (Base = 2006)						
2007	-0.057**	-0.013	-0.044*	-0.009	0.043	0.007
	(0.026)	(0.008)	(0.026)	(0.008)	(0.068)	(0.008)
2008	-0.068***	-0.036***	0.117***	0.042***	0.091	-0.027***
	(0.024)	(0.007)	(0.025)	(0.007)	(0.072)	(0.007)
2009	-0.007	-0.033***	0.260***	0.073***	0.349***	-0.049***
	(0.029)	(0.009)	(0.030)	(0.009)	(0.092)	(0.008)
2010	-0.065*	-0.044***	0.273***	0.095***	0.305***	-0.070***
	(0.035)	(0.010)	(0.036)	(0.010)	(0.115)	(0.010)
Constant	-6.348***	-1.743***	-4.836***	-1.354***	0.812***	2.390***
	(0.173)	(0.054)	(0.132)	(0.042)	(0.264)	(0.039)
Pseudo R^2	0.241	0.266	0.370	0.228	0.146	0.279
Observations	34207	33990	34207	33990	34207	33455

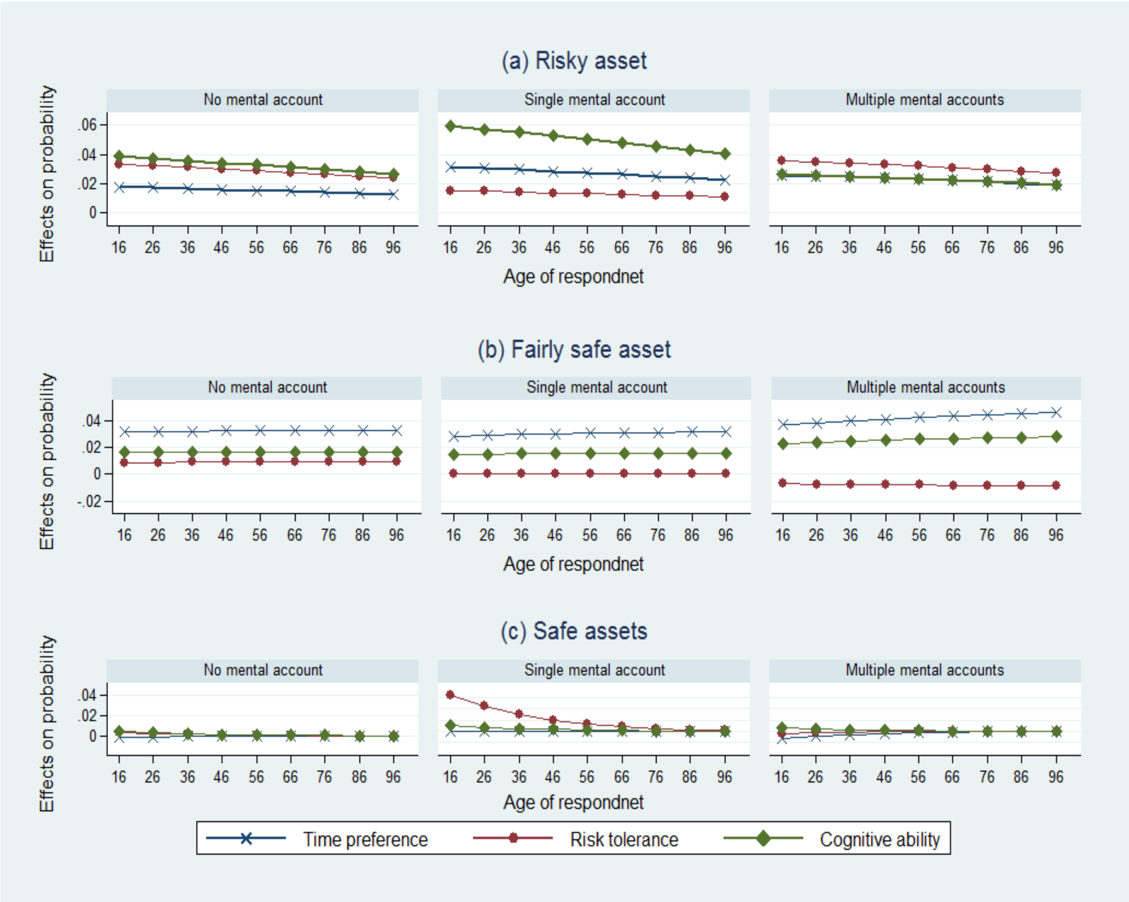
In line with the literature (Ai and Norton, 2003; Greene, 2010), Figure 3.4 displays the marginal effects of the interaction terms derived from the probit estimates in Table 3.5 by mental accounts and across age. For ownership of a risky asset (Panel (a)), I find that the marginal effect of *time preference* has a significant effect at the 5% level for households that exhibit a *single mental account* and *multiple mental accounts*; *risk tolerance* has a significant effect among households that exhibit *no mental account* (5% level) and those that exhibit *multiple mental accounts* (1% level); and *cognitive ability* has a significant effect at the 1% level for both *no mental account* and a *single mental account*, and at the 5% level for *multiple mental accounts*.

For ownership of a fairly safe asset (Panel (b)), *time preference* has a significant effect among households that exhibit *no mental account* (5% level), those that exhibit a *single mental account* (10% level) and for those that exhibit *multiple mental accounts* (1% level). *Cognitive ability* has a significant effect, but only at the 10% level, among households that exhibit multiple mental accounts while *risk tolerance* has no effect across all mental accounts. As expected, *time preference*, *risk tolerance* and *cognitive ability* have no significant effects across mental accounts for ownership of a safe asset, Panel (c).

Taken together, these results show that mental accounting, *time preference, risk tolerance* and *cognitive ability* are associated with both the probability of owning and the portfolio share in the three asset classes. Remarkably, for the conditional regressions, the estimates for mental accounting are about two times larger than those for the unconditional regressions. However, comparisons between the conditional and unconditional regressions, using a likelihood ratio test, result in statistically significant improvements of model fit for portfolio share regressions and the result for ownership

Figure 3.4 Conditional marginal effects of time preference, risk tolerance and cognitive ability

The figure displays conditional marginal effects of time preference, risk tolerance and cognitive ability on the probability of owning a risky asset, a fairly safe asset and a safe asset. The marginal effects are calculated using estimates derived from pooled probit regressions in Table 3.5: that is, column (3) specification for Panel (a); column (6) specification for Panel (b); and column (9) specification for Panel (c). The marginal effects are evaluated at highest value of all explanatory variables apart from age, total household wealth and total financial wealth which are evaluated using their average values.



are insignificant. Nonetheless, these results are consistent with hypotheses 1a and 1b in that similar households with different mental accounts make varying portfolio choices and that, conditional on mental accounting, portfolio choice also varies with *time preference*, *risk tolerance* and *cognitive ability*. The regressions in Columns (3), (6) and (9) of Table 3.4 and Table 3.5 are henceforth referred to as the baseline regressions.

3.5.2 Financial advice, mental accounting and portfolio choice

Table 3.6 extends the analysis and includes financial advice as an additional explanatory variable to the baseline regressions in Table 3.4. For each asset class, I run two regressions using both pooled probit and tobit regressions for ownership and portfolio share, respectively, using specifications that include mental accounts, *time preference*, *risk tolerance, cognitive ability* and the control variables. Overall, the results show that financial advice has a positive influence on ownership and share of risky assets and fairly safe assets but has a negative effect on share of safe assets. However, when interacted with mental accounting, financial advice reduces share of fairly safe assets and increases share of safe assets.

The results for the variables mental accounts, *time preference*, *risk tolerance* and *cognitive ability* are consistent with the results in Table 3.4 for both ownership and portfolio share. For ownership and portfolio share in a risky asset, the entering variable, financial advice, has a weak and negative effect among households that exhibit a *single source* of advice and it has a weak and positive effect for those that exhibit *multiple sources*. Concerning ownership and portfolio share in a fairly safe asset, financial advice is positive and highly significant for both *single source* and *multiple sources* of financial advice. However, for safe assets financial advice is insignificant for ownership and is negative and significant for portfolio share. Although most of the control variables remain unchanged, I see a change in the magnitude, sign and levels of significance for the year dummies. For example, with regard to portfolio share, the effects across the three asset classes become significant for 2007; the effects are positive for portfolio share in a safe asset and are negative for portfolio share in both a risky and a fairly safe asset.

Table 3.6 Effects of mental accounting and financial advice

The table presents marginal effects from both pooled probit regressions, (Column (1), (3) and (5), and from pooled tobit regressions, (Column (2), (4) and (6)). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Time preference equals one if respondent would prefer GBP £ 1,100 next year and zero if GBP £ 1,000 today. Risk tolerance equals one if respondent would prefer a one in five chance of winning GBP £ 10,000 and zero if response is guaranteed GBP £ 1,000. Cognitive ability equals one if response is excellent or good and zero if response is moderate or poor. The control variables as described in Table 1 are age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, expects good financial situation, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Mental account (Base=none)						
Single mental account	0.003	-0.014*	0.034***	0.021***	0.002*	-0.009
	(0.006)	(0.008)	(0.005)	(0.007)	(0.001)	(0.007)
Multiple mental account	0.031***	0.005	0.084***	0.055***	0.006***	-0.040***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
Financial advice (Base=none)						
Single source	-0.009*	-0.014*	0.017***	0.042***	-0.001	-0.037***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.007)
Multiple sources	0.010*	0.016**	0.041***	0.056***	-0.001	-0.062***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.007)
Time preference	0.016***	0.004	0.021***	-0.004	-0.001	0.009
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Risk tolerance	0.015***	0.019***	0.000	-0.019***	0.002	0.009
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)

Table 3.6 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Cognitive ability	0.026***	0.024***	0.011**	0.010	0.001	-0.015**
	(0.006)	(0.008)	(0.005)	(0.007)	(0.001)	(0.007)
Age	-0.001	-0.005***	-0.001	0.001	0.000**	-0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Age square	0.000	0.000***	-0.000	-0.000***	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.009	0.014**	-0.046***	-0.057***	0.001	0.046***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
Couple	0.002	-0.018**	0.034***	0.038***	0.003***	-0.029***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.007)
Degree level or above qualification	0.033***	0.038***	0.019***	-0.019***	0.000	0.004
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Employed or self-employed	0.008	0.022***	-0.011*	0.000	0.003**	-0.002
	(0.007)	(0.008)	(0.006)	(0.008)	(0.001)	(0.008)
Has children	-0.022***	-0.021**	-0.068***	-0.057***	-0.010***	0.048***
	(0.007)	(0.008)	(0.007)	(0.008)	(0.002)	(0.008)
Lives in urban area	-0.005	-0.009	0.012**	0.035***	-0.001	-0.027***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Christian	0.023***	0.025***	0.019***	0.034***	0.002*	-0.030***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.007)
Has good health	0.020***	0.028***	0.010**	0.014**	-0.002	-0.024***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
White British	0.017*	0.009	0.061***	0.080***	-0.000	-0.070***
	(0.009)	(0.012)	(0.009)	(0.012)	(0.002)	(0.011)
Log of net household wealth	0.042***	0.056***	0.021***	0.023***	0.001*	-0.032***
	(0.003)	(0.004)	(0.002)	(0.003)	(0.000)	(0.003)
Log of net financial wealth	0.069***	0.077***	0.093***	0.120***	0.001***	-0.122***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.000)	(0.002)

Table 3.6 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Region (Base = North East)						
North West	0.010	0.006	0.016	0.012	-0.003	-0.017
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)
Yorkshire & Humber	0.025*	0.016	0.032**	0.034*	-0.003	-0.029*
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
East Midlands	0.030**	0.007	0.039***	0.034*	0.001	-0.028*
	(0.014)	(0.018)	(0.013)	(0.018)	(0.003)	(0.017)
West Midlands	-0.008	-0.037**	0.028**	0.017	-0.001	-0.009
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.017)
East of England	0.032**	0.029	0.024*	0.010	-0.003	-0.015
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)
London	0.043***	0.030	-0.009	-0.077***	0.003	0.058***
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
South East	0.059***	0.053***	0.019	-0.028*	0.001	0.010
	(0.013)	(0.017)	(0.012)	(0.017)	(0.003)	(0.016)
South West	0.038***	0.036*	0.034***	0.014	0.002	-0.023
	(0.014)	(0.018)	(0.013)	(0.018)	(0.003)	(0.016)
Wales	-0.011	-0.018	0.008	0.001	-0.002	0.001
	(0.016)	(0.021)	(0.014)	(0.020)	(0.003)	(0.018)
Scotland	0.012	0.024	0.010	0.024	-0.001	-0.033**
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.017)
Year (Base = 2006)						
2007	-0.016**	-0.016**	-0.020***	-0.023***	0.001	0.022***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.008)
2008	-0.020***	-0.042***	0.007	0.016**	0.002	0.001
	(0.006)	(0.008)	(0.006)	(0.008)	(0.002)	(0.008)
2009	-0.005	-0.039***	0.041***	0.048***	0.007***	-0.022**
	(0.007)	(0.009)	(0.007)	(0.009)	(0.002)	(0.008)
2010	-0.019**	-0.050***	0.044***	0.069***	0.006***	-0.042***
	(0.008)	(0.011)	(0.009)	(0.011)	(0.002)	(0.010)
Constant		-1.725***		-1.330***		2.364***
		(0.053)		(0.041)		(0.039)
Pseudo R^2	0.242	0.266	0.371	0.229	0.143	0.280
Observations	34207	33990	34207	33990	34207	33455

After 2007, the signs are reversed and become positive for portfolio share in a fairly safe asset and negative for portfolio share in a safe asset. These findings supports our conjecture that most households reduced their investment in risky assets and safe assets after the global economic crisis and instead increased their investment in fairly safe assets. In addition, when I test for the fitness of the model using a likelihood ratio test, inclusion of financial advice leads to a statistically significant improvement of the models in Table 3.5, apart from ownership of risky assets which is insignificant.

To investigate the effects of financial advice, conditional on mental accounting, I interact mental accounting with financial advice using the specifications in Table 3.5. Table 3.7 presents raw coefficient estimates for ownership and marginal effects for portfolio share. Beginning with the main effects of the key variables, the result for financial advice is similar to the unconditional analysis result in Table 3.6; however, the effects of a *single source of advice* become insignificant. In addition, for mental accounting and the variables *time preference*, *risk tolerance* and *cognitive ability* the findings are consistent with the results in Table 3.5 apart from the effect of mental accounting on ownership of a safe asset, which declines in significance. The interaction terms show that exhibiting a *single mental account* or *multiple mental accounts* and having a *single advisor* or *multiple advisors* differentially influence portfolio choice over and above the influence captured by interactions between mental accounting and *time preference*, *risk tolerance* and *cognitive ability* in Table 3.5.

For example, the interaction term between *multiple mental accounts* and *single source* of financial advice has a negative influence on both the ownership and portfolio share in fairly safe assets, and it has a positive effect on the ownership of and portfolio share in a safe asset.

Table 3.7 Conditional marginal effects of mental accounting and financial advice

The table presents raw coefficient estimates from pooled probit regressions, Column (1), (3) and (5), and marginal effects from pooled tobit regressions, Column (2), (4) and (6). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Time preference equals one if respondent would prefer GBP £ 1,100 next year and zero if GBP £ 1,000 today. Risk tolerance equals one if respondent would prefer a one in five chance of winning GBP £ 10,000 and zero if response is guaranteed GBP £ 1,000. The interaction terms are for mental accounts interacted with financial advice, risk tolerance, risk perceptions and cognitive ability. The control variables as described in Table 1 are age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Mental account (Base=none)						
Single mental account	-0.059	-0.018	0.127**	0.068***	0.098	-0.058***
	(0.065)	(0.021)	(0.051)	(0.019)	(0.137)	(0.017)
Multiple mental account	0.211***	0.055***	0.371***	0.130***	0.317*	-0.124***
	(0.059)	(0.019)	(0.052)	(0.017)	(0.175)	(0.016)
Financial advice (Base=none)						
Single source	-0.033	-0.010	0.094***	0.063***	-0.119	-0.061***
	(0.040)	(0.013)	(0.032)	(0.012)	(0.075)	(0.011)
Multiple sources	0.069*	0.033**	0.158***	0.084***	0.021	-0.096***
	(0.039)	(0.013)	(0.034)	(0.012)	(0.088)	(0.011)
Time preference	0.042	0.000	0.082**	0.021*	-0.009	-0.008
	(0.038)	(0.012)	(0.035)	(0.012)	(0.084)	(0.011)
Risk tolerance	0.093**	0.045***	0.025	-0.009	0.028	-0.010
	(0.038)	(0.012)	(0.035)	(0.012)	(0.082)	(0.011)

Table 3.7 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Cognitive ability	0.113***	0.033**	0.045	0.029**	0.032	-0.035***
	(0.041)	(0.014)	(0.031)	(0.012)	(0.064)	(0.011)
Single mental account * single source	0.041	0.012	0.007	-0.024	-0.031	0.027*
	(0.058)	(0.018)	(0.051)	(0.018)	(0.145)	(0.016)
Single mental account * multiple sources	0.053	0.004	0.068	-0.033*	-0.219	0.036**
	(0.057)	(0.018)	(0.054)	(0.017)	(0.151)	(0.016)
Multiple mental account * single source	-0.046	-0.017	-0.092*	-0.044***	0.436**	0.048***
	(0.053)	(0.016)	(0.051)	(0.016)	(0.218)	(0.015)
Multiple mental account * multiple sources	-0.084*	-0.038**	0.010	-0.051***	0.024	0.062***
	(0.049)	(0.015)	(0.049)	(0.015)	(0.161)	(0.014)
Single mental account * time preference	0.049	0.014	-0.004	-0.035**	0.015	0.022
	(0.054)	(0.016)	(0.054)	(0.016)	(0.151)	(0.015)
Multiple mental account * time preference	0.030	0.001	0.033	-0.034**	-0.113	0.025*
	(0.047)	(0.014)	(0.050)	(0.014)	(0.159)	(0.013)
Single mental account * risk tolerance	-0.088	-0.059***	-0.020	-0.005	0.483**	0.034**
	(0.055)	(0.017)	(0.055)	(0.017)	(0.212)	(0.016)
Multiple mental account * risk tolerance	-0.021	-0.026*	-0.052	-0.021	-0.052	0.025*
	(0.048)	(0.015)	(0.051)	(0.014)	(0.167)	(0.013)
Single mental account * cognitive ability	0.055	0.010	-0.007	-0.027	0.040	0.023
	(0.059)	(0.019)	(0.048)	(0.017)	(0.124)	(0.016)
Multiple mental account * cognitive ability	-0.036	-0.028*	0.025	-0.037**	0.040	0.045***
	(0.053)	(0.017)	(0.048)	(0.015)	(0.164)	(0.014)
Age	-0.005	-0.005***	-0.005	0.001	0.018**	-0.000
	(0.005)	(0.002)	(0.004)	(0.001)	(0.008)	(0.001)
Age square	0.000	0.000***	-0.000	-0.000***	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.037	0.014**	-0.205***	-0.056***	0.056	0.046***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.052)	(0.006)
Couple	0.009	-0.018**	0.146***	0.038***	0.189***	-0.028***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.058)	(0.007)
Degree level or above qualification	0.138***	0.038***	0.082***	-0.018***	0.022	0.003
	(0.024)	(0.007)	(0.027)	(0.007)	(0.071)	(0.006)

Table 3.7 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Employed or self-employed	0.034	0.022***	-0.049*	0.000	0.174**	-0.001
	(0.028)	(0.008)	(0.028)	(0.008)	(0.068)	(0.008)
Has children	-0.095***	-0.021**	-0.288***	-0.057***	-0.417***	0.048***
	(0.029)	(0.008)	(0.028)	(0.008)	(0.059)	(0.008)
Lives in urban area	-0.019	-0.009	0.051**	0.035***	-0.066	-0.027***
	(0.024)	(0.007)	(0.024)	(0.007)	(0.068)	(0.006)
Christian	0.100***	0.025***	0.081***	0.034***	0.118**	-0.030***
	(0.028)	(0.008)	(0.027)	(0.008)	(0.060)	(0.007)
Has good health	0.086***	0.028***	0.045**	0.013**	-0.098	-0.023***
	(0.023)	(0.007)	(0.021)	(0.007)	(0.061)	(0.006)
White British	0.072*	0.009	0.260***	0.080***	-0.019	-0.070***
	(0.040)	(0.012)	(0.035)	(0.012)	(0.083)	(0.011)
Log of net household wealth	0.177***	0.056***	0.094***	0.023***	0.027*	-0.032***
	(0.014)	(0.004)	(0.009)	(0.003)	(0.014)	(0.003)
Log of net financial wealth	0.294***	0.077***	0.410***	0.120***	0.055***	-0.122***
	(0.008)	(0.003)	(0.008)	(0.002)	(0.014)	(0.002)
Region (Base = North East)						
North West	0.040	0.005	0.068	0.011	-0.126	-0.016
	(0.059)	(0.018)	(0.053)	(0.017)	(0.137)	(0.016)
Yorkshire & Humber	0.106*	0.015	0.138**	0.034*	-0.136	-0.029*
	(0.061)	(0.019)	(0.056)	(0.018)	(0.141)	(0.017)
East Midlands	0.130**	0.008	0.170***	0.035*	0.047	-0.029*
	(0.061)	(0.018)	(0.057)	(0.018)	(0.153)	(0.017)
West Midlands	-0.036	-0.037**	0.123**	0.017	-0.053	-0.009
	(0.061)	(0.019)	(0.055)	(0.018)	(0.142)	(0.017)
East of England	0.135**	0.029	0.103*	0.010	-0.158	-0.015
	(0.059)	(0.018)	(0.055)	(0.017)	(0.139)	(0.016)
London	0.184***	0.031	-0.043	-0.076***	0.147	0.058***
	(0.061)	(0.019)	(0.058)	(0.018)	(0.154)	(0.017)
South East	0.250***	0.054***	0.082	-0.028*	0.048	0.010
	(0.056)	(0.017)	(0.053)	(0.017)	(0.144)	(0.016)

Table 3.7 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
South West	0.162***	0.036*	0.149***	0.013	0.113	-0.023
	(0.060)	(0.018)	(0.056)	(0.018)	(0.163)	(0.016)
Wales	-0.046	-0.018	0.033	0.001	-0.102	0.001
	(0.067)	(0.021)	(0.059)	(0.020)	(0.154)	(0.018)
Scotland	0.050	0.024	0.041	0.025	-0.026	-0.033**
	(0.060)	(0.019)	(0.055)	(0.018)	(0.140)	(0.017)
Year (Base = 2006)						
2007	-0.066**	-0.016**	-0.089***	-0.023***	0.065	0.022***
	(0.027)	(0.008)	(0.027)	(0.008)	(0.071)	(0.008)
2008	-0.084***	-0.042***	0.031	0.016**	0.127	0.002
	(0.026)	(0.008)	(0.028)	(0.008)	(0.084)	(0.008)
2009	-0.021	-0.038***	0.179***	0.047***	0.388***	-0.022**
	(0.031)	(0.009)	(0.032)	(0.009)	(0.101)	(0.009)
2010	-0.080**	-0.050***	0.191***	0.069***	0.346***	-0.042***
	(0.036)	(0.011)	(0.038)	(0.011)	(0.119)	(0.010)
Constant	-6.339***	-1.740***	-4.827***	-1.363***	0.800***	2.400***
	(0.174)	(0.054)	(0.132)	(0.042)	(0.265)	(0.039)
Pseudo R^2	0.242	0.267	0.372	0.229	0.148	0.281
Observations	34207	33990	34207	33990	34207	33455

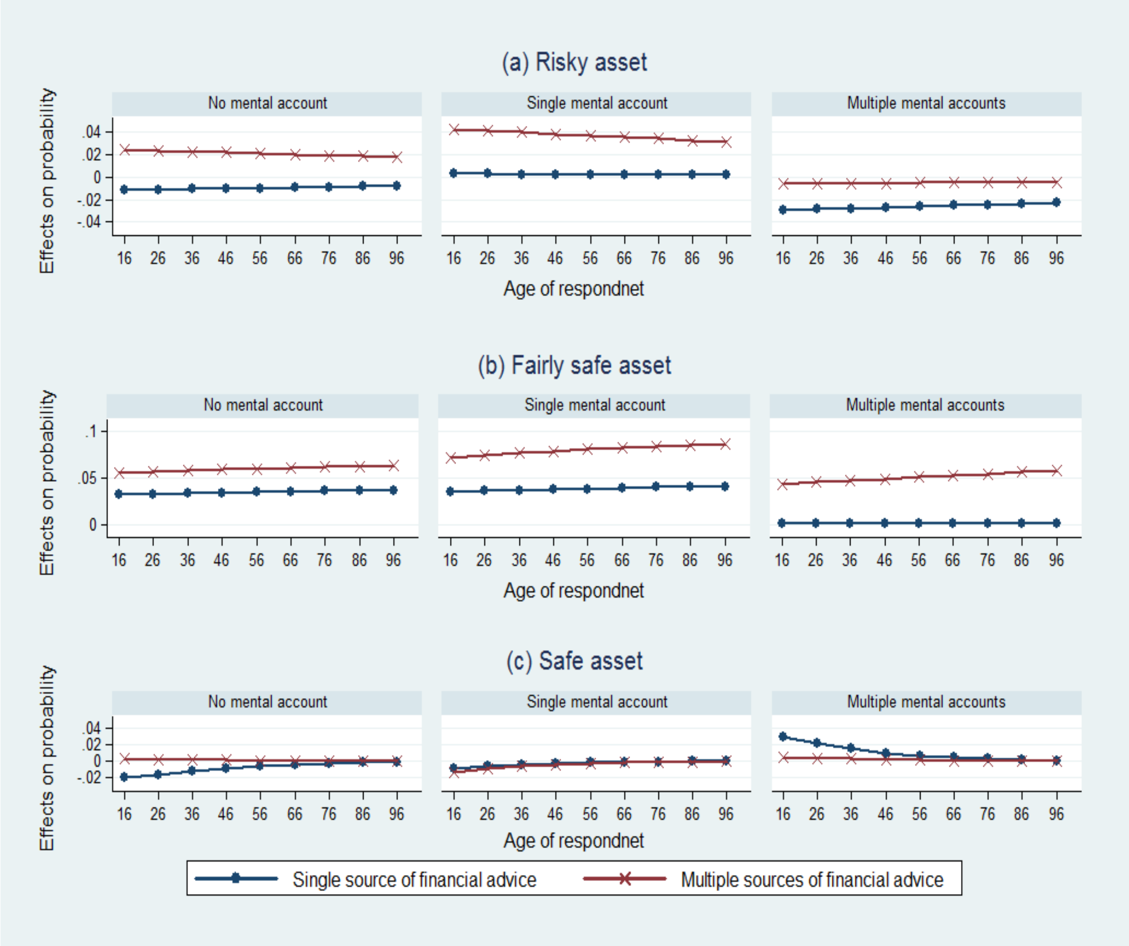
Further, the interaction term between *multiple mental accounts* and *multiple sources* of financial advice is negative for both ownership of and portfolio share in a risky asset; is negative for portfolio share in a fairly safe asset; and is positive for portfolio share in a safe asset.

Figure 3.5 displays the conditional marginal effects of financial advice on mental accounts calculated using the probit regressions in Table 3.7. For ownership of a risky asset, Figure (a), a *single source* of advice has a negative and significant effect at the 5% level among households that exhibit *multiple mental accounts* while *multiple sources* of financial advice has a positive and significant effect at the 10% level among households that exhibit *no mental account* and a positive and significant effect at the 1% level among those households that exhibit a *single mental account*. Panel (b) shows the conditional effects of financial advice on ownership of a fairly safe asset. The effects of a *single of source* of financial advice is significant at the 1% level among household that exhibit *no mental account* and is positive and significant at the 5% level for those that exhibit a *single mental account*. Across all mental accounts, *multiple sources* of financial advice has a positive and highly significant effect on ownership of a fairly safe asset. For ownership of safe assets, Panel (c), the effect of financial advice is insignificant.

In summary, these results are in line with hypotheses 2(a) and 2(b) and support both the extended BPT theory of Alexandre and Baptista (2011), which incorporates financial advice, and the findings in Bhattacharya *et al.* (2012). However, the interactive effect of financial advice appears to be relevant only for portfolio share in the three asset classes and not for ownership; a likelihood ratio test

Figure 3.5 Conditional marginal effects of financial advice on ownership

The figure displays conditional marginal effects of financial advice on the probability of owning a risky asset, a fairly safe asset and a safe asset. The marginal effects are calculated using estimates derived from pooled probit regressions in Table 3.7: that is, column (1) specification for Panel (a); column (3) specification for Panel (b); and column (5) specification for Panel (c). The marginal effects are evaluated at highest value of all explanatory variables apart from age, total household wealth and total financial wealth which are evaluated at their average values.



comparing the unconditional regressions (in Table 3.6) and conditional regressions (in Table 3.7) does not improve the model fit for ownership but yields statistically significant improvement for portfolio share. The finding that, when compared with households that have *no mental account* and do not seek financial advice, households that exhibit a *single mental account* or *multiple mental accounts* and have a *single source* or *multiple sources* of financial advice have low proportions of fairly safe assets and high proportions of safe asset, indicates that these households may be holding sub-optimal portfolios. This result is consistent with findings in other studies, which suggest that investors do not follow the recommendations made by financial advisors (Bhattacharya *et al.*, 2012; Hackethal *et al.*, 2012).

3.5.3 Housing tenure, mental accounts and portfolio choice

In this section I extend the analysis further and include housing tenure to examine the influence of both background risk/asset. Table 3.8 reports the results, in which I add housing tenure to the specifications in Table 3.6 and I include interaction terms in Table 3.9 using the specifications in Table 3.7. For each asset class, I run two regressions using pooled probit and tobit regressions for ownership and portfolio share, respectively, and I report marginal effects. In summary, the results show that the influence of housing tenure is subsumed by mental accounting for ownership and portfolio share in risky assets. When interacted with mental accounting, housing tenure increases ownership and portfolio share in risky assets.

The results show that housing tenure influences portfolio choice. For ownership of and portfolio share in a risky asset, I find a significant effect of homeownership through a mortgage. However, for ownership of a risky asset, there is no significant difference between households that own their home through a mortgage and those that own outright. Regarding fairly safe assets, both ownership and portfolio share are influenced by housing tenure; the effect of homeownership through a mortgage is higher than that of outright ownership and this difference is significant at the 5% level. For portfolio share in a safe asset, the effect is negative and significant for homeownership through a mortgage and outright homeownership; the effects are significantly different at the 1% level, suggesting that households that own their home through a mortgage have a low proportion of safe assets compared to those that own their homes outright.

Table 3.8 Effects of mental accounting, financial advice and housing tenure

The table presents marginal effects from both pooled probit regressions (Column (1), (3) and (5)) and from pooled tobit regressions (Column (2), (4) and (6)). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Mental account (Base=none)						
Single mental account	0.002	-0.014*	0.034***	0.021***	0.002*	-0.009
	(0.006)	(0.008)	(0.005)	(0.007)	(0.001)	(0.007)
Multiple mental account	0.032***	0.005	0.084***	0.055***	0.006***	-0.040***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
Financial advice (Base=none)						
Single source	-0.009*	-0.014*	0.017***	0.042***	-0.001	-0.038***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.007)
Multiple sources	0.011*	0.017**	0.043***	0.057***	-0.001	-0.064***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.007)
Housing tenure (Base=rents)						
Under a mortgage	0.024**	0.031**	0.020**	0.141***	0.001	-0.123***
	(0.009)	(0.013)	(0.009)	(0.012)	(0.002)	(0.011)
Own outright	0.024**	0.014	0.071***	0.132***	0.002	-0.109***
	(0.010)	(0.013)	(0.009)	(0.012)	(0.002)	(0.011)

Table 3.8 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Time preference	0.016***	0.005	0.020***	-0.002	-0.001	0.007
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Risk tolerance	0.015***	0.019***	0.001	-0.019***	0.002*	0.009
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Cognitive ability	0.026***	0.023***	0.013**	0.011	0.001	-0.016**
	(0.006)	(0.008)	(0.005)	(0.007)	(0.001)	(0.007)
Age	-0.001	-0.004***	-0.001	0.003**	0.000**	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Age square	0.000	0.000***	-0.000*	-0.000***	-0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.009	0.014**	-0.044***	-0.055***	0.001	0.045***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
Couple	0.002	-0.018**	0.033***	0.036***	0.003***	-0.027***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.007)
Degree level or above qualification	0.034***	0.038***	0.022***	-0.014**	0.000	-0.000
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Employed or self-employed	0.007	0.018**	-0.001	-0.007	0.003**	0.006
	(0.007)	(0.008)	(0.007)	(0.008)	(0.001)	(0.008)
Has children	-0.022***	-0.024***	-0.060***	-0.059***	-0.009***	0.051***
	(0.007)	(0.009)	(0.007)	(0.008)	(0.002)	(0.008)
Lives in urban area	-0.006	-0.010	0.011**	0.030***	-0.001	-0.022***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Christian	0.023***	0.025***	0.020***	0.034***	0.002*	-0.030***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.007)
Has good health	0.020***	0.028***	0.008	0.011*	-0.002*	-0.021***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
White British	0.016*	0.008	0.064***	0.076***	-0.000	-0.066***
	(0.009)	(0.012)	(0.009)	(0.012)	(0.002)	(0.011)
Log of net household wealth	0.037***	0.053***	0.010***	-0.003	0.000	-0.010***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.000)	(0.003)
Log of net financial wealth	0.070***	0.078***	0.093***	0.122***	0.001***	-0.124***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.000)	(0.002)

Table 3.8 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	portfolio share	Ownership	portfolio share	Ownership	portfolio share
Region (Base = North East)						
North West	0.009	0.006	0.014	0.010	-0.003	-0.015
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)
Yorkshire & Humber	0.025*	0.016	0.032**	0.034*	-0.003	-0.030*
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
East Midlands	0.030**	0.007	0.036***	0.031*	0.001	-0.026
	(0.014)	(0.018)	(0.013)	(0.018)	(0.003)	(0.017)
West Midlands	-0.009	-0.037**	0.026**	0.015	-0.001	-0.008
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.017)
East of England	0.032**	0.029	0.024*	0.010	-0.003	-0.016
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)
London	0.045***	0.031*	-0.004	-0.067***	0.003	0.049***
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
South East	0.060***	0.054***	0.021*	-0.023	0.001	0.006
	(0.013)	(0.017)	(0.012)	(0.017)	(0.003)	(0.016)
South West	0.038***	0.036*	0.034***	0.015	0.002	-0.025
	(0.014)	(0.018)	(0.013)	(0.018)	(0.003)	(0.016)
Wales	-0.012	-0.018	0.004	-0.005	-0.002	0.005
	(0.016)	(0.021)	(0.013)	(0.020)	(0.003)	(0.018)
Scotland	0.012	0.024	0.010	0.025	-0.001	-0.033**
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.017)
Year (Base = 2006)						
2007	-0.015**	-0.016*	-0.020***	-0.021**	0.001	0.020***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.008)
2008	-0.020***	-0.042***	0.008	0.019**	0.002	-0.001
	(0.006)	(0.008)	(0.006)	(0.008)	(0.002)	(0.008)
2009	-0.004	-0.038***	0.043***	0.054***	0.007***	-0.027***
	(0.007)	(0.009)	(0.007)	(0.009)	(0.002)	(0.009)
2010	-0.018**	-0.049***	0.046***	0.075***	0.006***	-0.047***
	(0.008)	(0.011)	(0.009)	(0.011)	(0.002)	(0.010)
Constant		-1.725***		-1.169***		2.231***
		(0.056)		(0.044)		(0.041)
Pseudo R^2	0.242	0.266	0.374	0.233	0.144	0.283
Observations	34205	33988	34205	33988	34205	33453

When compared to the results in Table 3.6, the effects of mental accounting, financial advice and the variables, *time preference*, *risk tolerance* and *cognitive ability* remain unchanged. In addition, the control variables remain unchanged apart from total household wealth, which reduces in magnitude or becomes insignificant. This is expected since, as discussed earlier, housing wealth constitutes a higher proportion of household wealth, which is now captured by housing tenure.

Table 3.9 reports raw coefficient estimates for ownership and marginal effects for portfolio share for the conditional effects of housing tenure using the specifications in Table 3.7. The analysis includes interaction terms and combines mental accounting with housing tenure, financial advice, *time preference, risk tolerance* and *cognitive ability*. When compared to the analysis in Table 3.7, I find that the results for the main effects of the variables financial advice, *time preference, risk tolerance* and *cognitive ability* are generally consistent for both ownership and portfolio share in the three asset categories. However, for risky asset, the effect of mental accounting on ownership and portfolio share are reversed and become negative and significant among households that exhibit a *single mental account*. Furthermore, for portfolio share in fairly safe assets and safe assets the magnitudes of the effects of housing tenure increase substantially, especially among households' that have *multiple mental accounts*. The main effect of housing tenure, when compared to the results in Table 3.8, becomes insignificant for both ownership of and portfolio share in a risky asset; the effect becomes insignificant for ownership of a fairly safe asset among households that own their homes through a mortgage; and remain unchanged for portfolio share in a fairly safe asset and a safe asset.

Table 3.9 Conditional marginal effects of mental accounting, financial advice, and housing tenure

The table presents raw coefficient estimates from pooled probit regressions, Column (1), (3) and (5), and marginal effects from pooled tobit regressions, Column (2), (4) and (6). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if one source of advice is identified and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Mental account (Base=none)						
Single mental account	-0.305***	-0.072**	0.130**	0.100***	0.248	-0.082***
	(0.101)	(0.032)	(0.062)	(0.024)	(0.173)	(0.023)
Multiple mental account	0.110	0.046*	0.350***	0.219***	0.284	-0.197***
	(0.086)	(0.028)	(0.064)	(0.023)	(0.182)	(0.022)
Financial advice (Base=none)						
Single source	-0.031	-0.010	0.096***	0.060***	-0.122	-0.059***
	(0.040)	(0.013)	(0.032)	(0.012)	(0.075)	(0.011)
Multiple sources	0.076*	0.034***	0.176***	0.086***	0.012	-0.097***
	(0.039)	(0.013)	(0.034)	(0.012)	(0.088)	(0.011)
Home tenure (Base=rents)						
Under a mortgage	-0.040	0.011	-0.029	0.142***	0.123	-0.127***
	(0.061)	(0.020)	(0.045)	(0.018)	(0.099)	(0.016)
Own outright	0.006	-0.004	0.342***	0.203***	0.123	-0.163***
	(0.058)	(0.019)	(0.042)	(0.017)	(0.098)	(0.015)

Table 3.9 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Time preference	0.043	0.001	0.080**	0.019	-0.013	-0.008
	(0.038)	(0.012)	(0.035)	(0.012)	(0.084)	(0.011)
Risk tolerance	0.098**	0.046***	0.036	-0.009	0.021	-0.009
	(0.038)	(0.012)	(0.035)	(0.012)	(0.083)	(0.011)
Cognitive ability	0.121***	0.033**	0.063**	0.029**	0.024	-0.035***
	(0.041)	(0.014)	(0.031)	(0.012)	(0.064)	(0.011)
Single mental account * single source	0.041	0.011	0.010	-0.020	-0.001	0.025
	(0.058)	(0.018)	(0.051)	(0.018)	(0.145)	(0.016)
Single mental account * multiple sources	0.041	0.001	0.048	-0.035**	-0.164	0.038**
	(0.057)	(0.018)	(0.054)	(0.017)	(0.151)	(0.016)
Multiple mental account * single source	-0.048	-0.017	-0.093*	-0.037**	0.446**	0.042***
	(0.053)	(0.016)	(0.051)	(0.016)	(0.215)	(0.015)
Multiple mental account * multiple sources	-0.089*	-0.038**	-0.012	-0.051***	0.017	0.061***
	(0.049)	(0.015)	(0.050)	(0.015)	(0.163)	(0.014)
Single mental account * under a mortgage	0.359***	0.075**	0.171***	0.016	-0.424***	-0.012
	(0.093)	(0.030)	(0.062)	(0.024)	(0.151)	(0.022)
Single mental account * own outright	0.255***	0.059**	-0.070	-0.076***	-0.211	0.057***
	(0.088)	(0.028)	(0.056)	(0.021)	(0.153)	(0.020)
Multiple mental account * under a mortgage	0.151**	0.010	0.198***	-0.046**	0.125	0.047**
	(0.077)	(0.025)	(0.060)	(0.022)	(0.187)	(0.020)
Multiple mental account * own outright	0.110	0.014	-0.056	-0.154***	-0.061	0.122***
	(0.073)	(0.023)	(0.057)	(0.020)	(0.180)	(0.019)
Single mental account * time preference	0.048	0.013	-0.011	-0.032*	0.025	0.019
	(0.054)	(0.016)	(0.054)	(0.016)	(0.151)	(0.015)
Multiple mental account * time preference	0.030	0.001	0.028	-0.030**	-0.112	0.021
	(0.046)	(0.014)	(0.050)	(0.014)	(0.159)	(0.013)
Single mental account * risk tolerance	-0.097*	-0.060***	-0.037	-0.004	0.496**	0.033**
	(0.056)	(0.017)	(0.055)	(0.017)	(0.215)	(0.016)
Multiple mental account * risk tolerance	-0.025	-0.026*	-0.066	-0.019	-0.055	0.022*
	(0.048)	(0.015)	(0.051)	(0.015)	(0.166)	(0.013)
Single mental account * cognitive ability	0.039	0.007	-0.032	-0.028*	0.102	0.023
	(0.059)	(0.019)	(0.048)	(0.017)	(0.122)	(0.016)

Table 3.9 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Multiple mental account * cognitive ability	-0.044	-0.029*	0.004	-0.033**	0.031	0.040***
	(0.053)	(0.017)	(0.048)	(0.015)	(0.164)	(0.014)
Age	-0.005	-0.004***	-0.003	0.004***	0.019**	-0.002*
	(0.005)	(0.002)	(0.004)	(0.001)	(0.008)	(0.001)
Age square	0.000	0.000***	-0.000*	-0.000***	-0.000*	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.040*	0.014**	-0.198***	-0.055***	0.056	0.045***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.052)	(0.006)
Couple	0.007	-0.019**	0.143***	0.036***	0.184***	-0.027***
	(0.024)	(0.007)	(0.023)	(0.007)	(0.058)	(0.007)
Degree level or above qualification	0.142***	0.038***	0.098***	-0.012*	0.027	-0.002
	(0.024)	(0.007)	(0.027)	(0.007)	(0.070)	(0.006)
Employed or self-employed	0.034	0.018**	0.001	-0.007	0.174**	0.006
	(0.029)	(0.008)	(0.029)	(0.008)	(0.074)	(0.008)
Has children	-0.096***	-0.024***	-0.253***	-0.055***	-0.417***	0.047***
	(0.029)	(0.009)	(0.028)	(0.008)	(0.058)	(0.008)
Lives in urban area	-0.024	-0.010	0.048**	0.030***	-0.067	-0.022***
	(0.024)	(0.007)	(0.024)	(0.007)	(0.068)	(0.006)
Christian	0.100***	0.026***	0.084***	0.033***	0.118**	-0.029***
	(0.028)	(0.008)	(0.027)	(0.008)	(0.060)	(0.007)
Has good health	0.085***	0.028***	0.034	0.011	-0.099	-0.021***
	(0.023)	(0.007)	(0.022)	(0.007)	(0.061)	(0.006)
White British	0.066*	0.007	0.271***	0.078***	-0.011	-0.067***
	(0.040)	(0.012)	(0.035)	(0.012)	(0.083)	(0.011)
Log of net household wealth	0.160***	0.053***	0.045***	-0.005	0.019	-0.008**
	(0.015)	(0.005)	(0.011)	(0.004)	(0.017)	(0.004)
Log of net financial wealth	0.296***	0.078***	0.412***	0.123***	0.053***	-0.124***
	(0.008)	(0.003)	(0.008)	(0.002)	(0.014)	(0.002)

Table 3.9 Continued

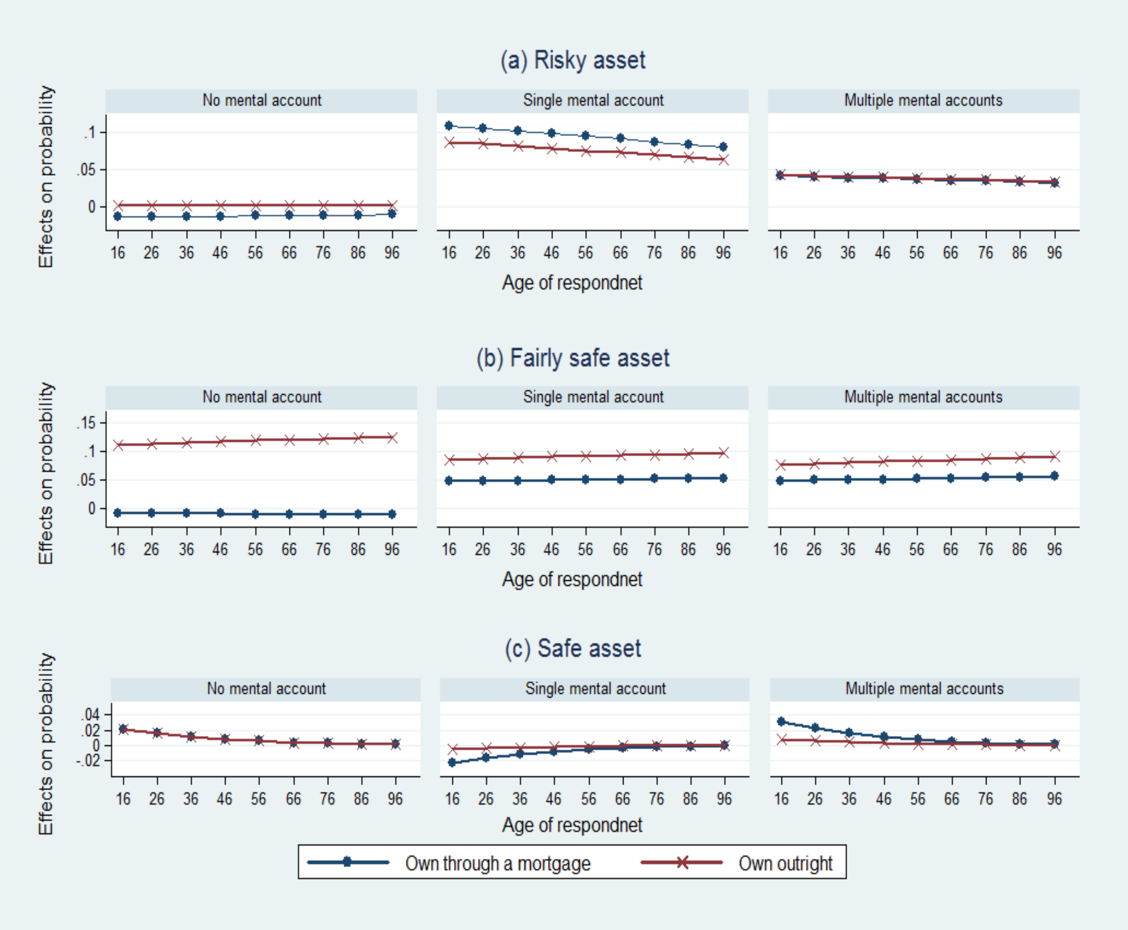
Independent variable	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
Region (Base = North East)						
North West	0.036	0.005	0.056	0.007	-0.128	-0.014
	(0.060)	(0.018)	(0.053)	(0.017)	(0.137)	(0.016)
Yorkshire & Humber	0.104*	0.015	0.138**	0.033*	-0.139	-0.029*
	(0.061)	(0.019)	(0.056)	(0.018)	(0.140)	(0.017)
East Midlands	0.125**	0.007	0.155***	0.030*	0.043	-0.026
	(0.061)	(0.018)	(0.057)	(0.018)	(0.153)	(0.017)
West Midlands	-0.040	-0.037**	0.111**	0.013	-0.057	-0.006
	(0.061)	(0.019)	(0.055)	(0.018)	(0.141)	(0.017)
East of England	0.135**	0.029	0.103*	0.009	-0.159	-0.015
	(0.059)	(0.018)	(0.055)	(0.017)	(0.139)	(0.016)
London	0.189***	0.031*	-0.025	-0.068***	0.152	0.050***
	(0.061)	(0.019)	(0.058)	(0.018)	(0.154)	(0.017)
South East	0.251***	0.054***	0.088*	-0.024	0.053	0.006
	(0.056)	(0.017)	(0.053)	(0.017)	(0.144)	(0.016)
South West	0.161***	0.036*	0.148***	0.014	0.105	-0.024
	(0.060)	(0.018)	(0.056)	(0.018)	(0.162)	(0.016)
Wales	-0.052	-0.018	0.013	-0.006	-0.105	0.006
	(0.067)	(0.021)	(0.060)	(0.020)	(0.154)	(0.018)
Scotland	0.048	0.024	0.042	0.024	-0.029	-0.033**
	(0.060)	(0.019)	(0.055)	(0.018)	(0.141)	(0.017)
Year (Base = 2006)						
2007	-0.064**	-0.016*	-0.086***	-0.021**	0.067	0.020***
	(0.027)	(0.008)	(0.027)	(0.008)	(0.071)	(0.008)
2008	-0.083***	-0.042***	0.035	0.019**	0.128	-0.001
	(0.026)	(0.008)	(0.028)	(0.008)	(0.084)	(0.008)
2009	-0.018	-0.037***	0.190***	0.054***	0.394***	-0.027***
	(0.031)	(0.009)	(0.032)	(0.009)	(0.102)	(0.009)
2010	-0.078**	-0.049***	0.203***	0.076***	0.353***	-0.048***
	(0.036)	(0.011)	(0.038)	(0.011)	(0.119)	(0.010)
Constant	-6.151***	-1.722***	-4.463***	-1.244***	0.848***	2.301***
	(0.183)	(0.058)	(0.141)	(0.045)	(0.272)	(0.042)
Pseudo R^2	0.243	0.268	0.375	0.235	0.152	0.286
Observations	34205	33988	34205	33988	34205	33453

Moreover, again the magnitudes for outright ownership sharply increase for portfolio share in fairly safe assets and safe assets. These results indicate that there is a strong interactive effect between mental accounting and housing tenure. A clearer picture of the combined influence of mental accounting and housing tenure is demonstrated by the interaction terms. The interactions between mental accounting and housing tenure have differential effects on ownership and portfolio share in the three asset classes.

For ownership and portfolio share in risky assets, the effects are positive and significant among households that exhibit a *single mental account* and either own their home through a mortgage or own outright. Among households that exhibit *multiple mental accounts* and own their homes outright, the effects are significant for ownership of a risky asset. With regard to ownership of a fairly safe asset, I find positive and significant effects for interactions between mental accounting (*single mental account* and *multiple accounts*) and homeownership through a mortgage. For portfolio share, all the interaction terms are negative and significant apart from the interaction between *single mental account* and *under mortgage*, which is insignificant. Finally, for safe assets, although I find that the interaction term between *single mental account* and *under a mortgage* is negative and significant for ownership, the interaction terms for portfolio share are positive and significant for all sets of interactions apart from that between *single mental account* and *under a mortgage*. Furthermore, across these interactions I find that the separate combinations of mental accounting and housing tenure are significantly different at the 5% level.

Figure 3.6 Conditional marginal effect of housing tenure on ownership

The figure displays conditional marginal effects of housing tenure on the probability of owning a risky asset, a fairly safe asset and a safe asset. The marginal effects are calculated using estimates derived from pooled probit regressions in Table 3.9: that is, column (1) specification for Panel (a); column (3) specification for Panel (b); and column (5) specification for Panel (c). The marginal effects are evaluated at highest value of all explanatory variables apart from age, total household wealth and total financial wealth which are evaluated at their average values.



A graphical analysis of the conditional effects of housing tenure calculated from the probit regression estimates in Table 3.9 is displayed in Figure 3.6. For ownership of a risky asset, Panel (a), the effects of both homeownership through a mortgage and outright homeownership are significant at the 1% level among households that exhibit a *single mental account* and at the 5% level among those that exhibit *multiple mental accounts*. For ownership of a fairly safe asset, the effect of outright homeownership is significant at the 1% level across mental accounts while the effect of ownership through a mortgage is significant at the 1% level for households that have a *single mental* *account* or *multiple mental accounts*. These findings further support the analysis in Table 3.9. In addition, the effects of outright homeownership are significant across all mental accounts. For ownership of a safe asset, Figure (c), the conditional effects are insignificant.

In sum, these results are consistent with Hypotheses 3(a) and 3(b) as I find that mental accounting and housing tenure both directly and interactively explain differences in portfolio choice. However, for ownership of risky assets, the direct effect of housing is subsumed by mental accounting. Furthermore, comparisons between the conditional and unconditional regressions, using likelihood ratio test, result in statistically significant improvement of model fit across all asset classes and confirms the correlation between mental accounting and housing tenure. This finding is also consistent with the extended BPT theory of Baptista (2012), which incorporates background risk. However, although it is not possible to establish whether households in this study hold mean-variance efficient portfolios, the findings contrasts with Baptista's (2012) suggestion that the presence of a background risk reduces portfolio share in risky assets. Instead, the evidence shows that among households that exhibit *multiple mental accounts* there is no significant difference in portfolio share of risky assets between those who own their home outright and those who own through a mortgage. In fact, outright homeowners have low investment shares in fairly safe assets and high investment shares in safe assets, when compared to homeownership through a mortgage.

3.5.4 Mental account types and sources of financial advice

Thus far, our analysis has focused on the influence of mental accounting and financial advice using broad definitions of the two variables. Here, I examine the effects of specific mental account types and sources of financial advice on portfolio choice. Table 3.10 reports marginal effects for both ownership and portfolio share using pooled probit and tobit regressions, respectively. Mental account types include investment goals such as "*for unexpected expenditure*", "*for family members*", "*to provide regular income*", "*for retirement*", "*for planned expenditure*", "*deposit for property*", "*for holiday*", "*for speculation*", and "*to earn good interest and see money grow*". Sources of financial advice include "*close associates*", "*print, media and Internet*", "*professional agents*", "*other independent advisors*", and "*independent financial advisors*". Along with the control variables, I include the variables housing tenure, *time preference*, *risk tolerance* and *cognitive ability*.

The results show that mental account types vary across the different categories of asset class ownership and investment. For example, saving money for "*unexpected expenditure*" is negatively associated with portfolio share in risky assets and is positively associated with ownership of and portfolio share in fairly safe assets. Saving money for "*family members*" is positively associated with both ownership and portfolio share in risky assets but is negatively associated with portfolio share in fairly safe assets. Saving money for "*planned expenditure*" and for "*holiday*" are both positively associated with ownership and portfolio share in fairly safe assets but are negatively associated with portfolio share in safe assets.

Table 3.10 Mental account types, sources of financial advice and portfolio choice

The table presents marginal effects from both pooled probit regressions (Column (1), (3) and (5)) and from pooled tobit regressions (Column (2), (4) and (6)). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental account types represent binary variables for each investment goal, which equals one if identified by a respondent regardless of its ranking, and include saving money for 'unexpected expenditure', ' family members', 'to provide regular income', 'retirement', 'planned expenditure', 'deposit for property', ' holiday', 'speculation', and 'to earn good interest and see money grow'. Sources of financial advice represent binary variables for each source trusted regardless of ranking and include 'close associates', 'print, media and internet', 'professional agents', 'other independent advisors', and 'independent financial advisors'. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, white British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
Mental account types (Dummies)						
Unexpected expenditure	-0.006	-0.015***	0.010**	0.018***	0.004***	-0.005
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.005)
Family members	0.017***	0.026***	-0.006	-0.025***	0.001	0.008
	(0.006)	(0.007)	(0.007)	(0.008)	(0.002)	(0.007)
Regular income	-0.008	-0.014	-0.008	-0.042***	0.003	0.043***
	(0.009)	(0.010)	(0.012)	(0.011)	(0.003)	(0.010)
Retirement	0.012**	-0.011*	0.042***	-0.006	-0.004	0.014**
	(0.006)	(0.007)	(0.007)	(0.007)	(0.002)	(0.006)
Planned expenditure	0.003	0.004	0.028***	0.018***	0.002*	-0.013**
	(0.005)	(0.006)	(0.006)	(0.006)	(0.001)	(0.006)
Deposit for property	0.006	-0.014	0.016	0.010	0.006***	0.013
	(0.013)	(0.014)	(0.014)	(0.016)	(0.002)	(0.015)
Holiday	0.010**	0.001	0.047***	0.058***	0.001	-0.050***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)

Table 3.10 Continued

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
Speculation & recreation	0.039***	0.042***	-0.001	-0.034***	0.003	0.013
	(0.010)	(0.011)	(0.014)	(0.012)	(0.003)	(0.011)
Good interest & to see money grow	0.046***	0.032***	0.065***	-0.003	0.002	-0.005
	(0.007)	(0.007)	(0.008)	(0.007)	(0.002)	(0.007)
Trusted financial advisors (Dummies)						
Close associates	0.008	0.007	0.001	0.001	-0.000	-0.005
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
Print, media & internet	0.029***	0.029***	0.017**	0.002	0.003*	-0.010
	(0.008)	(0.008)	(0.008)	(0.009)	(0.002)	(0.008)
Professional agents	-0.007*	-0.006	0.010**	0.013**	0.000	-0.016***
	(0.004)	(0.006)	(0.004)	(0.006)	(0.001)	(0.005)
Other independent advisors	0.009*	0.014**	0.014***	0.018***	-0.002	-0.023***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Independent financial advisors	0.013***	0.017***	0.036***	0.048***	0.001	-0.048***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.005)
Housing tenure (Base=rents)						
Under a mortgage	0.026***	0.031**	0.020**	0.135***	0.001	-0.117***
	(0.009)	(0.013)	(0.009)	(0.012)	(0.002)	(0.011)
Own outright	0.024***	0.015	0.070***	0.130***	0.002	-0.107***
	(0.009)	(0.013)	(0.008)	(0.012)	(0.002)	(0.011)
Time preference	0.015***	0.004	0.019***	0.000	-0.000	0.005
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Risk tolerance	0.014***	0.018***	-0.001	-0.019***	0.002*	0.009
	(0.005)	(0.006)	(0.005)	(0.006)	(0.001)	(0.006)
Cognitive ability	0.025***	0.023***	0.012**	0.010	0.001	-0.014**
	(0.006)	(0.008)	(0.005)	(0.007)	(0.001)	(0.007)
Age	-0.001	-0.004**	-0.002*	0.002*	0.000**	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)
Age square	0.000	0.000***	-0.000	-0.000***	-0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.008	0.013*	-0.046***	-0.054***	0.001	0.045***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)

Table 3.10 Continued

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
Couple	0.003	-0.017**	0.032***	0.032***	0.003***	-0.024***
	(0.006)	(0.007)	(0.005)	(0.007)	(0.001)	(0.007)
Degree level or above qualification	0.031***	0.035***	0.020***	-0.013*	0.000	-0.001
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Employed or self-employed	0.007	0.020**	-0.003	-0.006	0.004**	0.005
	(0.007)	(0.008)	(0.007)	(0.008)	(0.001)	(0.008)
Has children	-0.021***	-0.025***	-0.057***	-0.057***	-0.010***	0.050***
	(0.007)	(0.009)	(0.007)	(0.008)	(0.002)	(0.008)
Lives in urban area	-0.006	-0.010	0.011*	0.028***	-0.001	-0.020***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.001)	(0.006)
Christian	0.024***	0.026***	0.020***	0.033***	0.003*	-0.029***
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.007)
Has good health	0.019***	0.027***	0.006	0.008	-0.002*	-0.019***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.001)	(0.006)
White British	0.015*	0.007	0.061***	0.071***	-0.000	-0.061***
	(0.009)	(0.012)	(0.008)	(0.012)	(0.002)	(0.011)
Log of net household wealth	0.036***	0.051***	0.010***	-0.003	0.000	-0.010***
	(0.004)	(0.005)	(0.002)	(0.004)	(0.000)	(0.003)
Log of net financial wealth	0.068***	0.077***	0.091***	0.124***	0.001***	-0.125***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.000)	(0.002)
Region dummies (Base = North East)						
North West	0.009	0.007	0.013	0.010	-0.003	-0.016
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)
Yorkshire & Humber	0.025*	0.016	0.030**	0.033*	-0.003	-0.029*
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
East Midlands	0.029**	0.006	0.034***	0.031*	0.001	-0.026
	(0.014)	(0.018)	(0.013)	(0.018)	(0.003)	(0.017)
West Midlands	-0.010	-0.037**	0.024*	0.014	-0.001	-0.007
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.016)
East of England	0.033**	0.031*	0.023*	0.009	-0.003	-0.015
	(0.014)	(0.018)	(0.012)	(0.017)	(0.003)	(0.016)

Table 3.10 Continued

Independent variables	Risky asset		Fairly safe asset		Safe asset	
	(1)	(2)	(3)	(4)	(5)	(6)
	Ownership	Portfolio share	Ownership	Portfolio share	Ownership	Portfolio share
London	0.044***	0.033*	-0.008	-0.065***	0.002	0.047***
	(0.014)	(0.019)	(0.013)	(0.018)	(0.003)	(0.017)
South East	0.058***	0.053***	0.018	-0.023	0.001	0.005
	(0.013)	(0.017)	(0.012)	(0.017)	(0.003)	(0.015)
South West	0.037***	0.036*	0.031**	0.014	0.002	-0.024
	(0.014)	(0.018)	(0.013)	(0.017)	(0.003)	(0.016)
Wales	-0.011	-0.017	0.004	-0.005	-0.003	0.005
	(0.016)	(0.021)	(0.013)	(0.020)	(0.003)	(0.018)
Scotland	0.012	0.024	0.009	0.024	-0.001	-0.033**
	(0.014)	(0.019)	(0.012)	(0.018)	(0.003)	(0.017)
Year dummies (Base = 2006)						
2007	-0.016**	-0.017**	-0.017***	-0.017**	0.001	0.017**
	(0.006)	(0.008)	(0.006)	(0.008)	(0.001)	(0.008)
2008	-0.021***	-0.043***	0.013**	0.025***	0.002	-0.007
	(0.006)	(0.008)	(0.006)	(0.008)	(0.002)	(0.008)
2009	-0.005	-0.038***	0.049***	0.061***	0.007***	-0.034***
	(0.007)	(0.009)	(0.007)	(0.009)	(0.002)	(0.008)
2010	-0.017**	-0.049***	0.052***	0.081***	0.006***	-0.053***
	(0.008)	(0.010)	(0.008)	(0.011)	(0.002)	(0.010)
Constant		-1.713***		-1.162***		2.221***
		(0.057)		(0.045)		(0.042)
Pseudo R^2	0.245	0.269	0.377	0.235	0.146	0.285
Observations	34205	33988	34205	33988	34205	33453

Regarding sources of financial advice, use of the "*print, media and internet*" has a significant effect on ownership and portfolio share in risky assets; use of "*professional agents*" has positive effects on both ownership of and portfolio share in fairly safe assets and a negative effect on portfolio share in safe assets; use of "*other independent advisors*" and "*independent financial advisors*" both have a positive effect on ownership of and portfolio share in risky assets and fairly safe assets, and have negative effects on portfolio share of safe assets.

In sum, these results provide further support for Hypotheses (1) to (3) and our results in Table 3.4 to Table 3.9 which demonstrate that mental accounting behaviour can explain differences in portfolio choice.

3.6 Robustness checks

In classifying financial assets and constructing proxies for the key independent variables, I make assumptions regarding the level of risk ascribed across asset classes, and categorisations of both mental accounting and sources of financial advice. Furthermore, the separate regressions for different asset classes ignore common unobserved factors across these regressions. As these assumptions could contaminate the results, in this section I carry out robustness checks using sub-samples, alternative classifications of financial assets, and re-parameterized dependent variable. Generally, the robustness checks are consistent with and strengthen the main conclusions.

3.6.1 Multi-equation estimates

A concern in all of the empirical analysis in Section 3.5 is that the estimated coefficients may be biased by possible correlations of error terms across the three sets of regressions for both asset ownership and portfolio share. In other words, there may be common unobserved factors that influence the dependent variables in the three regressions. In addition, the separate equations do not provide a mechanism for testing whether the coefficient estimates are significantly different across the three regressions. Using the seemingly unrelated regressions (SUR) framework (Zellner, 1962) to account for these correlations, I estimate two-equation and three-equation models for both ownership and portfolio share using conditional mixed process (CMP) estimator (Roodman, 2009; Roodman, 2011). These models contain the same set of regressors. In the two-equation model, I exclude the equation for safe assets while all the three asset classes are included in the three-equation model. The two-equation model is given by Equation (9) and (10) while the three-equation model includes these two equations and Equation (11) as below:

$$AC_{ir} = MA_{ir}\beta_1 + BR_{ir}\beta_2 + FA_{ir}\beta_3 + RT_{ir}\beta_4 + RP_{ir}\beta_5 + CA_{ir}\beta_6 + IT_{ir} + CV_{ir}\alpha + \varepsilon_{ir}, \tag{9}$$

$$AC_{if} = MA_{if}\beta_1 + BR_{if}\beta_2 + FA_{if}\beta_3 + RT_{if}\beta_4 + RP_{if}\beta_5 + CA_{if}\beta_6 + IT_{if} + CV_{if}\alpha + \varepsilon_{if}, \tag{10}$$

$$AC_{is} = MA_{is}\beta_1 + BR_{is}\beta_2 + FA_{is}\beta_3 + RT_{is}\beta_4 + RP_{is}\beta_5 + CA_{is}\beta_6 + IT_{is} + CV_{is}\alpha + \varepsilon_{is}, \tag{11}$$

$$\left.\begin{array}{l}\mathrm{Cov}(\varepsilon_{ir}, \varepsilon_{if}) \neq 0 \\ \mathrm{Cov}(\varepsilon_{ir}, \varepsilon_{is}) \neq 0 \\ \mathrm{Cov}(\varepsilon_{if}, \varepsilon_{is}) \neq 0\end{array}\right\} \tag{12}$$

Where the variables are as defined in Section 3.4; however, the subscripts r represents ownership of a risky asset, f represents ownership of a fairly safe asset and s represents ownership of a safe asset. The dependent variable, AC, represents either ownership of or portfolio share in each asset class. Most importantly, the error terms given by ε accounts for non-zero correlations of common unobserved factors across the three equations as in Equation (12) and the estimated coefficient represents the extent to which these factors determine ownership or portfolio share in each asset class.

First, I run the ownership regressions in Table 3.9 using both a bivariate probit model (BPM) and a three-equation probit model (TPM). The BPM and the TPM estimates reported in Table 3.11 are generally consistent with those reported in Table 3.9 columns (1), (3) and (5); however, for some covariates the levels of significance improve and for others there is a miniscule increase in magnitude. This can be attributed to the low error correlations between equations. For the BPM, the correlation between the regression for ownership of a risky asset (column (1)) and that for ownership of a fairly safe asset (column (2)) is positive and significant. For the TPM, when compared to the BPM, the results for the risky asset ownership regression remain unchanged and they slightly change for the fairly safe asset ownership regression. There is a positive significant correlation between the equations for ownership of a risky asset and ownership of a fairly safe asset (0.144); an insignificant correlation between the equations for ownership of a risky asset and ownership of a safe asset; and a negative significant correlation between the equations for ownership of a fairly safe asset and ownership of a safe asset (0.188). Nevertheless, Wald tests show that the key variables mental accounting, financial advice and housing are significantly different from zero across the three equations.

Table 3.11 Bivariate and three-equation probit models estimates for asset ownership

The table presents coefficient estimates from bivariate probit model (BPM) and three-equation probit model (MPM). The BPM is for ownership of a risky asset (column (1)) and ownership of a fairly safe asset (column (2)) while the MPM is for ownership a risky asset (column (3)), ownership of a fairly safe asset (column (4)) and ownership of a safe asset (column (5)). Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. The correlation coefficient between equations is represented by "atanhrho", which is an unbounded transformation of "rho" using arc-hyperbolic tangents; the calculated p-value tests the hypothesis that the error terms of pairs of equations are not significantly different from zero. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

	Bivariate probit model		Three-equation probit model		
Independent variables	Ownership of risky asset	Ownership of fairly safe asset	Ownership risky asset	Ownership fair safe asset	Ownership safe asset
	(1)	(2)	(3)	(4)	(5)
Mental account (Base=none)					
Single mental account	-0.305***	0.127**	-0.305***	0.127**	0.247
	(0.101)	(0.062)	(0.101)	(0.062)	(0.173)
Multiple mental account	0.111	0.345***	0.111	0.345***	0.291
	(0.087)	(0.064)	(0.086)	(0.064)	(0.184)
Financial advice (Base=none)					
Single source	-0.032	0.094***	-0.031	0.094***	-0.116
	(0.040)	(0.032)	(0.040)	(0.032)	(0.074)
Multiple sources	0.078**	0.176***	0.078**	0.176***	0.022
	(0.039)	(0.034)	(0.039)	(0.034)	(0.087)
Home tenure (Base=rents)					
Under a mortgage	-0.038	-0.029	-0.038	-0.031	0.120
	(0.061)	(0.045)	(0.061)	(0.045)	(0.098)
Own outright	0.004	0.342***	0.004	0.341***	0.129
	(0.058)	(0.042)	(0.058)	(0.042)	(0.097)
Time preference	0.042	0.081**	0.042	0.081**	-0.009
	(0.038)	(0.035)	(0.038)	(0.035)	(0.084)
Risk tolerance	0.097**	0.035	0.097**	0.035	0.022
	(0.038)	(0.035)	(0.038)	(0.035)	(0.083)
Cognitive ability	0.123***	0.063**	0.123***	0.063**	0.020
	(0.041)	(0.031)	(0.041)	(0.031)	(0.064)
Single mental account * single source	0.044	0.011	0.044	0.011	0.007
	(0.058)	(0.051)	(0.058)	(0.051)	(0.144)
Single mental account * multiple sources	0.041	0.048	0.041	0.047	-0.171
	(0.057)	(0.054)	(0.057)	(0.054)	(0.151)
Multiple mental account * single source	-0.048	-0.089*	-0.048	-0.088*	0.440**
	(0.053)	(0.051)	(0.053)	(0.051)	(0.214)
Multiple mental account * multiple sources	-0.089*	-0.009	-0.089*	-0.009	0.020
	(0.049)	(0.050)	(0.049)	(0.050)	(0.162)

Table 3.11 continued

Independent variables	Bivariate probit model		Three-equation probit model		
	Ownership of risky asset	Ownership of fairly safe asset	Ownership risky asset	Ownership fair safe asset	Ownership safe asset
	(1)	(2)	(3)	(4)	(5)
Single mental account * under a mortgage	0.360***	0.172***	0.360***	0.172***	-0.424***
	(0.093)	(0.062)	(0.093)	(0.062)	(0.152)
Single mental account * own outright	0.258***	-0.067	0.258***	-0.068	-0.217
	(0.088)	(0.056)	(0.088)	(0.056)	(0.153)
Multiple mental account * under a mortgage	0.148*	0.199***	0.148*	0.200***	0.109
	(0.077)	(0.060)	(0.077)	(0.060)	(0.185)
Multiple mental account * own outright	0.109	-0.052	0.109	-0.052	-0.072
	(0.073)	(0.057)	(0.073)	(0.057)	(0.179)
Single mental account * time preference	0.048	-0.013	0.049	-0.012	0.018
	(0.054)	(0.054)	(0.054)	(0.054)	(0.151)
Multiple mental account * time preference	0.030	0.027	0.030	0.026	-0.117
	(0.046)	(0.050)	(0.046)	(0.050)	(0.158)
Single mental account * risk tolerance	-0.096*	-0.033	-0.096*	-0.033	0.500**
	(0.056)	(0.055)	(0.056)	(0.055)	(0.215)
Multiple mental account * risk tolerance	-0.024	-0.064	-0.023	-0.065	-0.046
	(0.048)	(0.051)	(0.048)	(0.051)	(0.166)
Single mental account * cognitive ability	0.036	-0.030	0.036	-0.030	0.112
	(0.059)	(0.048)	(0.059)	(0.048)	(0.123)
Multiple mental account * cognitive ability	-0.045	0.006	-0.045	0.005	0.049
	(0.053)	(0.048)	(0.053)	(0.048)	(0.163)
Age	-0.005	-0.003	-0.005	-0.003	0.019**
	(0.005)	(0.004)	(0.005)	(0.004)	(0.008)
Age square	0.000	-0.000*	0.000	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.038	-0.197***	0.039	-0.197***	0.053
	(0.024)	(0.023)	(0.024)	(0.023)	(0.053)
Couple	0.005	0.143***	0.005	0.143***	0.184***
	(0.024)	(0.023)	(0.024)	(0.023)	(0.058)
Degree level or above qualification	0.142***	0.097***	0.142***	0.097***	0.033
	(0.024)	(0.027)	(0.024)	(0.027)	(0.070)
Employed or self-employed	0.037	-0.000	0.038	0.000	0.192***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.074)
Has children	-0.099***	-0.251***	-0.099***	-0.250***	-0.421***
	(0.029)	(0.028)	(0.029)	(0.028)	(0.059)
Lives in urban area	-0.024	0.048**	-0.024	0.048**	-0.070
	(0.024)	(0.024)	(0.024)	(0.024)	(0.068)
Christian	0.100***	0.086***	0.100***	0.086***	0.114*
	(0.028)	(0.027)	(0.028)	(0.027)	(0.060)
Has good health	0.085***	0.033	0.085***	0.034	-0.097
	(0.023)	(0.022)	(0.023)	(0.022)	(0.061)
White British	0.069*	0.269***	0.069*	0.269***	-0.011
	(0.040)	(0.035)	(0.040)	(0.035)	(0.083)
Log of net household wealth	0.162***	0.045***	0.162***	0.046***	0.020
	(0.015)	(0.011)	(0.015)	(0.011)	(0.017)
Log of net financial wealth	0.296***	0.412***	0.296***	0.413***	0.048***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.013)
Region (Base = North East)					
North West	0.035	0.057	0.035	0.057	-0.130
	(0.059)	(0.054)	(0.059)	(0.054)	(0.136)
Yorkshire & Humber	0.105*	0.137**	0.105*	0.137**	-0.135
	(0.061)	(0.056)	(0.061)	(0.056)	(0.140)
East Midlands	0.124**	0.156***	0.124**	0.157***	0.038
	(0.061)	(0.057)	(0.061)	(0.057)	(0.152)
West Midlands	-0.040	0.112**	-0.041	0.113**	-0.056
	(0.061)	(0.055)	(0.061)	(0.055)	(0.141)
East of England	0.135**	0.100*	0.135**	0.099*	-0.169
	(0.059)	(0.055)	(0.059)	(0.055)	(0.139)
London	0.189***	-0.025	0.189***	-0.025	0.146
	(0.061)	(0.058)	(0.061)	(0.058)	(0.154)
South East	0.252***	0.089*	0.252***	0.089*	0.052
	(0.056)	(0.053)	(0.056)	(0.053)	(0.144)
South West	0.161***	0.147***	0.161***	0.148***	0.103
	(0.060)	(0.056)	(0.060)	(0.056)	(0.161)

Table 3.11 continued

Independent variables	Bivariate probit model: Ownership of risky asset	Bivariate probit model: Ownership of fairly safe asset	Three-equation probit model: Ownership risky asset	Three-equation probit model: Ownership fair safe asset	Three-equation probit model: Ownership safe asset
	(1)	(2)	(3)	(4)	(5)
Wales	-0.054	0.013	-0.054	0.013	-0.107
	(0.067)	(0.060)	(0.067)	(0.060)	(0.153)
Scotland	0.048	0.045	0.048	0.044	-0.033
	(0.060)	(0.055)	(0.060)	(0.055)	(0.140)
Year (Base = 2006)					
2007	-0.065**	-0.088***	-0.065**	-0.088***	0.061
	(0.027)	(0.027)	(0.027)	(0.027)	(0.071)
2008	-0.085***	0.033	-0.085***	0.033	0.122
	(0.026)	(0.028)	(0.026)	(0.028)	(0.084)
2009	-0.021	0.188***	-0.021	0.188***	0.379***
	(0.031)	(0.032)	(0.031)	(0.032)	(0.101)
2010	-0.079**	0.201***	-0.080**	0.201***	0.347***
	(0.036)	(0.038)	(0.036)	(0.038)	(0.119)
Constant	-6.173***	-4.463***	-6.175***	-4.466***	0.855***
	(0.183)	(0.141)	(0.183)	(0.141)	(0.271)
Correlation coefficients between residuals					
atanhrho_12		0.145***			
		(0.015)			
atanhrho_34					0.144***
					(0.015)
atanhrho_35					0.053
					(0.050)
atanhrho_45					-0.188***
					(0.041)
Observations	34205	34205	34205	34205	34205

Using the BPM, I further investigate whether mental accounting, financial advice and housing are differentially associated with different combinations of ownership of the two asset classes. The results reported in Table 3.12, show that having multiple mental accounts, multiple sources of financial advice and homeownership increases the bivariate probability of owning both a risky and a fairly safe asset (column (1)) or owning a fairly safe and not a risky asset (column (4)). In contrast, these variables are negatively associated with the bivariate probability of not owning either of the two assets (column (2)) and owning a risky and not a fairly safe asset (column (3). These results are consistent with the marginal effects reported in Table 3.13 for the univariate and conditional probabilities of ownership of a risky asset and fairly safe asset.

Table 3.12 Bivariate marginal effects for different ownership combinations

The table presents marginal effects from bivariate probit regressions for the probability of owning both a risky and a fairly safe asset (column (1)); the probability of not owning either asset (Column (2)); the probability of owning a risky asset and not owning a fairly safe asset (column (3)); and the probability of owning a fairly safe asset and not owning a risky asset (column (4)). Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Probability (risky=1 and fairly safe =1)	Probability (risky=0 and fairly safe =0)	Probability (risky=1 and fairly safe =0)	Probability (risky=0 and fairly safe =1)
	(1)	(2)	(3)	(4)
Mental account (Base=none)				
Single mental account	0.002	-0.042***	-0.008***	0.047***
	(0.005)	(0.007)	(0.002)	(0.008)
Multiple mental account	0.040***	-0.109***	-0.009***	0.078***
	(0.005)	(0.007)	(0.002)	(0.008)
Financial advice (Base=none)				
Single source	-0.004	-0.018**	-0.005***	0.026***
	(0.004)	(0.007)	(0.002)	(0.008)
Multiple sources	0.019***	-0.058***	-0.005***	0.044***
	(0.005)	(0.007)	(0.002)	(0.008)
Housing tenure (Base=rents)				
Under a mortgage	0.021***	-0.034***	0.003	0.010
	(0.007)	(0.012)	(0.003)	(0.013)
Own outright	0.032***	-0.099***	-0.007***	0.074***
	(0.007)	(0.011)	(0.003)	(0.013)
Time preference	0.016***	-0.029***	-0.000	0.014*
	(0.004)	(0.007)	(0.002)	(0.007)
Risk tolerance	0.012***	-0.005	0.004**	-0.011
	(0.004)	(0.007)	(0.002)	(0.008)
Cognitive ability	0.022***	-0.024***	0.004**	-0.003
	(0.005)	(0.007)	(0.002)	(0.008)
Age	-0.001	0.001	-0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)
Age square	0.000	0.000*	0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Male	-0.002	0.056***	0.011***	-0.065***
	(0.004)	(0.007)	(0.002)	(0.008)
Couple	0.007*	-0.043***	-0.006***	0.042***
	(0.004)	(0.007)	(0.002)	(0.008)
Degree level or above qualification	0.031***	-0.036***	0.004*	0.002
	(0.005)	(0.008)	(0.002)	(0.009)

Table 3.12 continued

Independent variable	Probability (risky=1 and fairly safe =1) (1)	Probability (risky=0 and fairly safe =0) (2)	Probability (risky=1 and fairly safe =0) (3)	Probability (risky=0 and fairly safe =1) (4)
Employed or self-employed	0.007	-0.002	0.002	-0.007
	(0.005)	(0.009)	(0.002)	(0.010)
Has children	-0.028***	0.084***	0.005**	-0.061***
	(0.005)	(0.009)	(0.002)	(0.010)
Lives in urban area	-0.002	-0.013*	-0.004**	0.019**
	(0.004)	(0.008)	(0.002)	(0.008)
Christian	0.021***	-0.032***	0.002	0.009
	(0.005)	(0.009)	(0.002)	(0.009)
Has good health	0.016***	-0.015**	0.003**	-0.005
	(0.004)	(0.007)	(0.002)	(0.007)
White British	0.024***	-0.089***	-0.008***	0.073***
	(0.006)	(0.012)	(0.003)	(0.013)
Log of net household wealth	0.031***	-0.023***	0.007***	-0.016***
	(0.003)	(0.003)	(0.001)	(0.004)
Log of net financial wealth	0.072***	-0.139***	-0.002***	0.070***
	(0.002)	(0.002)	(0.001)	(0.003)
Region dummies (Base = North East)				
North West	0.008	-0.020	-0.000	0.012
	(0.010)	(0.017)	(0.004)	(0.019)
Yorkshire & Humber	0.024**	-0.047***	-0.000	0.024
	(0.011)	(0.018)	(0.004)	(0.019)
East Midlands	0.028***	-0.054***	0.000	0.026
	(0.011)	(0.018)	(0.004)	(0.020)
West Midlands	-0.002	-0.033*	-0.006*	0.041**
	(0.010)	(0.018)	(0.004)	(0.019)
East of England	0.027***	-0.038**	0.003	0.007
	(0.010)	(0.018)	(0.004)	(0.019)
London	0.031***	-0.004	0.013***	-0.040**
	(0.011)	(0.019)	(0.004)	(0.020)
South East	0.050***	-0.042**	0.011***	-0.019
	(0.010)	(0.017)	(0.004)	(0.018)
South West	0.035***	-0.053***	0.002	0.016
	(0.011)	(0.018)	(0.004)	(0.019)
Wales	-0.008	-0.001	-0.003	0.012
	(0.011)	(0.019)	(0.004)	(0.021)
Scotland	0.010	-0.017	0.001	0.006
	(0.010)	(0.018)	(0.004)	(0.019)
Year dummies (Base = 2006)				
2007	-0.016***	0.031***	0.000	-0.015*
	(0.005)	(0.009)	(0.002)	(0.009)
2008	-0.014***	-0.005	-0.007***	0.025***
	(0.005)	(0.009)	(0.002)	(0.009)
2009	0.005	-0.052***	-0.010***	0.057***
	(0.006)	(0.009)	(0.002)	(0.011)
2010	-0.006	-0.053***	-0.013***	0.072***
	(0.007)	(0.011)	(0.002)	(0.012)
Interaction terms	Yes	Yes	Yes	Yes
Observations	34205	34205	34205	34205

Table 3.13 Univariate and conditional marginal effects

The table presents marginal effects for the univariate (column (1) and (2)) and conditional (column (3) and (4)) probability of success for ownership of a risky asset and ownership of a fairly safe asset. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variables	Univariate probability of success		Conditional probability of success	
	(risky=1)	(fairly safe=1)	(risky=1 | fairly safe =1)	(fairly safe=1 | risky=1)
	(1)	(2)	(3)	(4)
Mental account (Base=none)				
Single mental account	-0.005	0.049***	-0.008	0.044***
	(0.006)	(0.008)	(0.007)	(0.007)
Multiple mental account	0.031***	0.118***	0.027***	0.098***
	(0.006)	(0.007)	(0.006)	(0.007)
Financial advice (Base=none)				
Single source	-0.009	0.023***	-0.011*	0.021***
	(0.006)	(0.008)	(0.006)	(0.007)
Multiple sources	0.013**	0.063***	0.011*	0.053***
	(0.006)	(0.008)	(0.006)	(0.007)
Housing tenure (Base=rents)				
Under a mortgage	0.023**	0.031**	0.024**	0.024**
	(0.009)	(0.013)	(0.010)	(0.012)
Own outright	0.024***	0.106***	0.021**	0.088***
	(0.009)	(0.012)	(0.010)	(0.011)
Time preference	0.016***	0.030***	0.015***	0.023***
	(0.005)	(0.007)	(0.006)	(0.006)
Risk tolerance	0.016***	0.001	0.017***	-0.001
	(0.005)	(0.008)	(0.006)	(0.007)
Cognitive ability	0.026***	0.020**	0.027***	0.013*
	(0.006)	(0.008)	(0.006)	(0.007)
Age	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Age square	0.000	-0.000*	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.009	-0.067***	0.013**	-0.059***
	(0.006)	(0.008)	(0.006)	(0.007)
Couple	0.001	0.049***	-0.001	0.043***
	(0.006)	(0.008)	(0.006)	(0.007)
Degree level or above qualification	0.035***	0.033***	0.035***	0.024***
	(0.006)	(0.009)	(0.006)	(0.008)

Table 3.13 continued

Independent variables	Univariate probability of success (risky=1) (1)	Univariate probability of success (fairly safe=1) (2)	Conditional probability of success (risky=1 | fairly safe =1) (3)	Conditional probability of success (fairly safe=1 | risky=1) (4)
Employed or self-employed	0.009	-0.000	0.009	-0.001
	(0.007)	(0.010)	(0.007)	(0.009)
Has children	-0.023***	-0.089***	-0.020***	-0.075***
	(0.006)	(0.010)	(0.007)	(0.009)
Lives in urban area	-0.006	0.017**	-0.007	0.015**
	(0.006)	(0.008)	(0.006)	(0.007)
Christian	0.023***	0.030***	0.023***	0.022***
	(0.006)	(0.010)	(0.007)	(0.008)
Has good health	0.020***	0.011	0.021***	0.007
	(0.005)	(0.007)	(0.006)	(0.006)
White British	0.016*	0.097***	0.012	0.084***
	(0.009)	(0.013)	(0.010)	(0.012)
Log of net household wealth	0.038***	0.015***	0.040***	0.008**
	(0.004)	(0.004)	(0.004)	(0.003)
Log of net financial wealth	0.070***	0.141***	0.068***	0.112***
	(0.002)	(0.003)	(0.002)	(0.004)
Region dummies (Base = North East)				
North West	0.008	0.020	0.007	0.016
	(0.013)	(0.019)	(0.014)	(0.017)
Yorkshire & Humber	0.023*	0.047**	0.023	0.037**
	(0.013)	(0.019)	(0.014)	(0.017)
East Midlands	0.028**	0.054***	0.028*	0.042**
	(0.013)	(0.020)	(0.014)	(0.017)
West Midlands	-0.008	0.039**	-0.011	0.035**
	(0.013)	(0.019)	(0.014)	(0.017)
East of England	0.031**	0.035*	0.031**	0.026
	(0.013)	(0.019)	(0.014)	(0.017)
London	0.044***	-0.009	0.048***	-0.015
	(0.014)	(0.021)	(0.015)	(0.018)
South East	0.061***	0.031*	0.064***	0.018
	(0.013)	(0.019)	(0.013)	(0.016)
South West	0.037***	0.051***	0.037***	0.038**
	(0.013)	(0.019)	(0.014)	(0.017)
Wales	-0.011	0.005	-0.012	0.006
	(0.014)	(0.021)	(0.015)	(0.018)
Scotland	0.010	0.016	0.011	0.012
	(0.013)	(0.019)	(0.014)	(0.017)
Year dummies (Base = 2006)				
2007	-0.016**	-0.031***	-0.015**	-0.025***
	(0.007)	(0.010)	(0.007)	(0.008)
2008	-0.020***	0.011	-0.022***	0.013
	(0.006)	(0.010)	(0.007)	(0.008)
2009	-0.005	0.062***	-0.009	0.054***
	(0.008)	(0.011)	(0.008)	(0.009)
2010	-0.019**	0.066***	-0.024***	0.059***
	(0.008)	(0.012)	(0.009)	(0.011)
Interaction terms	Yes	Yes	Yes	Yes
Observations	34205	34205	34205	34205

Second, I estimate the portfolio share regressions in Table 3.9, columns (2), (4) and (6), using a bivariate tobit model (BTM) and a three-equation tobit model (TTM). The results are reported in Table 3.14. Unlike the results for asset ownership reported in Table 3.11, when compared to the results in Table 3.9, here we see significant differences within and across models, especially for the TTM model. The estimates for the BTM model are generally consistent with those in Table 3.9, with a negative significant correlation (0.206). In the three-equation model, the coefficient estimates drop by more than 50% and the levels of significance either drop or increase across the three equations. The three pairs of correlation coefficients for the residuals are all negative and highly significant: that is, between equations for portfolio share in a risky asset and a fairly safe asset, 0.193; for portfolio share in a risky asset and in a safe asset, 0.213; and for portfolio share in a fairly safe asset and in a safe asset, 1.551.

Taken together, these results show that, although the residuals are correlated across equations, mental accounting behaviour is associated with both ownership of and portfolio share in a risky asset, a fairly safe asset and a safe asset.

Table 3.14 Bivariate and three-equation tobit estimates for portfolio share

The table presents coefficient estimates from bivariate tobit model (BTM) and three-equation tobit model (TTM). The BTM is for portfolio share in a risky asset (column (1)) and portfolio share in a fairly safe asset (column (2)) while the TTM is for portfolio share in a risky asset (column (3)), portfolio share in a fairly safe asset (column (4)) and portfolio share in a safe asset (column (5)). Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. The correlation coefficient between equations is represented by "atanhrho", which is an unbounded transformation of "rho" using arc-hyperbolic tangents; the calculated p-value tests the hypothesis that the error terms of pairs of equations are not significantly different from zero. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

	Bivairate tobit model		Three-equation tobit model		
Independent variable	Portfolio share risky asset (1)	Portfolio share fairly safe asset (2)	Portfolio share risky asset (3)	Portfolio share fair safe asset (4)	Portfolio share safe asset (5)
Mental account (Base=none)					
Single mental account	-0.069**	0.108***	-0.015*	0.025*	0.012
	(0.032)	(0.025)	(0.009)	(0.014)	(0.012)
Multiple mental account	0.042	0.225***	0.018**	0.085***	-0.028**
	(0.027)	(0.024)	(0.008)	(0.015)	(0.014)
Financial advice (Base=none)					
Single source	-0.010	0.061***	-0.001	0.031***	-0.027***
	(0.013)	(0.012)	(0.004)	(0.007)	(0.007)
Multiple sources	0.029**	0.084***	0.010**	0.047***	-0.051***
	(0.013)	(0.013)	(0.004)	(0.008)	(0.007)
Home tenure (Base=rents)					
Under a mortgage	0.016	0.129***	0.011	0.059***	-0.020**
	(0.021)	(0.019)	(0.007)	(0.011)	(0.010)
Own outright	0.010	0.206***	0.014**	0.116***	-0.065***
	(0.019)	(0.017)	(0.007)	(0.010)	(0.009)
Time preference	-0.006	0.023*	-0.003	0.013	-0.006
	(0.012)	(0.012)	(0.004)	(0.008)	(0.008)
Risk tolerance	0.036***	-0.005	0.014***	-0.003	-0.006
	(0.013)	(0.012)	(0.004)	(0.008)	(0.008)
Cognitive ability	0.019	0.030**	0.004	0.015**	-0.009
	(0.014)	(0.012)	(0.004)	(0.007)	(0.007)
Single mental account * single source	0.014	-0.028	0.003	-0.008	0.006
	(0.018)	(0.018)	(0.005)	(0.012)	(0.011)
Single mental account * multiple sources	0.004	-0.034*	0.000	-0.011	0.011
	(0.018)	(0.018)	(0.006)	(0.012)	(0.012)
Multiple mental account * single source	-0.013	-0.035**	-0.007	-0.005	0.007
	(0.016)	(0.016)	(0.005)	(0.011)	(0.010)
Multiple mental account * multiple sources	-0.034**	-0.047***	-0.009*	-0.011	0.012
	(0.015)	(0.015)	(0.005)	(0.011)	(0.010)

Table 3.14 continued

Independent variable	Bivairate tobit model: Portfolio share risky asset (1)	Bivairate tobit model: Portfolio share fairly safe asset (2)	Three-equation tobit model: Portfolio share risky asset (3)	Three-equation tobit model: Portfolio share fair safe asset (4)	Three-equation tobit model: Portfolio share safe asset (5)
Single mental account * under a mortgage	0.058*	0.026	0.013	0.050***	-0.065***
	(0.031)	(0.025)	(0.009)	(0.015)	(0.014)
Single mental account * own outright	0.035	-0.077***	0.007	-0.015	-0.012
	(0.029)	(0.022)	(0.009)	(0.013)	(0.012)
Multiple mental account * under a mortgage	0.006	-0.032	-0.007	0.022	-0.049***
	(0.025)	(0.023)	(0.008)	(0.015)	(0.013)
Multiple mental account * own outright	0.004	-0.155***	-0.003	-0.052***	0.001
	(0.023)	(0.021)	(0.007)	(0.013)	(0.012)
Single mental account * time preference	0.024	-0.032*	0.009	-0.018	0.010
	(0.016)	(0.017)	(0.006)	(0.012)	(0.011)
Multiple mental account * time preference	0.009	-0.034**	0.003	-0.015	0.008
	(0.014)	(0.014)	(0.005)	(0.010)	(0.010)
Single mental account * risk tolerance	-0.043**	-0.019	-0.017***	-0.012	0.023**
	(0.017)	(0.017)	(0.006)	(0.012)	(0.011)
Multiple mental account * risk tolerance	-0.015	-0.023	-0.002	-0.015	0.011
	(0.015)	(0.015)	(0.005)	(0.011)	(0.010)
Single mental account * cognitive ability	0.024	-0.025	0.008	-0.010	0.002
	(0.019)	(0.017)	(0.005)	(0.011)	(0.011)
Multiple mental account * cognitive ability	-0.017	-0.035**	-0.003	-0.012	0.006
	(0.017)	(0.015)	(0.005)	(0.011)	(0.010)
Age	-0.004***	0.006***	-0.000	0.006***	-0.006***
	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)
Age square	0.000***	-0.000***	0.000	-0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.016**	-0.051***	0.006**	-0.031***	0.024***
	(0.007)	(0.007)	(0.002)	(0.005)	(0.005)
Couple	-0.018**	0.036***	-0.007***	0.029***	-0.021***
	(0.007)	(0.007)	(0.003)	(0.005)	(0.005)
Degree level or above qualification	0.035***	-0.018***	0.021***	-0.006	-0.013***
	(0.007)	(0.007)	(0.003)	(0.005)	(0.005)
Employed or self-employed	0.017**	-0.011	-0.001	-0.021***	0.024***
	(0.008)	(0.008)	(0.003)	(0.006)	(0.006)
Has children	-0.020**	-0.055***	-0.003	-0.033***	0.027***
	(0.009)	(0.009)	(0.003)	(0.006)	(0.006)
Lives in urban area	-0.009	0.031***	-0.006**	0.020***	-0.012**
	(0.007)	(0.007)	(0.003)	(0.005)	(0.005)
Christian	0.023***	0.025***	0.006**	0.017***	-0.019***
	(0.008)	(0.008)	(0.003)	(0.006)	(0.005)
Has good health	0.025***	0.012*	0.008***	0.010**	-0.015***
	(0.007)	(0.007)	(0.002)	(0.005)	(0.005)
White British	0.006	0.083***	0.003	0.050***	-0.042***
	(0.012)	(0.012)	(0.004)	(0.008)	(0.007)
Log of net household wealth	0.049***	-0.007**	0.010***	-0.008***	0.003*
	(0.005)	(0.004)	(0.001)	(0.002)	(0.002)
Log of net financial wealth	0.075***	0.126***	0.021***	0.075***	-0.075***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Region (Base = North East)					
North West	0.004	0.004	0.001	0.001	-0.001
	(0.018)	(0.018)	(0.005)	(0.012)	(0.011)
Yorkshire & Humber	0.021	0.028	0.004	0.014	-0.011
	(0.019)	(0.018)	(0.006)	(0.013)	(0.012)
East Midlands	0.002	0.031*	-0.004	0.020	-0.011
	(0.018)	(0.018)	(0.006)	(0.013)	(0.012)
West Midlands	-0.035*	0.019	-0.013**	0.012	0.001
	(0.019)	(0.018)	(0.005)	(0.012)	(0.011)
East of England	0.023	0.008	0.006	0.002	0.000
	(0.018)	(0.018)	(0.006)	(0.012)	(0.011)
London	0.032*	-0.069***	0.011*	-0.048***	0.043***
	(0.019)	(0.018)	(0.006)	(0.012)	(0.012)
South East	0.044***	-0.030*	0.016***	-0.024**	0.015
	(0.017)	(0.017)	(0.005)	(0.012)	(0.011)
South West	0.032*	0.018	0.008	0.010	-0.009
	(0.018)	(0.018)	(0.006)	(0.012)	(0.012)

Table 3.14 continued

Independent variable	Bivairate tobit model: Portfolio share risky asset (1)	Bivairate tobit model: Portfolio share fairly safe asset (2)	Three-equation tobit model: Portfolio share risky asset (3)	Three-equation tobit model: Portfolio share fair safe asset (4)	Three-equation tobit model: Portfolio share safe asset (5)
Wales	-0.011	-0.007	-0.004	-0.009	0.010
	(0.021)	(0.020)	(0.006)	(0.014)	(0.013)
Scotland	0.017	0.026	0.006	0.018	-0.026**
	(0.019)	(0.018)	(0.006)	(0.012)	(0.011)
Year (Base = 2006)					
2007	-0.008	-0.019**	-0.001	-0.011*	0.009
	(0.008)	(0.008)	(0.003)	(0.006)	(0.006)
2008	-0.037***	0.018**	-0.014***	0.014**	-0.001
	(0.008)	(0.008)	(0.003)	(0.006)	(0.006)
2009	-0.031***	0.056***	-0.015***	0.041***	-0.022***
	(0.009)	(0.009)	(0.003)	(0.007)	(0.006)
2010	-0.048***	0.082***	-0.020***	0.063***	-0.041***
	(0.010)	(0.011)	(0.004)	(0.008)	(0.008)
Constant	-1.629***	-1.323***	-0.363***	-0.604***	1.545***
	(0.057)	(0.047)	(0.016)	(0.029)	(0.026)
Correlations coefficients between residuals					
atanhrho_12		-0.206***			
		(0.010)			
atanhrho_34					-0.193***
					(0.006)
atanhrho_35					-0.213***
					(0.006)
atanhrho_45					-1.551***
					(0.015)
Observations	31227	31227	31227	31227	31227

3.6.2 Estimates using sub-samples

Although our main analyses show that mental accounting and housing tenure are important determinants of portfolio choice, the conditional analyses show variations in household behaviour when these variables are interacted together. This suggests that the effects of these variables are hidden in the complete sample or that there may be other household characteristics which have been subordinated in the main regressions. In the results reported in Table 3.15 I split the sample into sub-samples of mental accounting; *no mental account*, *single mental account* and *multiple mental accounts*. Further, to examine whether all coefficients vary between the full model for each asset class and the corresponding mental accounting sub-samples, I use Chow-type tests, which test the hypothesis that all coefficients of a model do not vary between disjointed subsets of the data (Hosmer and Leshow, 2000).

For housing tenure, outright ownership is significant for ownership of fairly safe assets among households that exhibit *no mental account*; both outright ownership and ownership through a mortgage are significant for ownership of risky assets and fairly safe assets, among households that exhibit a *single mental account*; and, for households that exhibit *multiple mental accounts*, both ownership through a mortgage and outright ownership have significant effects on ownership of fairly safe assets. *Time preference* has a significant effect on ownership of fairly safe assets for households that exhibit *no mental account*; it has a significant effect on ownership of risky asset for households that exhibit a *single mental account*; and it has a significant effect on ownership of both risky and fairly safe assets among household that exhibit *multiple mental accounts*. This implies that households time preferences are linked with ownership of financial products especially fairly safe assets.

The effect of *risk tolerance* is significant for ownership of risky assets among households that exhibit *no mental account* and *multiple mental accounts*; and it is significant for ownership of safe assets among households that exhibit a *single mental account*. *Cognitive ability* has a significant effect on ownership of risky assets among households that exhibit *no mental account* and those that exhibit a *single mental account*.

Panel B presents the results for portfolio share in the three asset classes. The results are generally consistent with the results reported in Table 3.8. However, for housing tenure (both under a mortgage and outright ownership), the results differ and I find significant effects on portfolio share in risky assets among households that exhibit a *single mental account* and none for households that exhibit *no mental account* or *multiple mental accounts*.

Table 3.15 Estimates using sub-samples of mental accounts

The table presents marginal effects from both pooled probit regressions (Panel A) and from pooled tobit regressions (Panel B). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
Financial advice (Base=none)									
Single source	-0.007	0.022**	-0.005*	0.001	0.030***	-0.002	-0.021*	0.001	0.002
	(0.007)	(0.008)	(0.003)	(0.011)	(0.011)	(0.002)	(0.011)	(0.008)	(0.001)
Multiple sources	0.011	0.044***	-0.000	0.026**	0.058***	-0.003	0.001	0.030***	0.001
	(0.007)	(0.009)	(0.003)	(0.011)	(0.012)	(0.003)	(0.011)	(0.008)	(0.001)
Housing tenure (Base=rents)									
Under a mortgage	-0.015	-0.008	0.004	0.092***	0.034*	-0.007**	0.030*	0.035***	0.002
	(0.012)	(0.013)	(0.003)	(0.017)	(0.018)	(0.003)	(0.018)	(0.013)	(0.001)
Own outright	-0.007	0.072***	0.004	0.070***	0.080***	-0.001	0.035*	0.068***	0.000
	(0.011)	(0.013)	(0.003)	(0.017)	(0.017)	(0.002)	(0.018)	(0.013)	(0.002)
Time preference	0.008	0.018**	-0.000	0.022**	0.017	-0.000	0.021**	0.021***	-0.001
	(0.007)	(0.009)	(0.003)	(0.010)	(0.010)	(0.002)	(0.009)	(0.007)	(0.001)

Table 3.15 Continued

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
Risk tolerance	0.019***	0.008	0.001	0.002	-0.001	0.006***	0.019**	-0.004	-0.000
	(0.007)	(0.009)	(0.003)	(0.010)	(0.011)	(0.001)	(0.009)	(0.007)	(0.001)
Cognitive ability	0.021***	0.013	0.001	0.040***	0.007	0.002	0.020*	0.015*	0.001
	(0.007)	(0.008)	(0.002)	(0.011)	(0.010)	(0.002)	(0.011)	(0.008)	(0.001)
Age	-0.000	0.001	0.001***	-0.001	0.001	-0.000	-0.002	-0.003*	0.000
	(0.002)	(0.002)	(0.000)	(0.002)	(0.002)	(0.000)	(0.002)	(0.001)	(0.000)
Age square	0.000	-0.000*	-0.000**	0.000	-0.000*	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.001	-0.046***	0.001	0.002	-0.047***	0.002	0.023**	-0.040***	-0.000
	(0.007)	(0.008)	(0.002)	(0.010)	(0.010)	(0.002)	(0.010)	(0.007)	(0.001)
Couple	-0.001	0.042***	0.006**	-0.002	0.041***	0.003*	0.009	0.016**	0.000
	(0.007)	(0.009)	(0.002)	(0.010)	(0.011)	(0.002)	(0.010)	(0.008)	(0.001)
Degree level or above qualification	0.029***	0.035***	0.004	0.048***	0.015	-0.004	0.032***	0.015*	0.000
	(0.008)	(0.011)	(0.003)	(0.011)	(0.012)	(0.003)	(0.010)	(0.008)	(0.001)
Employed or self-employed	0.008	0.001	0.008***	-0.007	0.011	0.003	0.018	-0.010	-0.002**
	(0.008)	(0.010)	(0.003)	(0.013)	(0.014)	(0.003)	(0.012)	(0.010)	(0.001)
Has children	-0.015	-0.073***	-0.018***	-0.023*	-0.041***	-0.007**	-0.032***	-0.049***	-0.003**
	(0.009)	(0.011)	(0.004)	(0.013)	(0.013)	(0.003)	(0.012)	(0.009)	(0.001)
Lives in urban area	0.001	0.002	-0.004*	-0.023**	0.007	-0.002	-0.001	0.024***	0.002
	(0.007)	(0.009)	(0.002)	(0.010)	(0.011)	(0.002)	(0.010)	(0.008)	(0.001)
Christian	0.003	0.011	0.002	0.040***	0.028**	0.007**	0.034***	0.018**	-0.000
	(0.009)	(0.010)	(0.003)	(0.011)	(0.012)	(0.003)	(0.011)	(0.009)	(0.001)
Has good health	0.016**	0.012	-0.005**	0.017	0.003	0.001	0.026**	0.006	0.000
	(0.006)	(0.008)	(0.002)	(0.010)	(0.010)	(0.002)	(0.010)	(0.008)	(0.001)
White British	0.022*	0.068***	0.003	0.002	0.064***	-0.002	0.017	0.061***	-0.001
	(0.011)	(0.013)	(0.004)	(0.018)	(0.017)	(0.002)	(0.017)	(0.013)	(0.001)
Log of net household wealth	0.036***	0.009**	0.001	0.029***	0.009*	0.000	0.042***	0.013***	0.000
	(0.004)	(0.004)	(0.001)	(0.007)	(0.005)	(0.001)	(0.007)	(0.004)	(0.000)
Log of net financial wealth	0.047***	0.105***	0.001	0.072***	0.100***	0.002***	0.097***	0.073***	0.001***
	(0.002)	(0.002)	(0.000)	(0.004)	(0.003)	(0.000)	(0.004)	(0.003)	(0.000)

Table 3.15 Continued

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Probability of ownership									
Region (Base = North East)									
North West	-0.016	0.034	-0.009	0.035	-0.004	0.001	0.015	0.004	0.000
	(0.018)	(0.021)	(0.006)	(0.026)	(0.023)	(0.004)	(0.025)	(0.016)	(0.002)
Yorkshire & Humber	0.015	0.041*	-0.009	0.037	0.041*	0.002	0.022	0.018	0.000
	(0.018)	(0.022)	(0.006)	(0.027)	(0.024)	(0.005)	(0.026)	(0.017)	(0.002)
East Midlands	0.008	0.047**	-0.004	0.075***	0.048*	0.001	0.020	0.017	
	(0.018)	(0.022)	(0.006)	(0.026)	(0.025)	(0.005)	(0.026)	(0.018)	
West Midlands	-0.017	0.049**	-0.006	0.006	0.024	-0.001	-0.011	-0.000	0.003
	(0.018)	(0.022)	(0.006)	(0.026)	(0.023)	(0.004)	(0.027)	(0.017)	(0.003)
East of England	0.022	0.046**	-0.010*	0.078***	0.029	-0.002	0.006	-0.001	0.002
	(0.018)	(0.022)	(0.006)	(0.025)	(0.023)	(0.004)	(0.025)	(0.016)	(0.002)
London	0.020	0.000	0.000	0.102***	0.012	0.005	0.030	-0.022	0.003
	(0.019)	(0.023)	(0.006)	(0.026)	(0.024)	(0.005)	(0.026)	(0.018)	(0.003)
South East	0.032*	0.040*	0.001	0.083***	0.021	0.000	0.069***	0.003	0.001
	(0.017)	(0.021)	(0.006)	(0.024)	(0.023)	(0.004)	(0.024)	(0.016)	(0.002)
South West	0.023	0.048**	0.006	0.076***	0.041*	0.004	0.026	0.015	-0.001
	(0.018)	(0.022)	(0.007)	(0.026)	(0.024)	(0.005)	(0.026)	(0.017)	(0.002)
Wales	-0.018	0.013	-0.009	0.011	0.026	0.002	-0.023	-0.023	0.001
	(0.020)	(0.023)	(0.006)	(0.028)	(0.025)	(0.005)	(0.029)	(0.019)	(0.002)
Scotland	-0.008	0.017	-0.007	0.040	0.002	0.003	0.013	0.013	0.002
	(0.018)	(0.022)	(0.006)	(0.025)	(0.022)	(0.004)	(0.026)	(0.017)	(0.002)
Year (Base = 2006)									
2007	-0.013	-0.025**	0.004	-0.012	-0.023*	0.001	-0.021*	-0.011	-0.001
	(0.009)	(0.011)	(0.003)	(0.013)	(0.013)	(0.002)	(0.012)	(0.009)	(0.001)
2008	-0.009	0.011	0.005	-0.018	0.003	0.002	-0.033***	0.008	0.001
	(0.009)	(0.011)	(0.003)	(0.013)	(0.014)	(0.003)	(0.012)	(0.009)	(0.002)
2009	0.006	0.043***	0.014***	0.008	0.040***	0.009**	-0.026*	0.045***	0.000
	(0.009)	(0.012)	(0.004)	(0.014)	(0.015)	(0.004)	(0.014)	(0.011)	(0.002)
2010	-0.017	0.056***	0.016***	0.015	0.052***	0.006	-0.043***	0.028**	-0.001
	(0.011)	(0.014)	(0.005)	(0.017)	(0.019)	(0.004)	(0.016)	(0.013)	(0.002)
Pseudo R^2									
Observations	13512	13512	13512	8235	8235	8235	12458	12458	11434

Table 3.15 Continued

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
Financial advice (Base=none)									
Single source	-0.015	0.050***	-0.050***	-0.000	0.048***	-0.042***	-0.023**	0.030***	-0.022**
	(0.016)	(0.014)	(0.013)	(0.014)	(0.014)	(0.013)	(0.009)	(0.010)	(0.010)
Multiple sources	0.031*	0.070***	-0.080***	0.033**	0.060***	-0.069***	0.002	0.050***	-0.050***
	(0.017)	(0.015)	(0.013)	(0.014)	(0.014)	(0.013)	(0.009)	(0.009)	(0.009)
Housing tenure (Base=rents)									
Under a mortgage	-0.021	0.094***	-0.083***	0.113***	0.159***	-0.146***	0.020	0.128***	-0.106***
	(0.027)	(0.024)	(0.021)	(0.028)	(0.022)	(0.021)	(0.016)	(0.016)	(0.016)
Own outright	-0.028	0.121***	-0.099***	0.075***	0.146***	-0.126***	0.009	0.121***	-0.094***
	(0.026)	(0.022)	(0.020)	(0.028)	(0.022)	(0.021)	(0.016)	(0.017)	(0.016)
Time preference	-0.002	-0.000	0.011	0.014	-0.010	0.011	0.004	0.006	-0.002
	(0.015)	(0.014)	(0.012)	(0.012)	(0.012)	(0.011)	(0.007)	(0.007)	(0.007)
Risk tolerance	0.052***	-0.022	0.000	-0.015	-0.012	0.024**	0.019**	-0.014*	0.001
	(0.015)	(0.014)	(0.012)	(0.012)	(0.012)	(0.011)	(0.007)	(0.008)	(0.007)
Cognitive ability	0.038**	0.011	-0.019	0.044***	0.003	-0.015	0.005	0.013	-0.009
	(0.017)	(0.013)	(0.012)	(0.015)	(0.013)	(0.013)	(0.010)	(0.010)	(0.009)
Age	-0.002	0.005*	-0.005*	-0.005*	0.006**	-0.003	-0.005**	0.005**	-0.001
	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000	-0.000***	0.000***	0.000**	-0.000***	0.000**	0.000***	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.001	-0.083***	0.074***	0.017	-0.058***	0.044***	0.017**	-0.031***	0.023***
	(0.016)	(0.014)	(0.012)	(0.013)	(0.012)	(0.012)	(0.008)	(0.008)	(0.008)
Couple	-0.009	0.055***	-0.052***	-0.036***	0.039***	-0.019	-0.015*	0.021**	-0.012
	(0.016)	(0.014)	(0.013)	(0.014)	(0.013)	(0.012)	(0.009)	(0.009)	(0.009)
Degree level or above qualification	0.065***	0.018	-0.035***	0.048***	-0.024*	0.015	0.024***	-0.007	-0.004
	(0.017)	(0.015)	(0.014)	(0.013)	(0.013)	(0.012)	(0.008)	(0.008)	(0.008)

Table 3.15 Continued

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
Employed or self-employed	0.034*	-0.002	-0.004	-0.004	-0.009	0.015	0.021**	-0.015	0.009
	(0.018)	(0.016)	(0.015)	(0.016)	(0.016)	(0.015)	(0.010)	(0.011)	(0.010)
Has children	-0.023	-0.107***	0.079***	-0.024	-0.031*	0.029*	-0.024**	-0.022**	0.027***
	(0.022)	(0.019)	(0.017)	(0.017)	(0.016)	(0.015)	(0.010)	(0.010)	(0.010)
Lives in urban area	0.003	0.034**	-0.037***	-0.031**	0.021	-0.003	-0.005	0.032***	-0.025***
	(0.015)	(0.014)	(0.012)	(0.013)	(0.013)	(0.012)	(0.008)	(0.009)	(0.008)
Christian	0.011	0.030*	-0.021	0.043***	0.036**	-0.033**	0.024**	0.027***	-0.029***
	(0.019)	(0.017)	(0.015)	(0.016)	(0.015)	(0.014)	(0.010)	(0.010)	(0.010)
Has good health	0.040***	0.010	-0.024**	0.026*	0.010	-0.019	0.022**	0.009	-0.016*
	(0.015)	(0.013)	(0.012)	(0.014)	(0.013)	(0.012)	(0.009)	(0.009)	(0.009)
White British	0.043	0.109***	-0.100***	-0.013	0.053**	-0.051**	-0.000	0.064***	-0.051***
	(0.029)	(0.023)	(0.022)	(0.023)	(0.022)	(0.021)	(0.014)	(0.015)	(0.015)
Log of net household wealth	0.082***	0.004	-0.015**	0.044***	-0.006	-0.007	0.041***	-0.009	-0.008
	(0.010)	(0.007)	(0.006)	(0.009)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)
Log of net financial wealth	0.092***	0.172***	-0.162***	0.083***	0.116***	-0.121***	0.072***	0.079***	-0.089***
	(0.005)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Region (Base = North East)									
North West	-0.035	0.034	-0.031	0.051	-0.027	0.016	0.000	0.019	-0.025
	(0.042)	(0.037)	(0.033)	(0.034)	(0.031)	(0.029)	(0.021)	(0.022)	(0.021)
Yorkshire & Humber	0.013	0.055	-0.045	0.025	0.001	0.007	0.008	0.045**	-0.046**
	(0.041)	(0.038)	(0.034)	(0.035)	(0.032)	(0.031)	(0.022)	(0.022)	(0.021)
East Midlands	-0.030	0.064*	-0.045	0.086**	0.005	-0.018	-0.011	0.034	-0.028
	(0.041)	(0.038)	(0.034)	(0.034)	(0.032)	(0.030)	(0.022)	(0.022)	(0.021)
West Midlands	-0.057	0.055	-0.047	-0.003	-0.019	0.021	-0.044**	0.014	-0.001
	(0.042)	(0.038)	(0.033)	(0.034)	(0.030)	(0.029)	(0.022)	(0.023)	(0.022)
East of England	0.028	0.048	-0.047	0.098***	0.009	-0.027	-0.003	-0.004	0.003
	(0.040)	(0.037)	(0.033)	(0.033)	(0.030)	(0.029)	(0.021)	(0.022)	(0.021)
London	0.030	-0.061	0.021	0.102***	-0.078**	0.053*	-0.003	-0.055**	0.056***
	(0.042)	(0.040)	(0.035)	(0.034)	(0.032)	(0.030)	(0.022)	(0.022)	(0.022)

Table 3.15 Continued

Independent variable	No mental account			Single mental account			Multiple mental accounts		
	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset	Risky asset	Fairly safe asset	Safe asset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B: Portfolio share									
South East	0.046	0.024	-0.031	0.105***	-0.054*	0.018	0.032	-0.017	0.007
	(0.038)	(0.037)	(0.032)	(0.032)	(0.029)	(0.028)	(0.020)	(0.020)	(0.020)
South West	0.035	0.044	-0.054	0.093***	-0.033	0.010	0.009	0.028	-0.029
	(0.041)	(0.038)	(0.033)	(0.034)	(0.031)	(0.029)	(0.021)	(0.022)	(0.021)
Wales	-0.058	0.004	0.005	0.016	-0.000	-0.003	-0.008	-0.008	0.002
	(0.045)	(0.040)	(0.036)	(0.037)	(0.034)	(0.032)	(0.026)	(0.026)	(0.025)
Scotland	-0.007	0.043	-0.041	0.068**	-0.020	-0.003	0.017	0.051**	-0.060***
	(0.042)	(0.038)	(0.033)	(0.033)	(0.030)	(0.029)	(0.023)	(0.023)	(0.022)
Year (Base = 2006)									
2007	-0.025	-0.038**	0.033**	-0.018	-0.030*	0.034**	-0.010	-0.005	0.005
	(0.020)	(0.018)	(0.016)	(0.017)	(0.016)	(0.015)	(0.010)	(0.011)	(0.010)
2008	-0.044**	0.023	-0.009	-0.044**	0.006	0.023	-0.038***	0.020*	-0.005
	(0.020)	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.010)	(0.011)	(0.011)
2009	-0.028	0.062***	-0.032*	-0.019	0.028	-0.010	-0.049***	0.062***	-0.033***
	(0.021)	(0.019)	(0.018)	(0.018)	(0.018)	(0.017)	(0.011)	(0.012)	(0.011)
2010	-0.065**	0.099***	-0.072***	-0.019	0.069***	-0.042**	-0.056***	0.060***	-0.030**
	(0.026)	(0.022)	(0.020)	(0.021)	(0.021)	(0.020)	(0.013)	(0.014)	(0.013)
Constant	-2.414***	-1.833***	2.822***	-1.738***	-1.073***	2.114***	-1.385***	-0.629***	1.779***
	(0.134)	(0.093)	(0.084)	(0.103)	(0.080)	(0.074)	(0.067)	(0.060)	(0.058)
Pseudo R^2	0.251	0.260	0.296	0.254	0.183	0.230	0.246	0.144	0.209
Observations	13329	13329	12987	8209	8209	8123	12450	12450	12343

Risk tolerance is significant among households that exhibit *no mental account* and those households exhibiting *multiple mental accounts* while *cognitive ability* has significant effects among households that exhibit *no mental account* and those that exhibit a *single mental account*. Regarding control variables, the effect of the variable *degree or above qualification* is about three times higher in magnitude among households that exhibit *no mental account*, when compared to the effects among households that exhibit *multiple mental accounts*. Another important finding, concerns year dummies where I observe consistent and significant negative effects during 2008, 2009 and 2010 for portfolio share in a risky asset and positive and significant effects during 2009 and 2010 for portfolio share in a fairly risky asset, among households that exhibit *multiple mental accounts*. This finding suggests that households that exhibit *multiple mental accounts* responded to the crisis by reducing investment in risky assets while increasing investment in fairly safe assets.

Most importantly, when I use Chow-type tests, I reject at the 1% level the hypothesis that the coefficient estimates derived for each mental account sub-sample, for both ownership and portfolio share, are not statistically different from the full sample coefficient estimates. Thus I conclude that mental accounts lead households to make different portfolio choices.

3.6.3 Alternative classification of financial assets

Classification of financial assets into risky, fairly safe or safe assets is debatable in the literature and compositions of assets in each category vary across studies (See for example Guiso et al., 2000; Christelis et al., 2010; Atella et al., 2012). This is because some financial products provide tax benefits (for example, ISAs and friendly society savings plans in the UK) while other products consist of varying levels of risk depending on the proportion invested in a risky or a riskless asset (for example unit trusts). This suggests that the results may be driven by the manner in which assets have been classified into the three asset classes. Thus, in the alternative classifications, I consider risky assets to consist of direct holding of stock in UK or overseas (listed or unlisted companies), employee shares, investment ISAs and unit or investment bonds. Fairly safe assets include investments in fixed-term investment bonds, overseas and UK gilts, endowment or regular premium policies, single premium policies, lump-sum insurance policies, national savings products, individual retirement accounts or other financial assets and friendly society saving plans. Finally, safe assets include investments in individual savings and current accounts. Table 3.16 reports raw coefficient estimates from pooled probit regressions and tobit regressions using the specifications for conditional analysis in Table 3.9.

Overall the results are consistent with the findings in Table 3.9. Nevertheless, as expected, the effects of some variables become significant or the levels of significance increase. For example, the negative effect of exhibiting a *single mental account* on ownership of and portfolio share in a risky asset declines while the level of significance for the effect of exhibiting *multiple mental accounts* increases for portfolio share in a risky asset. For financial advice, the effect of a *single source* becomes significant for ownership of and portfolio share in a risky asset while its effect on ownership of a fairly safe asset dissipates. The negative effect of housing tenure (under mortgage) on ownership of a risky asset becomes significant and its effect on other asset classes is stable.

Table 3.16 Estimates using alternative definitions of asset class

The table presents marginal effects from both pooled probit regressions (Column (1), (3) and (5)) and from pooled tobit regressions (Column (2), (4) and (6)). The dependent variables are risky asset, fairly safe asset and safe asset; ownership equals one if households owns at least one asset in each asset class or zero otherwise and portfolio share is the proportion of financial assets invested in each asset class to total financial assets. Risky assets consist of direct holding of stock in UK or overseas (listed or unlisted companies), employee shares, investment ISAs and unit or investment bonds. Fairly safe assets include investments in fixed-term investment bonds, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump-sum insurance policy, individual retirement accounts or other financial assets and friendly society saving plan. Safe assets include investments in individual savings and current accounts, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Mental account (Base=none)						
Single mental account	-0.188**	-0.053*	0.086	0.124***	0.320**	-0.063***
	(0.083)	(0.031)	(0.060)	(0.023)	(0.152)	(0.022)
Multiple mental account	0.109	0.072***	0.366***	0.212***	0.231	-0.175***
	(0.075)	(0.028)	(0.061)	(0.021)	(0.160)	(0.021)
Financial advice (Base=none)						
Single source	0.088**	0.085***	0.026	0.067***	-0.062	-0.044***
	(0.035)	(0.014)	(0.031)	(0.011)	(0.069)	(0.011)
Multiple sources	0.166***	0.119***	0.140***	0.064***	0.028	-0.086***
	(0.036)	(0.014)	(0.033)	(0.011)	(0.082)	(0.011)
Home tenure (Base=rents)						
Under a mortgage	-0.138***	0.018	0.021	0.128***	0.053	-0.112***
	(0.052)	(0.021)	(0.043)	(0.016)	(0.092)	(0.016)
Own outright	0.009	0.013	0.324***	0.155***	0.015	-0.160***
	(0.050)	(0.020)	(0.040)	(0.015)	(0.089)	(0.015)

Table 3.16 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Time preference	0.034	-0.001	0.027	0.002	-0.031	0.003
	(0.036)	(0.013)	(0.034)	(0.011)	(0.077)	(0.011)
Risk tolerance	0.041	0.024*	0.105***	-0.018*	0.059	-0.020*
	(0.035)	(0.013)	(0.033)	(0.011)	(0.078)	(0.011)
Cognitive ability	0.098***	0.023*	0.087***	0.025**	0.064	-0.038***
	(0.035)	(0.014)	(0.029)	(0.011)	(0.059)	(0.011)
Single mental account * single source	-0.037	-0.046**	0.015	-0.031*	-0.013	0.019
	(0.053)	(0.020)	(0.049)	(0.016)	(0.134)	(0.016)
Single mental account * multiple sources	0.022	-0.049**	0.061	-0.047***	-0.159	0.028*
	(0.054)	(0.020)	(0.052)	(0.016)	(0.139)	(0.016)
Multiple mental account * single source	-0.087*	-0.055***	-0.047	-0.066***	0.518**	0.034**
	(0.049)	(0.017)	(0.049)	(0.015)	(0.210)	(0.014)
Multiple mental account * multiple sources	-0.071	-0.081***	-0.018	-0.086***	0.036	0.059***
	(0.047)	(0.017)	(0.048)	(0.014)	(0.148)	(0.013)
Single mental account * under a mortgage	0.339***	0.071**	0.177***	-0.030	-0.298**	-0.020
	(0.077)	(0.030)	(0.059)	(0.022)	(0.144)	(0.021)
Single mental account * own outright	0.161**	0.033	-0.016	-0.089***	-0.174	0.046**
	(0.072)	(0.028)	(0.054)	(0.020)	(0.138)	(0.019)
Multiple mental account * under a mortgage	0.219***	0.020	0.156***	-0.062***	0.046	0.028
	(0.067)	(0.026)	(0.056)	(0.020)	(0.180)	(0.019)
Multiple mental account * own outright	0.120*	-0.012	-0.069	-0.145***	-0.073	0.108***
	(0.063)	(0.024)	(0.054)	(0.019)	(0.168)	(0.018)
Single mental account * time preference	0.073	0.013	0.013	-0.023	0.028	0.007
	(0.051)	(0.018)	(0.053)	(0.015)	(0.140)	(0.015)
Multiple mental account * time preference	0.044	-0.021	0.082*	-0.011	-0.054	0.010
	(0.045)	(0.015)	(0.047)	(0.013)	(0.145)	(0.013)
Single mental account * risk tolerance	-0.053	-0.027	-0.112**	-0.005	0.180	0.037**
	(0.052)	(0.019)	(0.052)	(0.016)	(0.164)	(0.015)
Multiple mental account * risk tolerance	0.054	-0.006	-0.127***	-0.011	0.004	0.025*
	(0.046)	(0.016)	(0.048)	(0.014)	(0.160)	(0.013)
Single mental account * cognitive ability	0.003	0.012	-0.005	-0.033**	0.013	0.019
	(0.053)	(0.020)	(0.047)	(0.016)	(0.115)	(0.015)

Table 3.16 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Multiple mental account * cognitive ability	-0.038	-0.027	-0.026	-0.034**	0.111	0.038***
	(0.048)	(0.017)	(0.046)	(0.014)	(0.145)	(0.014)
Age	-0.011**	-0.005***	0.003	0.004***	0.019**	-0.002*
	(0.005)	(0.002)	(0.004)	(0.001)	(0.008)	(0.001)
Age square	0.000	0.000**	-0.000**	-0.000***	-0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.035	0.025***	-0.206***	-0.055***	0.043	0.043***
	(0.022)	(0.007)	(0.022)	(0.006)	(0.050)	(0.006)
Couple	-0.033	-0.045***	0.193***	0.035***	0.155***	-0.025***
	(0.022)	(0.007)	(0.022)	(0.006)	(0.055)	(0.006)
Degree level or above qualification	0.170***	0.046***	0.021	-0.048***	0.003	0.000
	(0.023)	(0.007)	(0.025)	(0.006)	(0.064)	(0.006)
Employed or self-employed	0.019	0.002	-0.000	-0.007	0.136*	0.016**
	(0.027)	(0.009)	(0.028)	(0.008)	(0.070)	(0.007)
Has children	-0.079***	-0.017**	-0.243***	-0.034***	-0.398***	0.044***
	(0.027)	(0.009)	(0.026)	(0.008)	(0.057)	(0.007)
Lives in urban area	-0.025	-0.002	0.042*	0.027***	-0.061	-0.016**
	(0.022)	(0.007)	(0.023)	(0.006)	(0.062)	(0.006)
Christian	0.095***	0.025***	0.072***	0.017**	0.078	-0.027***
	(0.026)	(0.009)	(0.025)	(0.007)	(0.057)	(0.007)
Has good health	0.094***	0.031***	0.039*	-0.001	-0.122**	-0.025***
	(0.021)	(0.007)	(0.021)	(0.006)	(0.056)	(0.006)
White British	0.146***	0.040***	0.295***	0.071***	-0.069	-0.080***
	(0.037)	(0.013)	(0.033)	(0.011)	(0.080)	(0.011)
Log of net household wealth	0.173***	0.054***	0.030***	-0.002	0.028*	-0.009**
	(0.014)	(0.004)	(0.011)	(0.003)	(0.016)	(0.004)
Log of net financial wealth	0.364***	0.096***	0.338***	0.068***	0.064***	-0.118***
	(0.008)	(0.003)	(0.007)	(0.002)	(0.013)	(0.002)
Region (Base = North East)						
North West	0.035	0.012	0.141***	0.004	-0.034	-0.020
	(0.054)	(0.019)	(0.049)	(0.016)	(0.126)	(0.016)

Table 3.16 Continued

Independent variable	Risky asset		Fairly safe asset		Safe asset	
	ownership	portfolio share	ownership	portfolio share	ownership	portfolio share
	(1)	(2)	(3)	(4)	(5)	(6)
Yorkshire & Humber	0.044	0.009	0.226***	0.025	-0.029	-0.032**
	(0.056)	(0.019)	(0.052)	(0.016)	(0.130)	(0.016)
East Midlands	0.070	-0.005	0.257***	0.031*	0.117	-0.031*
	(0.056)	(0.019)	(0.053)	(0.016)	(0.140)	(0.016)
West Midlands	-0.055	-0.022	0.197***	0.029*	-0.059	-0.021
	(0.055)	(0.019)	(0.052)	(0.016)	(0.128)	(0.016)
East of England	0.122**	0.020	0.265***	0.022	-0.044	-0.035**
	(0.054)	(0.018)	(0.052)	(0.016)	(0.129)	(0.016)
London	0.111*	0.009	0.066	-0.047***	0.093	0.027*
	(0.057)	(0.019)	(0.054)	(0.016)	(0.142)	(0.016)
South East	0.229***	0.040**	0.194***	-0.020	0.016	-0.017
	(0.052)	(0.018)	(0.050)	(0.015)	(0.128)	(0.015)
South West	0.153***	0.034*	0.317***	0.021	0.228	-0.052***
	(0.055)	(0.019)	(0.052)	(0.016)	(0.151)	(0.016)
Wales	-0.058	-0.014	0.077	-0.012	0.018	0.003
	(0.061)	(0.021)	(0.055)	(0.018)	(0.143)	(0.018)
Scotland	0.033	0.025	0.059	0.015	0.044	-0.026
	(0.055)	(0.019)	(0.051)	(0.016)	(0.131)	(0.016)
Year (Base = 2006)						
2007	-0.091***	-0.033***	-0.046*	-0.008	0.037	0.016**
	(0.026)	(0.009)	(0.026)	(0.008)	(0.065)	(0.007)
2008	-0.138***	0.014	0.021	0.084***	0.109	-0.002
	(0.026)	(0.009)	(0.027)	(0.008)	(0.077)	(0.007)
2009	-0.065**	0.196***	0.148***	0.229***	0.402***	-0.029***
	(0.030)	(0.010)	(0.031)	(0.008)	(0.094)	(0.008)
2010	-0.144***	0.218***	0.169***	0.247***	0.349***	-0.050***
	(0.035)	(0.012)	(0.036)	(0.010)	(0.110)	(0.009)
Constant	-6.068***	-1.673***	-4.028***	-0.768***	0.742***	2.231***
	(0.161)	(0.052)	(0.134)	(0.041)	(0.254)	(0.041)
Pseudo R^2	0.309	0.306	0.316	0.178	0.133	0.298
Observations	34205	26368	34205	30320	34205	33395

An interesting finding that supports our conjecture about risk is the change in the effects of *risk tolerance*, which now becomes insignificant for ownership of a risky asset but become significant for ownership of a fairly safe asset. This observation is also reflected by the change in the signs of year dummies for portfolio share in a risky asset and the increase in the magnitudes of their effects for portfolio share in both a risky asset and a fairly safe asset. In contrast, for ownership of a fairly safe asset, the effects of year dummies decline.

The corresponding interaction effects are seen across most of the interaction terms between mental accounting with financial advice, housing tenure, *time preference*, *risk tolerance* and *cognitive ability*. For example, the interaction terms between mental accounting and financial advice become significant for portfolio share in risky assets while still remaining significant for portfolio share in both fairly safe assets and safe assets. The negative effect of *risk tolerance* on mental accounting dissipates for portfolio share in risky assets but becomes influential for ownership of fairly safe assets; however, its effect on portfolio share in safe assets remains unchanged. Whereas the interaction effects between mental accounting and *time preference* are eliminated, the effects between mental accounting and *cognitive ability* remain unchanged. In sum, these results indicate that mental accounting does play an important role in the manner in which households respond to portfolio choices irrespective of how assets are classified.

3.6.4 Estimates from poisson regressions

Thus far, I have assumed that mental accounts are distinct from specific financial products that constitute the different asset classes. In other words, I take for granted that an investor does not literally link a specific mental account to a specific financial product or vice versa. However, as pointed out by Zhou and Pham (2004) households may "infer their investment priorities ex post from the financial products available to them" so that, in our case, mental accounting could simply be capturing the effects of the number of financial products. To investigate this, I first estimate poisson regressions where the dependent variable is the number of financial products held by a household in each asset class, using the specifications in Table 3.9. In these regressions, because of the way I construct mental accounting variables, I should expect to find significant effects of mental accounting on the number of financial products held by a household. Thus, in the second set of poisson regressions, I re-parameterize the categorical variable for mental accounting to be a continuous variable representing the number of reasons for saving money that households identify. This allows me to examine whether there is indeed a strong relationship between the number of investment products and the number of reasons for saving money. The results are presented in Table 3.17 and I report incidence-rate ratios (IRRs).

Table 3.17 Poisson regression estimates

Table presents incidence- rate ratios from poisson regressions. The dependent variables are the number of all financial assets held in each asset class. Risky assets include shares or stocks in listed or unlisted companies (overseas or UK). Fairly safe assets include investments in fixed-term investment bonds, unit or investment trust, employee share options and shares, overseas and UK gilts, endowment or regular premium policy, single premium policy, lump sum insurance policy, individual retirement accounts, or other financial assets. Safe assets include investments in individual savings and current accounts, friendly society saving plan, informal savings, or national savings products. Mental accounts is a categorical variable with three dummies: no mental account equals one if a household has no specific reason for saving money and zero otherwise (base level); single mental account equals one if a household identifies only one reason for saving money and zero otherwise; and multiple mental accounts equals one if a household identifies more than one reason for saving money and zero otherwise. Financial advice is a categorical variable with three dummies: no advice equals one if a respondent does not identify any source of advice (base level); single advice equals one if respondent identifies only one source of advice and zero otherwise; and multiple sources of advice equals one if respondent identifies more than one source of advice and zero otherwise. Housing tenure is a categorical variable with three dummies: rents current accommodation (base level); owns through a mortgage; and owns outright. The control variables as described in Table 3.1 are time preference, risk tolerance, cognitive ability, age, age square, male, couple, degree level or above, has children, lives in urban area, Christian, has good health, White British, log of net financial wealth, log of net household wealth, region dummies, and year dummies. Panel A replicates the specifications Table 3.9 while in Panel B the same specification is used apart from the categorical variable, mental accounts, which is replaced by a continuous variable, number of mental accounts. Standard errors are clustered at the individual level and are reported in parentheses. The levels of significance are given by * for 10%, ** for 5%, and *** for 1%.

Independent variable	All financial assets	Risky assets	Fairly safe assets	Safe assets
	(1)	(2)	(3)	(4)
***Panel A: Using specifications in* Table 3.9**				
Mental account (Base=none)				
Single mental account	1.076***	0.931	1.391***	1.125***
	(0.018)	(0.091)	(0.073)	(0.017)
Multiple mental account	1.202***	1.729***	1.829***	1.196***
	(0.020)	(0.142)	(0.087)	(0.018)
Financial advice (Base=none)				
Single source	1.029***	1.074**	1.083***	1.015*
	(0.009)	(0.039)	(0.025)	(0.008)
Multiple sources	1.069***	1.196***	1.129***	1.039***
	(0.010)	(0.042)	(0.026)	(0.009)
Home tenure (Base=rents)				
Under a mortgage	0.971**	1.289***	1.296***	0.989
	(0.013)	(0.084)	(0.052)	(0.012)
Own outright	1.123***	1.573***	1.641***	1.084***
	(0.013)	(0.099)	(0.062)	(0.012)
Time preference	1.040***	1.096***	1.095***	1.013
	(0.010)	(0.035)	(0.024)	(0.009)
Risk tolerance	1.031***	1.091***	0.999	1.028***
	(0.010)	(0.035)	(0.022)	(0.009)
Cognitive ability	1.051***	1.177***	1.050**	1.047***
	(0.009)	(0.046)	(0.024)	(0.008)
Single mental account * single source	1.001	1.007	0.993	0.991
	(0.013)	(0.051)	(0.032)	(0.012)
Single mental account * multiple sources	1.015	1.017	0.985	1.005
	(0.014)	(0.049)	(0.032)	(0.012)
Multiple mental account * single source	0.981	0.989	0.927***	0.980*
	(0.012)	(0.043)	(0.027)	(0.011)

Table 3.17 Continued

Independent variable	All financial assets (1)	Risky assets (2)	Fairly safe assets (3)	Safe assets (4)
***Panel A: Using specifications in* Table 3.9**				
Multiple mental account * multiple sources	0.970***	0.911**	0.919***	0.965***
	(0.011)	(0.037)	(0.025)	(0.010)
Single mental account * under a mortgage	1.083***	1.355***	0.957	1.005
	(0.019)	(0.125)	(0.049)	(0.015)
Single mental account * own outright	0.972*	1.067	0.814***	0.935***
	(0.014)	(0.093)	(0.039)	(0.012)
Multiple mental account * under a mortgage	1.088***	0.976	0.859***	1.030**
	(0.017)	(0.073)	(0.039)	(0.015)
Multiple mental account * own outright	0.965**	0.783***	0.698***	0.944***
	(0.014)	(0.055)	(0.029)	(0.012)
Single mental account * time preference	0.996	1.007	0.933**	1.004
	(0.013)	(0.043)	(0.027)	(0.012)
Multiple mental account * time preference	0.986	0.931*	0.929***	0.993
	(0.011)	(0.034)	(0.023)	(0.010)
Single mental account * risk tolerance	0.990	0.947	0.986	0.994
	(0.013)	(0.042)	(0.031)	(0.012)
Multiple mental account * risk tolerance	0.987	0.975	0.959	0.982*
	(0.011)	(0.036)	(0.025)	(0.010)
Single mental account * cognitive ability	0.992	0.991	0.950	0.990
	(0.013)	(0.053)	(0.031)	(0.011)
Multiple mental account * cognitive ability	0.984	0.884***	0.959	0.981*
	(0.011)	(0.041)	(0.027)	(0.010)
Age	1.001	0.992**	1.009***	0.997***
	(0.001)	(0.004)	(0.003)	(0.001)
Age square	1.000***	1.000	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.972***	1.049***	0.901***	0.981***
	(0.005)	(0.019)	(0.010)	(0.005)
Couple	1.056***	0.983	1.130***	1.044***
	(0.006)	(0.018)	(0.014)	(0.005)
Degree level or above qualification	1.036***	1.137***	0.972**	1.005
	(0.006)	(0.019)	(0.012)	(0.005)
Employed or self-employed	0.997	1.029	1.016	0.997
	(0.006)	(0.021)	(0.014)	(0.006)
Has children	0.947***	0.932***	0.894***	0.962***
	(0.006)	(0.021)	(0.014)	(0.006)
Lives in urban area	1.002	1.007	1.058***	0.987***
	(0.005)	(0.018)	(0.013)	(0.005)
Christian	1.032***	1.095***	1.031**	1.015***
	(0.006)	(0.023)	(0.015)	(0.006)
Has good health	1.020***	1.078***	1.020*	1.010**
	(0.005)	(0.020)	(0.012)	(0.005)
White British	1.078***	1.124***	1.130***	1.047***
	(0.010)	(0.041)	(0.026)	(0.008)
Log of net household wealth	1.033***	1.127***	0.989	1.024***
	(0.003)	(0.014)	(0.007)	(0.002)
Log of net financial wealth	1.175***	1.470***	1.322***	1.074***
	(0.002)	(0.010)	(0.006)	(0.002)
Region dummies (Base = North East)				
North West	1.034**	1.034	1.026	1.037***
	(0.014)	(0.051)	(0.030)	(0.012)
Yorkshire & Humber	1.058***	1.037	1.086***	1.055***
	(0.015)	(0.053)	(0.033)	(0.013)
East Midlands	1.088***	1.110**	1.127***	1.067***
	(0.015)	(0.056)	(0.034)	(0.013)

Table 3.15 Continued

Independent variable	All financial assets (1)	Risky assets (2)	Fairly safe assets (3)	Safe assets (4)
***Panel A: Using specifications in* Table 3.9**				
West Midlands	1.055***	1.011	1.076**	1.055***
	(0.015)	(0.052)	(0.033)	(0.013)
East of England	1.077***	1.107**	1.026	1.095***
	(0.015)	(0.054)	(0.031)	(0.013)
London	1.051***	1.093*	0.941*	1.068***
	(0.015)	(0.055)	(0.030)	(0.013)
South East	1.092***	1.202***	0.994	1.088***
	(0.014)	(0.056)	(0.028)	(0.012)
South West	1.102***	1.165***	1.065**	1.104***
	(0.015)	(0.057)	(0.032)	(0.013)
Wales	1.002	0.972	0.999	1.015
	(0.015)	(0.056)	(0.033)	(0.014)
Scotland	1.005	1.073	1.022	0.980*
	(0.014)	(0.054)	(0.032)	(0.012)
Year dummies (Base = 2006)				
2007	0.973***	0.906***	0.978	0.988**
	(0.006)	(0.018)	(0.015)	(0.006)
2008	0.989*	0.898***	1.045***	0.996
	(0.006)	(0.017)	(0.015)	(0.006)
2009	1.055***	0.985	1.180***	1.031***
	(0.007)	(0.022)	(0.019)	(0.007)
2010	1.038***	0.928***	1.163***	1.024***
	(0.008)	(0.025)	(0.021)	(0.008)
Pseudo R^2	0.168	0.246	0.147	0.041
Observations	34205	34205	34205	34205
Panel B: Re-parameterized variables				
Number of mental accounts	1.061***	1.179***	1.171***	1.059***
	(0.005)	(0.022)	(0.014)	(0.005)
Financial advice (Base=none)				
Single source	1.026***	1.071**	1.069***	1.013*
	(0.007)	(0.029)	(0.018)	(0.007)
Multiple sources	1.083***	1.206***	1.134***	1.051***
	(0.008)	(0.031)	(0.019)	(0.007)
Home tenure (Base=rents)				
Under a mortgage	1.015	1.486***	1.318***	1.009
	(0.011)	(0.076)	(0.042)	(0.010)
Own outright	1.121***	1.620***	1.546***	1.070***
	(0.011)	(0.082)	(0.048)	(0.010)
Time preference	1.048***	1.097***	1.071***	1.028***
	(0.007)	(0.024)	(0.016)	(0.006)
Risk tolerance	1.030***	1.074***	0.993	1.029***
	(0.007)	(0.024)	(0.016)	(0.006)
Cognitive ability	1.055***	1.180***	1.046**	1.050***
	(0.007)	(0.034)	(0.019)	(0.007)
No. of mental accounts * single source of advice	0.998	1.000	0.989	0.996
	(0.003)	(0.010)	(0.007)	(0.003)
No. of mental accounts * multiple sources of advice	0.986***	0.973***	0.974***	0.984***
	(0.003)	(0.008)	(0.006)	(0.003)
No. of mental accounts * under a mortgage	1.009**	0.958***	0.948***	0.997
	(0.004)	(0.016)	(0.010)	(0.004)
No. of mental accounts * own outright	0.987***	0.927***	0.913***	0.981***
	(0.004)	(0.015)	(0.009)	(0.004)
No. of mental accounts * time preference	0.992***	0.983**	0.985***	0.991***
	(0.002)	(0.007)	(0.005)	(0.002)

Table 3.17 Continued

Independent variable	All financial assets (1)	Risky assets (2)	Fairly safe assets (3)	Safe assets (4)
Panel B: Re-parameterized variables				
No. of mental accounts * risk tolerance	0.995*	0.995	0.990*	0.993***
	(0.003)	(0.007)	(0.005)	(0.002)
No. of mental accounts * cognitive ability	0.991***	0.964***	0.983**	0.991***
	(0.003)	(0.010)	(0.006)	(0.003)
Age	1.000	0.991**	1.007***	0.996***
	(0.001)	(0.004)	(0.003)	(0.001)
Age square	1.000	1.000	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.971***	1.046**	0.900***	0.980***
	(0.005)	(0.019)	(0.010)	(0.005)
Couple	1.055***	0.982	1.129***	1.043***
	(0.006)	(0.018)	(0.014)	(0.005)
Degree level or above qualification	1.034***	1.134***	0.970**	1.005
	(0.006)	(0.019)	(0.011)	(0.005)
Employed or self-employed	1.000	1.027	1.021	1.001
	(0.006)	(0.021)	(0.014)	(0.006)
Has children	0.943***	0.928***	0.887***	0.958***
	(0.006)	(0.021)	(0.014)	(0.006)
Lives in urban area	1.003	1.008	1.060***	0.988**
	(0.005)	(0.018)	(0.013)	(0.005)
Christian	1.033***	1.096***	1.033**	1.017***
	(0.006)	(0.023)	(0.015)	(0.006)
Has good health	1.021***	1.077***	1.022*	1.010**
	(0.005)	(0.020)	(0.012)	(0.005)
White British	1.080***	1.127***	1.133***	1.048***
	(0.010)	(0.041)	(0.026)	(0.008)
Log of net household wealth	1.033***	1.125***	0.989	1.024***
	(0.003)	(0.014)	(0.007)	(0.002)
Log of net financial wealth	1.175***	1.466***	1.321***	1.075***
	(0.002)	(0.010)	(0.006)	(0.001)
Region dummies (Base = North East)				
North West	1.031**	1.032	1.022	1.034***
	(0.014)	(0.051)	(0.030)	(0.012)
Yorkshire & Humber	1.055***	1.034	1.079**	1.052***
	(0.015)	(0.053)	(0.033)	(0.013)
East Midlands	1.086***	1.105**	1.121***	1.064***
	(0.015)	(0.056)	(0.034)	(0.013)
West Midlands	1.051***	1.005	1.069**	1.051***
	(0.015)	(0.052)	(0.033)	(0.013)
East of England	1.075***	1.105**	1.022	1.092***
	(0.014)	(0.054)	(0.031)	(0.013)
London	1.047***	1.087*	0.934**	1.064***
	(0.015)	(0.054)	(0.030)	(0.013)
South East	1.089***	1.197***	0.988	1.084***
	(0.014)	(0.055)	(0.028)	(0.012)
South West	1.098***	1.159***	1.058*	1.099***
	(0.015)	(0.056)	(0.032)	(0.013)
Wales	1.000	0.968	0.995	1.013
	(0.015)	(0.056)	(0.033)	(0.014)
Scotland	1.005	1.073	1.022	0.980*
	(0.014)	(0.054)	(0.032)	(0.012)

Table 3.17 Continued

Independent variable	All financial assets (1)	Risky assets (2)	Fairly safe assets (3)	Safe assets (4)
Panel B: Re-parameterized variables				
Year dummies (Base = 2006)				
2007	0.972***	0.906***	0.977	0.987**
	(0.006)	(0.018)	(0.015)	(0.006)
2008	0.991	0.902***	1.046***	0.997
	(0.006)	(0.017)	(0.015)	(0.006)
2009	1.057***	0.986	1.182***	1.032***
	(0.007)	(0.022)	(0.019)	(0.007)
2010	1.041***	0.932***	1.164***	1.025***
	(0.008)	(0.025)	(0.021)	(0.008)
Pseudo R^2	0.167	0.244	0.146	0.040
Observations	34205	33962	34205	34205

In Panel A, I present IRRs using the specifications in Table 3.9. The results show that, when compared to households that exhibit *no mental account*, households that exhibit *multiple mental accounts* overall hold 20% more financial assets, 73% more financial products in risky assets (Column (2)), 83% more financial products in fairly safe assets (Column (3)) and 20% more financial products in safe assets (Column (4)). When I interact mental accounts with financial advice, housing tenure and *time preference*, risk tolerance and *cognitive ability*, our results remain unchanged from the results in Table 3.9. For example, when compared to households that rent and exhibit *no mental account*, homeowners that hold a mortgage and exhibit a *single mental account* hold 35% more financial products in risky assets; outright homeowners who exhibit *multiple mental accounts* hold 22% less financial products in risky assets, 30% less in fairly safe assets and 6% less in safe assets.

In Panel B, I replace the categorical variable for mental accounting with the number of mental accounts. The results show that the number of mental accounts increases the overall number of financial products by 6%; the number of risky assets held by 18%; the number of fairly safe assets held by 17%; and the number of safe assets held by 6%.

When I interact the number of mental accounts with financial advice, *time preference*, *risk tolerance,* and *cognitive ability*, the results show that mental accounting decreases the overall number of financial products held and the number of financial products held in each asset class. All the interaction terms are significant, apart from the interaction terms between number of mental account with a *single source* of advice and risk tolerance. In summary, although the IRRs in Panel A suggest that there may be a strong relationship between mental accounting and the number of financial products, the results in Panel B show a decline in the magnitudes which rules out the possibility that households mainly infer their investment goals from the financial products available in the market.

3.7 Conclusion

Behavioural portfolio theory suggests that people manage their investments in layers, known as mental accounts, that they design sub-portfolios for each layer and that their risk appetite varies by these accounts. In contrast, standard portfolio theory assumes that people have one aggregate portfolio and a single measure of risk – overall portfolio risk. Motivated by new theoretical insights concerning the influences of financial advice and background risks on portfolio choice that are conditional on mental accounting behaviour, this study uses survey data to investigate whether these variables can explain differences in ownership and portfolio share in three asset classes.

Using two waves of the WAS, which covers the period 2006 to 2010, this Chapter builds on the existing literature in several ways. First, in contrast to previous studies that use different mental frames and subsets of household portfolios (Benartzi and Thaler, 2007; Choi *et al.*, 2009), I use investment goals and the entire household portfolio – three asset classes (risky asset, fairly safe asset and safe asset) – to provide new evidence of the influence of mental accounting behaviour. Following Shefrin and Statman (2000), I distinguish between households that have a single mental account and those that have multiple mental accounts and compare their portfolio choices with those of households that do not readily identify a reason for saving money. Second, I investigate whether *risk tolerance*, *time preference* and *cognitive ability* influence portfolio choice and whether these variables have an indirect influence through mental accounting. Third, I examine whether, conditional on mental accounting behaviour, differences in portfolio choice can be explained by background risk/assets and financial advice. Fourth, I examine the effect of specific mental accounts (such as saving for a holiday, a home purchase, home improvements, a bequest, and education) on the probability of owning, and the portfolio share in, the three asset classes.

Overall, I conclude that mental accounting behaviour does influence portfolio choice with statistically significant differences among households that exhibit *no mental account*, *a single mental account* and *multiple mental accounts*. In addition, the influence of mental accounting is mitigated (increased) by financial advice and housing tenure. The evidence shows that households that exhibit a *single mental account* are less likely to own and have low investment in risky assets. When compared to exhibiting *no mental account*, exhibiting a *single mental account* or *multiple mental accounts* increases the share of fairly safe assets but decreases the share of safe assets. Financial advice reduces the portfolio share in both risky assets and fairly safe assets but increases share in safe assets among households that have *multiple mental accounts*. In addition, I find that mental accounting eliminates the direct influence of housing tenure on investment in risky assets. Most importantly, both homeownership through a mortgage and outright ownership increase both the likelihood of holding and the share of investment in risky assets among households that exhibit a *single mental account*.

In the results for specific mental account types and sources of financial advice, I conclude that saving money *for unexpected expenditure*, *for purchase of property*, *for holiday*, and *for good interest or to see money grow*, all influence portfolio choice. Furthermore, for particular mental account types, I find differences in the share invested in different asset classes, which depends on *risk tolerance*, *risk perceptions*, or both. This suggests that for long term investments such as purchase of property, investors who are risk tolerant and have positive risk perceptions hold a high share of risky assets while those who only tolerate risk have a low share in risky assets but a high share in fairly safe assets. In sum, our results indicate that mental accounting behaviour is an important financial management tool, which improves our understanding of the household financial decision making process.

As noted in Chapter Two, a short panel and a low transition in asset ownership, which is also observed in the WAS sample, make it hard to control for unobserved effects and to address the problem of endogenous regressors. Although I use multi-equation models as a robustness check to control for correlated errors across equations, reverse causality may still occur because mental accounting behaviour might, for example, be determined by the available financial assets and the proportion of money invested. Thus, the significant correlations in my results should not be inferred as causal relationships. With this caveat in mind, the findings in this study have important implications. The main effect of mental accounting indicates that investors, while evaluating asset choices and asset allocation decisions, should be aware of the discrepancies caused by mental accounting. Moreover, considering the overarching effect of financial advice on mental accounting, investors should also be aware of, and be able to decipher, the different sets of information received from financial advisors or the nature of the investment products they provide.

This is important because our findings suggest that investors who trust more than one financial advisor may be inclined to sign up for similar investment products, which could impact negatively on portfolio composition and performance, if they also have multiple mental accounts. On the other hand, financial advisors should be aware of the benefits and the pitfalls of mental accounting and the current composition of their clients' portfolios so as to be able to appropriately guide investors. With regard to *time preference* and *risk tolerance*, the finding that both variables have varying effects on different asset classes and that mental accounting mediates these effects implies that financial advisors should regularly elicit more information about risk attitudes. Most importantly, advisors should broaden the type of questions asked to include questions that can capture levels of overconfidence, regret, trust and life satisfaction because such attitudes have been found to be correlated with risk attitudes (Pan and Statman, 2012).

Mental accounting behaviour also has important implications for the operations of financial markets and the wider economy. Because investment in fairly safe assets appears to be appealing to households that have multiple mental accounts, introduction of innovative and attractive financial products could encourage long term saving and investment behaviour. In turn, this could further enhance the development of financial markets and the available opportunities for wealth accumulation, which is beneficial to the wider economy because an increase in households' net worth increases the marginal propensity to consume (Poterba, 2000).

Chapter 4 Anchoring bias, asymmetric information and house prices

"What someone will pay for your house at the time you're trying to sell it is based on a whole host of non-monetary factors that an index can't even begin to touch"

(Greg Davies, Financial Times, June 2013)

4.1 Introduction

House price indices provide important information about housing market trends and general socio-economic conditions, which are useful to current and potential home owners and policy makers. These trends merit attention because housing contributes a significant proportion of both household and national wealth (see summary in Black *et al.*, 2006);[32] is the most talked about and watched investment (Himmelberg *et al.*, 2005; Shiller, 2007); and a key determinant of households' financial decision-making regarding consumption and investment (e.g. Campbell and Cocco, 2007; Disney *et al.*, 2010b). Further, house price indices are prevalent in print and online media and provide both historic data and online tools which enable homeowners to infer the value of their homes. In view of this, we might expect home owners to closely monitor and anchor their estimates of home house values on house price indices. Anchoring bias, a form of systematic bias - prevalent in most people and predictable - supposes that individuals are influenced by reference points while estimating the true value of a subject and are, for example, unable to sufficiently adjust for new information (Tversky and Kahneman, 1974). An important question is whether it is rational for homeowners to anchor on house price indices on the basis that in so doing they learn about trends in the housing market which they might not ordinarily observe, or whether it is a bias given that house price indices only represent the price of a hypothetical house.

This Chapter investigates whether changes in the quarterly hedonic house price index published by Nationwide between 1993 and 2008 (hereafter referred to as the house

[32] In the UK, more than 78% of households live in owner occupied accommodation and housing wealth is estimated to be 80% of total household wealth (Office of National Statistics, 2013a).

price index) can help explain changes in self-reported housing wealth (interchangeably referred to as self-reported house values) derived from the British Household Panel Study (BHPS). Self-reported housing wealth has been found to provide valuable information which may influence household financial decisions (Engelhardt, 1996). Second, I examine the influence of financial expectations and housing tenure (outright or through a mortgage) on anchoring. The literature documents the relationships between these factors and household financial decisions, suggesting a critical connection with anchoring. Third, I investigate whether mortgage refinancing and the use of money raised for home investment or other consumption purposes independently and conditionally influence changes in self-reported house values. Fourth, as suggested by Epley and Gilovich (2010), I investigate whether social factors influence anchoring bias. Specifically, I analyse the independent and conditional influence of both computer use and social engagement measures such as involvement in social groups, trust and religion. I am not aware of any other study that uses self-reported housing wealth to examine anchoring biases or the influence of socio-economic factors in the housing market. As a result, I add to the anchoring literature and provide new evidence about the mediating role played by socio-economic factors.

Previous studies primarily investigate whether economic fundamentals and behavioural factors can explain households' reactions to changes in house prices and trends in the housing market. As far as economic fundamentals are concerned, most studies examine how changes in house prices influence consumption (Attanasio *et al.*, 2009; Disney *et al.*, 2010b); indebtedness (Disney *et al.*, 2010a); savings behaviour (Engelhardt, 1996); and later life housing adjustments[33] (Ermisch and Jenkins, 1999). These studies find mixed results regarding the influence and significance of three life-cycle theories: the

[33] Later life housing adjustments include changes which are associated with house value and rental costs, the number of `excess' rooms, and the nature of housing tenure.

wealth effect, which holds that increases in perceived housing wealth trigger consumption among older people; the collateral effect, which posits that increases in house prices are correlated with indebtedness, especially among younger individuals; and a combination of the two, where both effects occur regardless of age (known as common causality). The few studies that approach this topic from a behavioural perspective focus on how psychological expectations influence market sentiments and momentum in house prices (Case and Shiller, 2003; Himmelberg *et al.*, 2005; Mayer and Sinai, 2009); on money illusion (Brunnermeier and Julliard, 2008; Mayer and Sinai, 2009); on loss aversion (Genesove and Mayer, 2001); and on how property pricing decisions are anchored on the initial price at which a property is listed (Northcraft and Neale, 1987). Connecting fundamental economic factors with behavioural factors, Disney et al. (2010a) find that the influence of changes in house prices on consumption is suppressed when they include a measure of financial expectations in their analysis.

I take a different approach from these studies and examine the relationship between changes in self-reported house values and changes in a widely reported house price index. Self-reported house values are arbitrary estimates of home values, reported by homeowners in most household surveys, and are commonly used to measure housing wealth. On the other hand, house price indices are determined from hedonic price functions and represent the price of a hypothetical average house; in reality prices reflect specific house types, unique attributes and regional location, among other factors. Furthermore, because trends in house prices vary across and within regions (Case and Shiller, 2003; Himmelberg *et al.*, 2005), an additional source of error emanates from the fact that both national and regional house price indices may conceal these differences. I posit that homeowners anchor their self-reported housing wealth on regional house prices and are unaware of these estimation errors that could cause house price indices to be different from the true market value of their homes. In other words, because of information asymmetries among homeowners, some fail to successfully adjust for unique hedonic characteristics, exceptional regional price movements, and other new market information.

Within the finance literature, and in support of my approach, different dimensions of anchoring are well documented in experimental and empirical studies. Studies that compare the influence of self-generated anchors (where judges are left to decide the anchor to use) with experimenter-provided anchors (where judges are provided with specific anchor values) show that self-generated anchors increase anchoring effects (e.g. Epley and Gilovich, 2001; Epley and Gilovich, 2010). Given the prevalence of house price indices in the media, I assume that homeowners' choose these indices as reference points– self-generated anchors. To isolate anchoring as a behavioural bias, some studies show that experts (professionals) are able to decipher market information and are less prone to anchoring in comparison to amateurs (lay persons) (e.g.Northcraft and Neale, 1987; Kaustia *et al.*, 2008). I examine whether information asymmetries among outright owners, mortgage holders who do not refinance and mortgage holders who refinance experience varying levels of anchoring. Here, the assumption is that mortgage holders are more likely to be interested in economic news about interest rates and house prices, and are more likely to consume market information from mortgage providers. Whereas, for individuals who refinance their mortgages, they are more likely to incorporate in their self-reported housing wealth additional information contained in professional valuations. In addition, those who use the funds raised from re-financing for home improvements or extensions will be more likely to incorporate these in their estimates, as compared to those who use the funds raised for other consumption purposes.

Using fixed effects OLS regressions and quantile regressions I find that a 10% change in the Nationwide house price is associated with a 2.6% change in self-reported house value and that this effect remains virtually unchanged whether I control for property characteristics, individual characteristics or both. When I extend the baseline specification to include proxies for financial expectations and ownership type, I find that having greater financial expectations and owning a home through a mortgage both increase anchoring by 11%. In addition, I show that, among individuals who refinance their mortgages, investing in both home improvements and extensions increases self-reported house value by 5%; however, conditional on a change in the house price index, investing in both home improvements and extensions leads to a 10% decrease in self-reported housing wealth. For homeowners who use the funds from mortgage refinancing for other consumption purposes, I find no direct correlation with self-reported housing wealth; however, the interactive effect, conditional on a change in the house price index, leads to a 7% decline in self-reported housing wealth. This evidence indicates that refinancing a mortgage provides new information about home values, which homeowners who refinance and use funds for home improvement incorporate in their self-reported house values. Furthermore, these results provide evidence of anchoring-and-adjustment because, when compared to homeowners who do not refinance, those who refinance are less anchored to the house price index. When I address potential endogeneity issues using a dynamic GMM estimator, my results are consistent regardless of the estimation strategy used.

The rest of the Chapter is organised as follows. In Section 4.2, I discuss the literature concerning anchoring bias and review empirical findings. Section 4.3 describes the data and key variables used in the empirical analysis. In Section 4.4, I discuss the empirical strategy. In Section 4.5, I report the findings of the main analysis and robustness checks. I conclude in Section 4.6 with a brief discussion of the implications of this study.

4.2 Prior literature and hypotheses development

There is a growing literature that investigates the relationship between changes in house prices and household financial decisions. One strand of the literature links house price shocks to changes in household consumption. Generally, these studies investigate the wealth effect, the collateral effect, and the common-causality hypotheses[34] which argue that households revise their consumption and investment plans in response to changes in house prices. As previously mentioned, the findings are mixed and inconclusive. For example, Campbell and Cocco (2007) find evidence of a wealth effect and show that changes in house prices are correlated with changes in household consumption and that the effects are higher among older homeowners. In contrast, Attanasio *et. al.* (2009) find this relationship to be more pronounced among younger households and they conclude that common causality could be a plausible explanation. Furthermore, when households' financial expectations are controlled for, the relationship between house price shocks and consumption becomes smaller, as does the difference between older and younger households (Disney *et al.*, 2010b). Regarding the collateral effect, Disney *et. al.* (2010a) find borrowing-constrained households to be more likely to use unsecured debt. These findings indicate that the relationships between house prices and fundamental factors remain open to debate.

Another strand of literature associates changes in house prices with psychological and other behavioural biases. These studies argue that, as opposed to the assumption of

[34] The three theories are: (1) the wealth effect – a surprise increase in house prices leads to increase in household wealth and thereby consumption; (2) the collateral effect – growth in house prices leads to increase in housing equity; and (3) common causality – house prices and consumption are both influenced by changes in expected future income.

rational behaviour in standard finance theory, real people in real situations behave differently and that departures from rationality are highly pervasive and systematic. First, there is increasing evidence that psychological expectations affect asset pricing. Based on surveys conducted in the US in 1988 and 2003, Case and Shiller (1988; 2003) find that most homeowners expect future house prices to continue increasing simply because national and global prices are also rising. They argue that house price momentum is driven by market psychology. Second, there is evidence that individuals are unable to distinguish between real and nominal values of a currency, a phenomenon referred to as money illusion. For example, homeowners perceive a decrease in inflation to be linked to a decrease in real interest rates leading them to the irrational belief that future real mortgage obligations will be lower (Brunnermeier and Julliard, 2008). Third, research suggests that individuals use reference points in assessing losses and gains (loss aversion) and in deriving subject values and forecasts (anchoring bias). Genesove and Mayer (2001) find that both investors and homeowners use the nominal purchase price of a house as a reference point and that they tend to quote a listing price higher than the purchase price, as evidence of loss-aversion. Regarding anchoring bias, the literature suggests that individuals' assessment of a target to be judged against and market forecasts are anchored on the listing price (Northcraft and Neale, 1987) and historical returns (Kaustia *et al.*, 2008) respectively. In this study, I focus on anchoring bias and the conditional effects of both mortgage refinancing decisions and social factors.

4.2.1 Anchoring bias

Following the work by Tversky and Kahneman (1974) concerning the influence of numerical anchors and insufficient adjustment to new information (basic anchoring), other perspectives on anchoring have been proposed in the literature, including anchoring-as-activation (Chapman and Johnson, 1999), also referred to as semantic anchoring (Mussweiler and Strack, 2001), and elaboration anchoring (Blankenship *et al.*, 2008; Wegener *et al.*, 2010). Regarding insufficient adjustment to new information, also referred to as anchoring-and-adjustment, individuals begin with a specific reference point, the anchor, and adjust for new information about the target value. To the extent that they are able to accurately incorporate new information, their estimates should gravitate towards the true value. However, if the new information is insufficiently adjusted for, the estimate of the target value will be biased towards the anchor. Anchoring as activation supposes that a chosen anchor only triggers information that is consistent with it: that is, "the notion that an anchor influences the availability, construction, or retrieval of features of the object to be judged" (Chapman and Johnson, 1999). In this account, when a low anchor is provided, an individual will tend to retrieve information and constructs that closely match the low anchor. Thus, anchoring occurs because of bias in the information retrieved and not as a result of insufficient adjustment.

In a similar context, Mussweiler and Strack (2001) suggest that anchoring is connected with a knowledge accessibility effect and that anchoring is a two stage process: (1) selection anchoring, which occurs at the point when judges identify specific bases for comparison; and (2) comparison anchoring, which involves a comprehensive process of testing whether the subject value could be similar to the anchor, using knowledge produced by judges about the subject. Further, Mussweiler and Strack note that selection anchoring plays an important role in everyday judgements where numerical anchors are not provided. Wegener *et al.* (2010) link the attitudes and persuasion literature (regarding how attitudes affect behaviour) and anchoring, and they propose that anchoring depends on the level of subject/anchor elaboration – high and low elaboration anchoring. Under high-elaboration anchoring, judges might engage in a thoughtful process using target-relevant knowledge whereas in low-elaboration anchoring judges do not engage in a thoughtful process about target-relevant knowledge. These differences in the level of elaboration may lead to varying anchoring effects.

This study focuses on anchoring-and-adjustment. I posit that homeowners perceive and respond differently to broad economic news and to mortgage-related information, which leads to insufficient adjustment. I make two important assumptions. First, because news about trends in the housing market may draw the attention of most homeowners (Himmelberg *et al.*, 2005; Shiller, 2007), I assume that homeowners use house price indices as anchors when they are asked to estimate the value of their homes. Epley and Gilovich (2001; 2010) argue that, when an anchor is self-generated, anchoring bias is caused by an inability to adequately adjust for available information and its effect is more pronounced than that observed with experimenter-provided numerical anchors. In the main analysis, I use the Nationwide house price index and I carry out robustness checks using Halifax house price index.

Second, given that we might expect information asymmetries in the housing market (both market wide and concerning mortgage related information) I consider three types of homeowners: outright owners, mortgage holders who do not refinance, and those who refinance their mortgages. Across these groups, I might expect that the accessibility, relevance and depth of information available to each group will differ. For outright homeowners, housing constitutes a significant proportion of net total wealth, they are not debt constrained and they may view housing as an investment. Thus, they are likely to focus more attention on trends in house prices and to be more anchored on house price indices. On the other hand, mortgage holders are likely to be debt constrained and housing wealth, as a proportion of total wealth, varies with the amount of outstanding mortgage payments. Therefore, mortgage holders might worry about news concerning broad economic conditions and government policy which may affect interest rates and their ability to meet mortgage obligations. This implies that they are likely to be anchored on house price indices, just like outright owners, because house prices are believed to be good proxies for economic conditions (Sutton, 2002). However, among mortgage holders, homeowners who refinance their mortgages have access to additional information, including a recent professional valuation. Furthermore, if they use the money raised from mortgage refinancing for home improvements or an extension, they can estimate the change in the value of their house using the bills paid or the actual cost. Taken together, these information asymmetries (i.e. between outright owners and mortgage holders, and between homeowners who refinance and those who do not) point to a plausible anchoring bias that could also be subject to insufficient adjustment for available information.

In the finance literature, as I discuss below, anchoring biases are well documented in studies that examine asset pricing (e.g. Huberman and Regev, 2001; Coval and Shumway, 2005) and asset allocation (e.g. Kahneman and Tversky, 1979; Shefrin and Statman, 1985; Feng and Seasholes, 2005). Generally, these studies show that financial markets are not efficient and that investors are not rational in their financial decisions (e.g. Linneman, 1986). Indeed, as argued by Case and Shiller (1989) the housing market is far from efficient, implying that irrational behaviour could be more pronounced and we can therefore learn more about individual behaviour. I now review the literature that links anchoring bias to financial forecasts and social factors, and derive my hypotheses.

4.2.2 Anchoring bias and financial forecasts

The evidence from both laboratory and 'real world' experiments shows that people respond conservatively to new information (Tversky and Kahneman, 1974; Northcraft and Neale, 1987; Chapman and Johnson, 1999) and that forecasts are biased towards reference points. Northcraft and Neale (1987) use real market information to investigate whether estimation measures, decision processes, and demographic factors differ between experts (real estate agents) and amateurs (business school undergraduate students). Both groups were provided with comprehensive information about property listings, summaries of property sales, neighbourhood property characteristics, neighbourhood property standard listing prices, and a questionnaire to be filled in after touring the evaluated properties. Using two experiments with different participants, they find a pattern consistent with anchoring-and-adjustment bias: both groups were influenced by the listing price and were more likely to use comparison computations (using values of similar properties in the neighbourhood or market values). In addition, amateurs were more likely to use a concrete referent (value adjustment using values of related property features) and were influenced by previous experiences in home buying.

Anchoring-and-adjustment bias is also documented in experimental studies that examine its effects in macroeconomic forecasts and financial markets forecasts. Campbell and Sharpe (2009) use monthly macroeconomic data to investigate whether experts' forecasts are correlated with previous months' releases. They find that experts' forecasts of economic releases such as consumer confidence, consumer price indices, and retail sales are biased towards the actual values released in previous months. This result is supported by the finding in Glaser *et al.* (2007) who investigate framing effects on stock market forecasts. They conducted three experiments in two German universities, Mannheim and Münster, using two classes of students attending advanced courses in decision theory and behavioural finance respectively. Respondents were provided with price charts and a performance index and were asked to state price estimates and return forecasts in two stages: in the first stage the stocks were not disclosed and in the second part they were disclosed. The authors find evidence of framing effects; compared to price forecasts, higher return forecasts were quoted for upward trends in forecasts and lower return forecasts for downward trends in forecasts. However, the price forecast estimates were lower than return forecasts. They also find that higher financial education reduced framing effects and overconfidence.

Kaustia *et al.* (2008) show the effects of both self-generated and 'disclosed' historical stock market return anchors and semantic priming[35] on stock market forecasts. They use a sample consisting of both professionals and student participants in 3 experiments involving: (1) self-generated versus disclosed historical stock returns, (2) low versus high numerical anchors, and (3) semantic priming using good versus bad stock market experiences. They report strong anchoring effects in experiments (1) and (2) and insignificant effects in experiment (3). However, the effects were larger for self-generated anchors than for numerical anchors. In addition, they find a larger anchoring effect for student subjects compared to experts and a lower anchoring effect among students with investment experience. This finding confirms the results in a previous study by Epley and Gilovich (2001) who argue that self-generated anchors "activate different mental processes than experiment-provided anchors". These studies provide consistent evidence of anchoring bias and the mitigating effects of experience and expert knowledge.

[35] Semantic priming involves providing additional information about the subject value; for example, priming respondents about good (bad) periods of market development, historical stock market returns, and reminding respondents about disclosed information (Kaustia *et al.*, 2008; Wang and Dowding, 2010).

In this study I investigate whether there is an association between self-reported house values and actual house prices reflected in published house price indices. The intuition is that the question *"about how much would you expect to get for your home if you sold it today*?" asked of home owners in the BHPS plausibly activates a mental process in which respondents generate anchors that help them derive these values. Note that the question does not provide anchors or a guide to respondents on how to compute the target value. As discussed earlier, one possible self-generated anchor that individuals could use as a reference point is the publicly available national house price indices that are released at the regional and aggregate national level. Another possible self-generated reference point is the purchase price of the property. Genesove and Mayer (2001) show that homeowners fix a reservation price that is higher than the purchase price because sellers are averse to loss – selling at a price that is below their purchase price. However, considering that house price indices are released on monthly and quarterly bases, homeowners could be inclined to revise their reference points (Baker and Nofsinger, 2002) and thereby use the latest estimated house price as a reference point instead of the historic purchase price. Furthermore, most homeowners view housing as an investment (Shiller, 2007) and they would therefore tend to evaluate performance using the most recently reported house prices.

Nonetheless, reported house prices are computed using hedonic estimates and represent a non-existent, average house, implying that reported house prices will deviate from the target estimated market value of any home that does not correspond to the average. Theoretically, the estimated market value of a home should be its intrinsic value, which is derived using a capitalization process that considers the market value of the property's attributes, the market value of comparable properties, or property prices in the local market (Brueggeman, 2011). As mentioned previously, when provided with anchors and a set of housing market information, individuals tend to use 'comparison computations' and 'concrete referent' valuation strategies in determining the estimated market value (Northcraft and Neale, 1987). I conjecture that, from the observed regional house price index, individuals should be able to adjust for changes in the value of their own homes – associated with the unique characteristics and condition of their property – and changes in local house prices. Specifically, a home that deviates substantially from an average home in terms of its attributes should have a self-reported value that is explained more by its attributes and by local house prices rather than by regional house prices indices. An anchoring bias will occur if the adjustment process leads to a self-reported target value that is biased towards the reported regional house price index. The hypothesis to be tested is

Hypothesis 1: Changes in self-reported house values are anchored on changes in regional house price indices.

Change in self-reported house value might, however, may be associated with homeowners beliefs that house prices will grow into the foreseeable future. This argument is supported by a general notion among homeowners that housing is the best investment that cannot lose money (Case and Shiller, 2003). Two surveys conducted by these authors in four US metropolitan cities in 1988 and 2003 provide interesting findings (Case and Shiller, 1988; 2003). Respondents were upbeat about future price appreciation both in the short-run (12 months) and long-run (over 10 years); they projected a substantial increase in future house prices; and believed that it was a good time to buy a house because house prices were expected to go up. When asked whether they discussed issues about the housing market with friends, more than 50% of the respondents acknowledged that they did so, sometimes or frequently. The authors conclude that expectations of future increases in house prices precipitate booms while word-of-mouth amplifies the effects.

In the BHPS, three questions relating to financial expectations are asked of respondents: (1) *"how well would you say you yourself are managing financially these days"*; (2) *"Would you say that you yourself are better off, worse off or about the same financially than you were a year ago?"*; and (3) *"Looking ahead, how do you think you yourself will be financially a year from now?"*. These variables are good proxies for expectations about both the national economic outlook and individuals' expectations. I use variables generated from these questions to test the following hypothesis:

Hypothesis 2: The relationship between changes in self-reported house value and changes in the regional house price index is moderated by financial expectations.

In the BHPS sample, approximately 63% of homeowners own their homes through a mortgage. Intuitively, holders of a mortgage are likely to keep abreast of house prices through interaction with their mortgage providers or they could merely be interested in observing house prices because they want to evaluate their outstanding mortgage obligations against house values (the loan-to-value – LTV ratio). This argument is supported by the finding in Disney *et. al.* (2010a) who, using LTV ratios[36] as a proxy for collateral constraints, show that homeowners with high LTV ratios are more likely to hold unsecured debt while those for whom LTV ratios are low are more likely to hold secured debt (and to refinance their mortgages). This implies that mortgage holders are more likely to anchor on house prices as compared to outright owners. I therefore test the following hypothesis:

[36] Their loan-to-value is derived from self-reported house value and other mortgage details in the BHPS.

Hypothesis 3: Home ownership through a mortgage increases anchoring on changes in house price indices.

Further, given that increases in house prices provide an incentive to refinance a mortgage (Campbell and Cocco, 2007; Disney *et al.*, 2010a), the use to which the funds generated by a mortgage refinancing are put might help illuminate the concept of anchoring-and-adjustment. An implicit assumption in hypothesis (2) is that mortgage holders who refinance their mortgages and those who do not refinance receive the same set of information. However, it could be the case that homeowners who refinance learn more about the estimated value of their homes as opposed to simply gleaning home values from house price indices. Since the process of mortgage refinancing invariably involves property appraisal, I would expect that, among homeowners who refinance their mortgages, self-reported house value will be closer to the true market price of a home. In this case, anchoring on regional house price should be lower when compared to outright ownership. Moreover, if a homeowner invests the loan on home improvements or an extension, I should expect anchoring to decline and to see a positive influence on the self-reported housing wealth (i.e. more accurate self-reported house value). Similarly, if the loan is used for other consumption purposes, I should expect to see decreasing anchoring effects; however, I should expect to see a weaker relationship with the self-reported value of housing wealth.

To investigate these issues, I use the question: "*What was this additional mortgage/loan used for*?" The responses to this question include: for home extension; for home improvements or repairs; for car purchase; for other consumer goods; and other specified reason (see variable description in Table 4.1). I test the following hypotheses:

Hypothesis 4a: Households that refinance their mortgages are less likely to be anchored on changes in house price indices relative to households that do not refinance.

Hypothesis 4b: Investing funds from mortgage refinancing in home improvement is positively associated with changes in self-reported house values relative to mortgage refinancing used for other consumption purposes.

Hypothesis 4c: Investing funds from mortgage refinancing in both home improvement and other consumption purposes equally reduce anchoring on changes in house price indices.

4.2.3 Anchoring and social moderators

Recent studies suggest versions of anchoring which consider the role of attitudes and persuasion in moderating anchoring effects, especially in real world situations (Epley and Gilovich, 2010; Wegener *et al.*, 2010). For example, social factors such as the credibility of an anchor's source, social status and self-affirmation might influence the extent to which individuals are anchored on self-generated or externally-provided anchors (Epley and Gilovich, 2010). People who belong to a high social class or those who are confident about their ability may believe that they have sufficient knowledge about the credibility of an anchor and are able to make a good judgement about the target value. These perspectives closely mirror the discussion and findings in Chapter 2 concerning the relationship between social engagement and stock market participation. In this case, we might expect social engagement to influence the level of anchoring on house price indices possibly because social engagement exposes individuals to more information about the housing market. Shiller (2003; 2007) suggests that home purchase decisions are influenced by 'casual word of mouth' and that booms and busts in the housing market are influenced by stories about house price forecasts. Furthermore, since homeownership tends to limit movement, homeowners are more likely to participate in elections, to join in the activities of non-professional organisations, and to frequently attend church when compared to renters (DiPasquale and Glaeser, 1999). In line with Putnam's (2000) Social Capital Index, DiPasquale and Glaeser (1999) also find a positive association between homeownership and investment in social capital. This can partially explain variations in house prices across regions and why homeowners might under (over) value their homes.

The question then, is whether the level of anchoring on house price indices varies across households, conditional on social engagement. I hypothesize that socially engaged homeowners are better informed about developments in the housing market both at national and local level and are able to incorporate this information in their self-reported values of housing wealth.

Hypothesis 5a: Trust increases anchoring on house price indices.

Hypothesis 5b: Involvement in social groups decreases anchoring on house price indices.

Hypothesis 5c: Political party identification increases anchoring on house price indices.

Hypothesis 5d: Religion decreases anchoring on house price indices.

Hypothesis 5e: Computer use increases anchoring on house price indices.

4.3 Data

4.3.1 Variables description

In this Chapter I use two types of data sets: the British Household Panel Survey (BHPS) and both the Nationwide Building Society house price index and (for robustness) the Halifax house price index. Table 4.1 presents the definitions of all of the variables used in the analysis.

The Nationwide Building Society provides a series of seasonally adjusted house price indices that date back to 1952, broken down by region, house type, buyer type, and property age. The house prices are derived from mortgage data for houses that are at their valuation stage when the respective valuation reports have been completed. The data excludes re-mortgaged, buy-to-let, and discounted right-to-buy sales properties and any property that does not fall within specified floor size limits for each house type. Property prices are estimated using property characteristics such as location, type of neighbourhood, floor size, and the actual price at which the property was sold for in the market. Thus, the reported house prices represent the price of a non-existent, average house. I use the series that reports quarterly and annual house prices by 12 UK regions and by house type – detached houses, semi-detached houses, terraced houses, and flats/apartments – covering the period 1993 to 2011. The existence of quarterly, in addition to annual, data provide additional variation because house prices are known to be seasonal, allowing me to control for any bias arising from households interviewed during low or high seasons. As I discuss below, I match and merge the reported house price data with the BHPS data.

The BHPS is a longitudinal study of a representative sample of households in Great Britain, which began in 1991 and lasted until 2008 when it was replaced by the

UKHLS. As noted in Chapter 2, the BHPS survey consists of data for approximately 5,500 households and 13,500 individuals, boosted over the years by additional households from Scotland, Northern Ireland and ethnic minorities. The UKHLS, which retains respondents in the BHPS sample, has a larger sample of 100,000 individuals and more than 40,000 households. This study uses 16 waves of the BHPS, covering surveys conducted from 1993 to 2008. The sample is restricted to homeowners during the panel period but excludes the first two waves of the BHPS because self-reported house values were not reported for 1992. The data set contain detailed individual information about self-reported house values, property attributes, and mortgage details and the respondents' demographic and socioeconomic characteristics.

I generate house type, geographic location, and time variables which facilitate matching and merging of house price data with BHPS data as well as to control for house type characteristics. In the BHPS, house type information is categorised into 12 house types before 1995 and 14 house types thereafter. These are: detached house or bungalow; semi-detached house or bungalow; enclosed terraced house; terraced house; purposed built flat; converted flat; house including business premises; bedsitter under 10; bedsitter more than 10; sheltered accommodation; institutional accommodation; and other types. For the waves after 1995 purpose built flats and converted flat house types were each broken down into two more categories, by number of units – less than 10 units and more than 10 units. In order to appropriately match house price data with the BHPS data, I generate four house types as defined in the Nationwide dataset: detached, semi-detached, terraced and flat. The sub-categories for terraced houses and flats are combined and the remaining house types are excluded. For geographic regions, I use the variable 'government office region' which describes the 13 UK regions; these comprise the 12 regions used in the Nationwide dataset and the Channel Islands.

Table 4.1 Variable definitions

The Table provides definitions of all the variables used in this Chapter. The data is drawn from Nationwide House Price information and the British Household Panel Survey (BHPS) for the period between 1993 and 2008.

Variable	Description	Value	Source	Wave/Year
Dependent Variables				
Change in self-reported house value	About how much would you expect to get for your home if you sold it today?	The logarithmic value of change in self-reported house value, excluding house values below £10,000.	BHPS	1991 - 2008
Key variables				
Change in house price index	Nationwide quarterly house price of a typical house by region and house type estimated using hedonic regressions. Hedonic characteristics include: region; house type (detached, semi-detached, terraced and flats); type of neighbourhood; floor size; and the actual sale price of the house.	The logarithmic value of change in house price index.	Nationwide & Halifax	1991 - 2008
Under mortgage	Derived variable: owned outright, owned with mortgage, local authority rent, housing association rented, rented from employer, rented private unfurnished, rented private furnished or other rented	owned with a mortgage =1 ; owned outright = 0; all rented accommodation are excluded	BHPS	1991 - 2008
Extra loan	Have you taken out any additional mortgage or loan on this house/flat since September 1st 1994?	Yes = 1; No = 0	BHPS	1991 - 2008
Home investment	What was this additional mortgage/loan used for? To which respondents select: home extension; home improvements or repairs; car purchase; other consumer goods; other specified reason	home extension & home improvements or repairs = 1 otherwise = 0	BHPS	1991 - 2008
Other Consumption	What was this additional mortgage/loan used for? To which respondents select: car purchase; other consumer goods; other specified reason	car purchase or other consumer goods or other specified reason = 0; otherwise = 0	BHPS	1991 - 2008
Computer user	Which item do you have? Home computer	Yes = 1; No = 0	BHPS	1991 - 2008
Religious	How much difference would you say religious beliefs make to your life?	some or a great difference = 1 ; a little or no difference = 0	BHPS	1992 - 2008
Active in tenants group	Respondents are asked "Are you currently active in: Tenants'/Residents' Group or Neighbourhood Watch"	I assign the value if response is yes, and zero otherwise	BHPS	1991 – 2008

Table 4.1 Continued

Variable	Description	Value	Source	Wave/Year
Trusts most people	Generally speaking, would say that most people can be trusted, or that you can't be too careful in dealing with people?	most people can be trusted = 1; can't be too careful = 0	BHPS	1991 - 2008
Overvalued	Calculated as the difference between self-assessed house value and the predicted market price.	I assign the value one if house value is higher than market price, and zero otherwise	BHPS & Nationwide	1991 - 2008
Property attributes				
House type	The classifications are: detached house or bungalow; semi-detached house or bungalow; enclosed terraced house; terraced house; purposed built flat; converted flat; house including business premises; bedsitter under 10; bedsitter more than 10; sheltered accommodation; institutional accommodation; and other types. For the waves after 1995 purpose built flats and converted flats house types were each broken into two more categories by number of units – less than 10 units and more than 10 units.	The sub-categories for terraced houses and flats are combined and the remaining house types are excluded in our analysis. I generate a binary variable for each house type.	BHPS	1991 - 2008
Number of rooms	Respondents are asked about "How many rooms are there here, including bedrooms but excluding kitchens, bathrooms, and any rooms you may let or sublet?" Number or rooms range from 1 to 19	The log of the number of rooms.	BHPS	1991 - 2008
Prefers to move	If you could choose, would you stay here in your present home or would you prefer to move somewhere else? Respondents chose either to 'stay here' or 'prefer to move'	I assign the value one for those who prefer to 'stay here' and zero otherwise.	BHPS	1991 - 2008
Likes present neighbourhood	Overall, do you like living in this neighbourhood?	I assign the value one if respondent likes present neighbourhood and the value zero otherwise.	BHPS	1991 - 2008
Control variables				
Health	Please think back over the last 12 months about how your health has been compared to people of your own age, would you say that your health has on the whole been...	excellent and good = 1 ; fair, poor or very poor =0	BHPS	1991 - 2008
Male	Interviewer check sex of the respondent	male = 1 ; female = 0	BHPS	1991 - 2008
Age	Derived variable: uses date of birth variables on survey database	age at date of interview	BHPS	1991 - 2008
Married	Married, separated, divorced, widowed or never married	married = 1 ; separated, divorced, widowed or never married = 0	BHPS	1991 - 2008

Table 4.1 Continued

Variable	Description	Value	Source	Wave/Year
Number of children	Number of own children below 16 years of age: derived from a set of questions	one=1; two=2,; three=3 ; four or more kids = 4	BHPS	1991 – 2008
First degree or above qualification	Derived variable - yearly updated qualification of new entrants and existing panel members qualifications include no qualification ; commercial qualification, no o-levels, CSE grade 2-5 or Scotland grade 4-5 ; GCE A-levels, GCE o-levels or equivalent; teaching , other higher or nursing qualifications ; and first or higher degree	first or higher degree = 1; other categories = 0	BHPS	1991 - 2008
Employed	Please look at this card and tell me which best describes your current situation? Self- employed, in paid employ, unemployed, retired, family care, FT student, long term sick/disabled, on maternity leave, government training or other	unemployed, maternity leave, family care, full time student, sick, disabled, government training scheme, or other = 1 ; retired = 2 ; self-employed = 3 ; and employed = 4	BHPS	1991 - 2008
Region	Internally computed government office region	North East = 1 ; North West = 2 ; Yorkshire and Humber = 3 ; East Midlands = 4 ; West Midlands = 5 ; East of England = 6 ; London = 7 ; South East = 8 ; South West = 9 ; Wales = 10 ; Scotland = 11 ; Northern Ireland = 12 ; and Channel Islands = 13	BHPS	1991 - 2008
Income	Derived variable that sums up all sources of income indicated by the respondent including : labour income and non-labour income		BHPS	1991 - 2008

I exclude the Channel Islands because data for the region consist of only three observations, cover a short period and in any event are not included in the Nationwide data. With respect to the time variable, I use the month and year when a respondent was interviewed to generate a quarterly time variable. Using these variables, I match the two datasets by region, house type, and interview date (quarter) from which I end up with 151,482 observations.

The question concerning self-reported value for housing wealth asked of the head of each household is: *About how much would you expect to get for your home if you sold it today?* The question is repeated in all waves apart from Wave 2; only respondents who were not interviewed in Wave 1 were asked the question. Using this self-reported value, the dependent variable, *change in self-reported house value*, is the log of the change in the value reported during each wave: that is, the current self-reported house value minus the preceding period value divided by the preceding period value. Because I am able to match the quarters in which the Nationwide and Halifax house price indices are reported with the quarter during which a respondent was interviewed, I use a similar construction for our measure of anchoring bias – *change in house price index*. From Table 4.2, I see that the distribution of self-reported house values in the BHPS varies considerably from the Nationwide house prices so I exclude individuals who report values below £ 5,000 and in excess of £ 1million as outliers. Further, I note that self-reported house values may be subject to measurement errors (the difference between the observed value and the true market value), as argued by some authors (e.g. Disney *et al.*, 2010a), though there is support for their use elsewhere in spite of these measurement errors (e.g. DiPasquale and Somerville, 1995; Engelhardt, 1996). Moreover, Goodman and Ittner (1992) suggest that rates of change in self-reported house values are unbiased.

To measure respondents' perceptions about financial wellbeing, three questions that ask about past, current, and future financial expectations are asked of respondents. Concerning future financial expectations, respondents are asked – *looking ahead, how do you think you will be financially a year from now?* – to which they can respond "better than now", "worse than now", or "about the same". The variable financial expectation equals one if the response is "better than now" and zero otherwise. This measure has been used in previous studies that examine, for example, the relationship between financial over-optimism and mortgage arrears (Dawson and Henley, 2012) and the relationship between consumption and house prices (Disney *et al.*, 2010b).

Four variables concerning homeownership tenure, mortgage refinancing, and use of money raised from refinancing are generated from three questions in the BHPS. The first variable is derived from the responses to the question – *Is this accommodation owned outright or through a mortgage?* I generate the variable *under mortgage*, which equals one if a home is owned through a mortgage and zero if owned outright. The second variable is derived from the responses to the question – *since last year have you taken out any additional mortgage or loan on this house/flat*? From this question, I generate the variable *taken out extra loan* which equals one for positive responses and zero otherwise. Finally, respondents who positively respond to this question are then asked two additional questions about the total amount of the additional loan taken and what the loan was used for. Responses to the question about the use of the loan include "for home improvement", "for home extension", "for car purchase", "for other consumer goods", and "for other specified reason". The variable *home investment* equals one if the response is home improvement or home extension and zero otherwise, while the variable *other consumption* equals one if the response is car purchase, other consumer goods, or other specified reason and zero otherwise.

The social moderators included in the analysis are represented by computer use and four social engagement measures. I define computer ownership as a dummy variable that equals 1 for positive responses and 0 otherwise. The four social engagement measures include active in tenancy groups; trusts most people; political party identification; and religion makes a difference in life. Active in tenancy groups is measured using responses to the question: "Do you join in the activities of any of these organisations on a regular basis: Tenants'/Residents' Group or Neighbourhood Watch?" The variable active in tenancy group equals 1 if the response is "yes" and zero if "no". The variable *trusts most people* is generated from the question – *generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people*? – and equals 1 for positive responses and 0 otherwise. Religiosity is measured by the dummy variable religion makes a difference. This takes a value 1 if respondents answer: a little difference, some difference or a great difference to the question: *how much difference would you say religious beliefs make to your life*? It takes the value 0 if the answer is no difference.

I control for a number of socio-economic and demographic factors that are associated with homeownership and may influence self-reported house values. Educational attainment is measured using the question about the highest academic qualification attained by respondents. These qualifications are broken down into five categories: "no qualification"; "commercial qualification, no o-levels, CSE grade 2-5 or Scotland grade 4-5"; "GCE A-levels, GCE o-levels or equivalent"; "teaching, other higher or nursing qualifications"; and "first or higher degree". The variable *first degree and above* equals 1 if respondent has 'first or higher degree' qualification and equals 0 otherwise. Responses to the question regarding occupation include employed, retired, self-employed and unemployed (the latter category includes those in family care, full time students, the long term sick/disabled, those on maternity leave, on government training or others). The variable *employed* equals 1 if respondent is employed and 0 otherwise. Respondents' income is a derived variable, which combines labour income and non-labour income at the individual level. I generate the variable log of income which is the logarithmic transformation of income. The variable *good health* takes the value 1 for respondents who say that their health condition is "excellent", "good", or "fair" and the value 0 if "poor" or "very poor". Age is controlled using the age at the date of interview and its square to capture possible non-linearity. The Cohort effect is accounted for using the variable year of birth to control for socio-economic circumstances peculiar to specific cohorts and time effects. *Married* is a dummy variable that takes the value 1 for 'married' and 0 otherwise.

Finally, I control for property attributes that could also be associated with self-reported house values. I would expect that homeowners are more informed about the specific characteristics that could reduce or increase the value of their homes. The variable *number of rooms* is the logarithmic transformation of the number of rooms in the house. From the question – "overall, do you like living in this neighbourhood" – I generate the variable *likes present neighbourhood*, which equals 1 if the response is 'yes' and 0 if the response is 'no'. The variable *prefers to move house* is generated from the question – *if you could choose, would you stay here in your present home or would you prefer to move somewhere else* – and equals 1 if the respondent prefers to move and zero otherwise. The question asked about ownership of other property is – *you or any members of your household own any of the types of property listed on this card*? I generate a dummy variable, *other property*, that takes the value 1 for positive responses, "yes", and the value 0 otherwise.

4.3.2 Descriptive statistics

4.3.2.1 Summary statistics

The summary statistics for the key variables used in the empirical analysis are reported in Table 4.2. I report summary statistics for two house price indices, the Nationwide index and the Halifax index, and for the BHPS self-reported value of housing wealth, property attributes and individual characteristics.

I find that the BHPS self-reported house values are widely distributed with a mean of £147,602 and a high standard deviation, when compared to the Nationwide house price mean of £113,411 and the Halifax house price mean of £124,336, with both having standard deviations which are more than 50% lower. This is expected because the hedonic prices derived from the Nationwide and Halifax data are based on an average house and geographic region, as discussed in the previous section. Dividing the sample by percentiles, I find that self-reported house values are close to the Nationwide house prices at the median and at the 10th and 25th percentiles but they deviate substantially more at the 75th and 90th percentiles. Because I use the logs of change in both the self-reported house values and the house price indices I do not expect this distribution to affect the analysis, and for robustness I use quantile regression and alternative house price indices.

Examining the proportion of homeowners who over/(under) value their homes, I find that relative to both the Nationwide and Halifax house price indices 61% and 57% of the households in the sample overvalue their homes, respectively. Regarding ownership tenure and mortgage refinancing, I find that 61% own their homes through a mortgage, whereas 4% refinance their mortgages; 3% use an extra loan for home improvement or an extension while 2% use an extra loan for other consumption.

Table 4.2 Summary statistics

Table reports weighted summary statistics for all the variables used in the study as described in Table 4.1. The data is drawn from Nationwide and Halifax house price indices and the BHPS for the period 1993 to 2008. For the BHPS, the sample consists of all respondents who own a house outright or through a mortgage and excludes Northern Ireland. The reported statistics are weighted using the BHPS cross-sectional enumerated individual weights.

Variable	Mean	Std. Dev.	Percentile					N
			10th	25th	50th	75th	90th	
Self-reported house value (GB£)	147,602	151540.8	44,000	65,000	105,000	185,000	380,000	101491
House price index - Nationwide (GB£)	113,411	71459.1	40,978	56,184	94,792	146,448	258,686	101102
House price index - Halifax (GB£)	124,336	62459	56,950	70,051	102,855	168,908	246,858	101491
Overvaluation relative to Nationwide index	0.6147	0.4867	0	0	1	1	1	101102
Overvaluation - relative to Halifax index	0.5746	0.4944	0	0	1	1	1	101491
Under a mortgage	0.6117	0.4874	0	0	1	1	1	101491
Taken out extra loan	0.04406	0.2052	0	0	0	0	0	101491
Financial expectations	0.2602	0.4388	0	0	0	1	1	95179
House improvement	0.02796	0.1649	0	0	0	0	0	101491
Other consumption	0.01989	0.1396	0	0	0	0	0	101491
Number of rooms in the house	5.028	1.6279	3	4	5	6	8	101379
Likes present neighbourhood	0.9404	0.2367	1	1	1	1	1	98377
Prefers to move house	0.3088	0.462	0	0	0	1	1	97781
Detached	0.3188	0.466	0	0	0	1	1	101491
Semi-detached	0.3703	0.4829	0	0	0	1	1	101491
Terraced	0.2462	0.4308	0	0	0	0	1	101491
Flats	0.06469	0.246	0	0	0	0	1	101491
Male	0.4723	0.4992	0	0	0	1	1	101491
Age	48	18.308	23	34	47	61	79	101217
Cohort	1953	18.617	1926	1939	1953	1966	1982	101483
Has children	0.2551	0.4359	0	0	0	1	1	101491
Married	0.615	0.4866	0	0	1	1	1	101463
Employed	0.5284	0.4992	0	0	1	1	1	101432
First degree or above qualification	0.1316	0.3381	0	0	0	0	1	97581
Income	14410	14837.6	2,307	5,415	11,048	19,175	37,605	96438

For property characteristics, I find that the average number of rooms in the sample is 5 rooms. Only 8% of homeowners live in flats, while 23% live in terraced houses, 35% in semi-detached and 32% in detached houses. On average, most homeowners like their present neighbourhood (95%) while those who prefer to move house constitutes 30% of the sample. Overall, most of the explanatory variables show high variations in the data apart from mortgage refinancing variables which have relatively low standard deviations.

Table 4.3 reports weighted pairwise correlations for all of the variables in our analysis, with the indicated levels of significance representing the 5% level and below. Interestingly, I see large differences in the correlations between the dependent variable and changes in regional house price indices; for the Nationwide index the coefficient is 0.233 while the coefficient for the Halifax index is 0.119. This may be associated with the manner in which the two indices are calculated as the Halifax house price index does not take into account quarterly changes in sample composition. However, for the national level indices, the correlation between the changes in self-reported house value and the change in the Halifax house price index is 0.310, which is much higher than the correlation coefficient for the change in the Nationwide house price index, 0.256. Other independent variables that are correlated with the dependent variable include the number of rooms (0.063), detached houses (0.0380) and income (0.029). I find a negative correlation between change in self-reported house values and *prefers to move house* (-0.024), terraced house types (-0.011), and flats (-0.064). Regarding housing tenure and mortgage refinancing, I note that homeownership through a mortgage and mortgage refinancing have positive correlations with changes in self-reported house values and changes in all house price indices apart from changes in the regional Halifax house price index, which is insignificant.

Table 4.3 Pairwise correlation matrix

Table reports weighted pairwise correlation matrix for all variables as described in Table 1. The data is drawn from Nationwide and Halifax house price indices and the BHPS for the period 1993 to 2008. For the BHPS, the sample consists of all respondents who own a house outright or through a mortgage and excludes Northern Ireland. The reported levels of significance are based on Bonferroni-adjusted p-values and are given by * for significance levels of 0.05 or less.

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Change in self-reported house value	1											
(2)	Change in Nationwide index (regional)	0.2326*	1										
(3)	Change in Nationwide index (National)	0.2559*	0.8243*	1									
(4)	Change in Halifax index (Regional)	0.1190*	0.2171*	0.2686*	1								
(5)	Change in Halifax index (National)	0.3104*	0.5612*	0.7125*	0.3696*	1							
(6)	Overvalue (relative to Nationwide index)	0.1020*	-0.1518*	-0.1148*	-0.0236*	-0.0674*	1						
(7)	Overvalue (relative to Halifax index)	0.0984*	-0.0352*	-0.0543*	-0.2910*	-0.0715*	0.3885*	1					
(8)	Financial expectations	0.0252*	0.0223*	0.0307*	0.0064	0.0400*	0.0083*	0.0262*	1				
(9)	Under mortgage	0.0313*	0.0153*	0.0223*	-0.0004	0.0260*	0.0108*	0.0222*	0.2359*	1			
(10)	Home investment	0.0376*	0.0171*	0.0166*	0.0095*	0.0213*	0.0088*	0.0101*	0.0356*	0.1351*	1		
(11)	Other consumption	0.0105*	0.0156*	0.0167*	0.006	0.0205*	0.0078*	0.0204*	0.0544*	0.1135*	0.1468*	1	
(12)	Number of rooms	0.0625*	0.0113*	0.0140*	0.0163*	0.0130*	0.3507*	0.3004*	0.0264*	0.0456*	0.0283*	0.0217*	1
(13)	Likes present neighbourhood	0.0131*	0.0068*	0.0088*	0.003	0.0044	0.0979*	0.0490*	-0.0185*	-0.0088*	0.0085*	-0.0021	0.0620*
(14)	Prefers to move house	-0.0234*	-0.0058	-0.0061	-0.0096*	-0.0078*	-0.1032*	-0.0449*	0.0965*	0.1115*	-0.0024	0.0255*	-0.0917*
(15)	Detached	0.0351*	0.1261*	0.1443*	0.0715*	0.1134*	0.0142*	0.0728*	-0.0355*	-0.0907*	-0.0091*	-0.0097*	0.3889*
(16)	Semi-detached	0.0002	-0.1667*	-0.1681*	-0.0224*	-0.0546*	0.4163*	-0.0561*	-0.0017	0.0400*	0.0157*	-0.0072*	-0.0656*
(17)	Terraced	-0.0149*	0.0628*	0.0500*	-0.0364*	-0.0600*	-0.4069*	-0.0258*	0.0266*	0.0540*	0.0041	0.0168*	-0.1753*
(18)	Flat	-0.0419*	-0.0236*	-0.0329*	-0.0295*	-0.0043	-0.1292*	0.0176*	0.0238*	-0.0013	-0.0206*	0.003	-0.3010*
(19)	Male	0.0029	0.0018	0.0044	0.0027	0.006	0.0097*	0.002	0.0788*	0.0304*	-0.0011	0.0038	0.0233*
(20)	Age	-0.0377*	-0.0223*	-0.0311*	-0.0057	-0.0373*	-0.0182*	-0.0356*	-0.3514*	-0.5749*	-0.0927*	-0.0746*	-0.1045*
(21)	Cohort	0.0489*	0.0150*	0.0218*	0.0062	0.0211*	0.0186*	0.0179*	0.3416*	0.5488*	0.0962*	0.0866*	0.1233*
(22)	Has child(ren)	0.0317*	0.0091*	0.0161*	0.0028	0.0183*	0.0539*	0.0330*	0.0796*	0.3527*	0.1023*	0.0537*	0.1514*
(23)	Married	0.0065*	-0.0071*	-0.0085*	0.0013	-0.0085*	0.0878*	0.0439*	-0.1256*	0.0144*	0.0244*	-0.0121*	0.1273*
(24)	Employed or self-employed	0.0245*	0.0149*	0.0147*	-0.0007	0.0152*	-0.0033	0.005	0.1469*	0.3995*	0.0748*	0.0507*	0.0057
(25)	First degree or above qualification	0.0258*	0.0047	0.0055	0.0043	0.0067*	0.1002*	0.1241*	0.0658*	0.0962*	0.0156*	0.0203*	0.1416*
(26)	Income	0.0205*	0.0018	-0.0006	0.0016	-0.0065	0.0411*	0.0463*	0.0093*	0.1204*	0.0286*	0.0308*	0.0250*

Table 4.3 Continued

	Variables	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
(13)	Likes present neighbourhood	1												
(14)	Prefers to move house	-0.3540*	1											
(15)	Detached	0.0812*	-0.1349*	1										
(16)	Semi-detached	0.0181*	-0.0042	-0.5246*	1									
(17)	Terraced	-0.0855*	0.1193*	-0.3910*	-0.4383*	1								
(18)	Flat	-0.0398*	0.0546*	-0.1799*	-0.2017*	-0.1503*	1							
(19)	Male	0.0150*	0.0184*	0.0107*	0.004	-0.0091*	-0.0123*	1						
(20)	Age	0.0254*	-0.1549*	0.0892*	-0.0301*	-0.0699*	0.0124*	-0.0395*	1					
(21)	Cohort	-0.0151*	0.1326*	-0.0832*	0.0303*	0.0674*	-0.0197*	0.0367*	-0.9690*	1				
(22)	Has child(ren)	0.0070*	0.0452*	-0.0021	0.0385*	0.0074*	-0.0846*	-0.0194*	-0.2935*	0.2798*	1			
(23)	Married	0.0271*	-0.0290*	0.1350*	0.0119*	-0.0741*	-0.1493*	0.0389*	0.2313*	-0.2422*	0.2739*	1		
(24)	Employed or self-employed	0.0134*	0.0939*	-0.0941*	0.0477*	0.0467*	0.0028	0.0479*	-0.4175*	0.4052*	0.2150*	0.0370*	1	
(25)	First degree or above qualification	0.0293*	0.0133*	0.0702*	-0.0737*	-0.0150*	0.0380*	0.0332*	-0.1017*	0.1146*	0.0869*	-0.0012	0.1325*	1
(26)	Income	0.0352*	0.0055	0.0255*	-0.0255*	-0.0224*	0.0406*	0.2729*	0.0346*	-0.0028	0.1219*	0.0816*	0.3976*	0.2090*

Preference to move house is negatively correlated with all of the variables apart from house type (terraced and flats) and individual characteristics (first degree and above qualification, employed and income). In summary, the correlations range between -0.522 and 0.405, implying that I should expect most of the right-hand side variables to explain variations in our data. In addition, I carry out multicollinearity tests and do not find this to be a problem.[37]

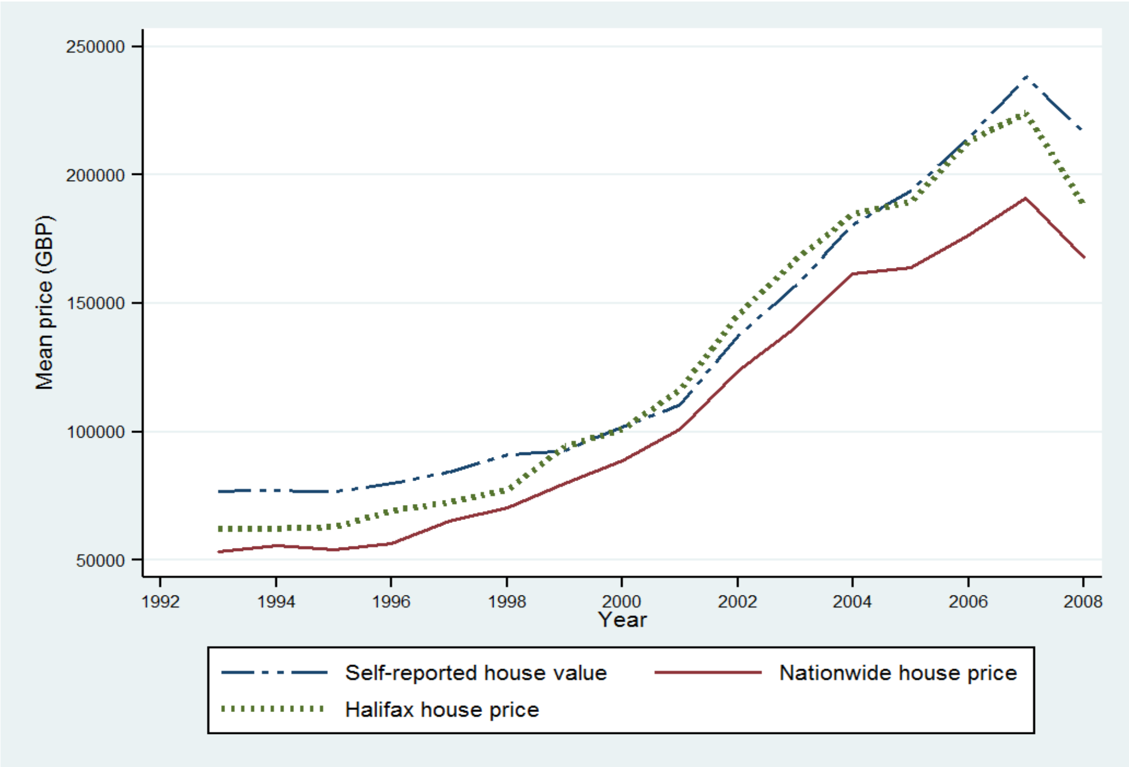
4.3.2.2 Graphical analysis

The relationships between the means of both self-reported house values and the Nationwide and Halifax house price indices, at national and regional level, are depicted in Figure 4.1 to Figure 4.3. As observed in the literature these relationships may suggest that self-reported house values could be anchored on house prices. Figure 4.1displays aggregate national means of self-reported housing wealth, the Nationwide house price index and the Halifax house price index against years. Overall, it can be observed that mean self-reported house values are higher than the mean of the Nationwide house price index throughout the period. However, the mean of the Halifax house price index is higher than the mean of self-reported house values for part of the study period - between 1999 and 2005. This suggests that most households tend to overvalue their homes relative to house price indices and that house price indices vary because of the different methodologies. Notably, both the mean self-reported house values and the means of the two house price indices increased during the period before 2007 and dropped thereafter, reflecting the peak in the housing market that preceded the onset of the financial crisis in 2008.

[37] For all the variables used in Table 6, we test for multicollinearity using the STATA software command ‘collin’ and find that all their variance inflation factors are below 10 (tolerance levels above 0.1) while the overall condition number is 10.

Figure 4.1 Means self-reported house values and published house price indices

This figure plots the relation between self-reported house value and house price index during 1993-2008 period. The self-reported house values are from the BHPS and house price indices are from the Nationwide and Halifax house price index series.



The same pattern is observed across regions, as reported in Figure 4.2, which displays the regional means of self-reported house values, the Nationwide house price index and the Halifax house price index against years by region. The Nationwide house price index is consistently lower than both the Halifax house price index and self-reported house values in all regions apart from London and the South East.

The Halifax house price index is higher than self-reported house values in the North East, Yorkshire and Humber, Wales and Scotland. In addition, the gap between the mean self-reported house value and both house price indices is wider in the East of England, London, and the South East. This finding indicates that there are substantial regional variations in both self-reported house values and published house price indices.

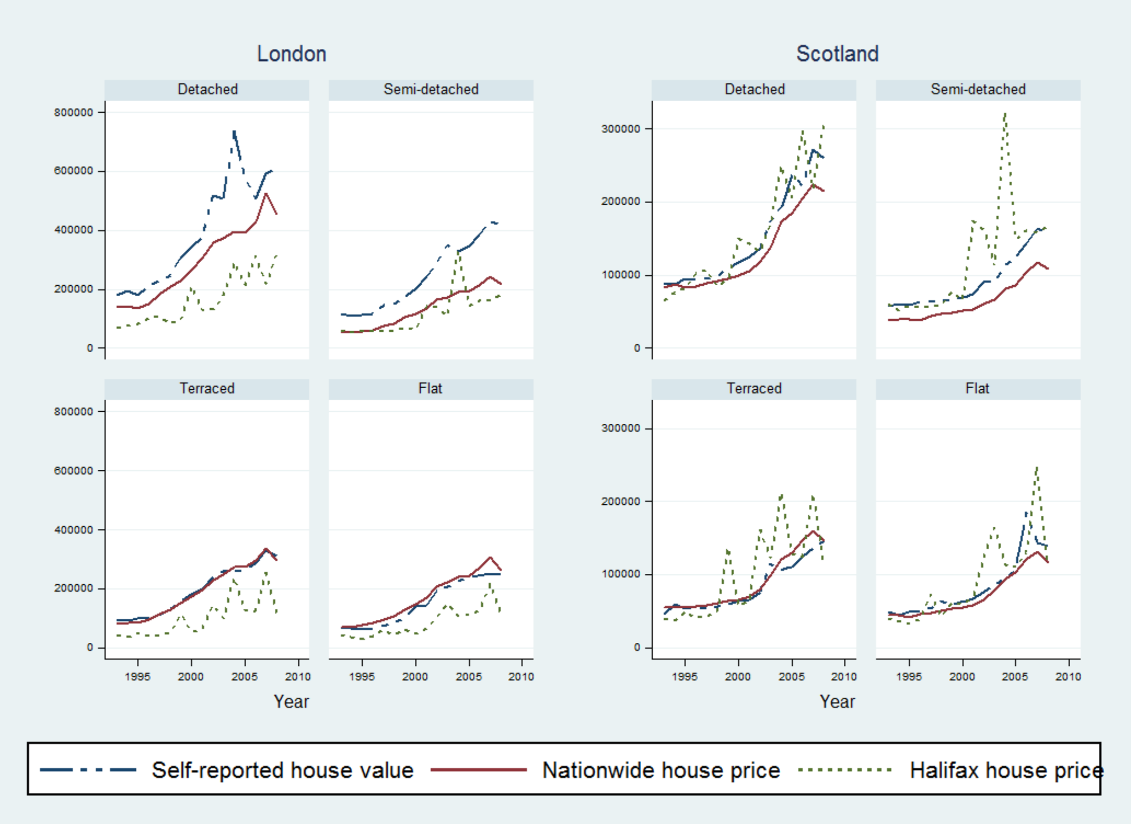
Figure 4.2 Means of self-reported house values and published house price indices by UK regions

This figure plots the relation between regional self-reported house value and regional house price index during 1993-2008 period. The self-reported house value are from the BHSP and the house price index is from the Nationwide house price index series.

Furthermore, when the means are calculated by house types and region, for example, London and Scotland, as displayed in Figure 4.3, differences by house type across regions are apparent. Reflecting differences in the index calculation methodology, more erratic price movements are evident for the Halifax index as compared to the Nationwide index. In London, there are stark differences between the mean of self-reported house value and the means of both the Nationwide and the Halifax house price indices for detached and semi-detached house types. Moreover, across house types in London, the mean of the Halifax house price index is below that of the Nationwide house price index.

Figure 4.3 Means of self-reported house values and house price index by region and house type

This figure plots the relation between aggregate national self-reported house value and national house price index during 1993-2008 period by house type and two UK region: London and Scotland. The self-reported house values are from the BHSP and house price index is from the Nationwide house price index series.



For terraced and flats house types, there is a high correlation between the self-reported housing values and both the Nationwide and the Halifax house price indices. For Scotland, a different pattern is evident as the means of the Halifax index are higher than both the means of self-reported house value and the Nationwide house price index. In summary, the graphical analysis provides evidence of variations in the data, across regions and by house type, which I exploit to investigate whether they are associated with anchoring biases.

4.4 Empirical strategy

Anchoring bias occurs when individuals' predictions are too close to uninformative reference points and thus underweight other relevant information about a subject value. As noted in section 4.3, aggregate self-reported house values are correlated with aggregate house price indices but this correlation varies across individuals, regions, and house type. This suggests that variations in self-reported house prices could be attributed to property characteristics, neighbourhood characteristics, and market information asymmetries among homeowners. Specifically, as in Northcraft and Neale (1987), such attributes include house type, square footage, the age of a property, and observed local house prices of comparable properties. Similar attributes are used for valuation in mortgage origination and related contractual agreements. However, variations could also occur because of measurement errors caused by information asymmetries that result in individuals being unable to value unique property characteristics.

Most studies that examine anchoring effects, in various fields, use a variety of methods. A straightforward analysis involves regressing actual data releases (i.e. house values) on the most recent forecasts and testing whether the slope coefficient is significantly different from unity (Aggarwal *et al.*, 1995; David C. Schirm, 2003). Anchoring can also be modelled as a 'surprise' – forecast subtracted from actual data release – and regressed on the expected 'surprise' – forecast minus the average value of a lagged series of forecasts (Campbell and Sharpe, 2009). In this case, rationality is overruled if the coefficient on the expected 'surprise' parameter is positive.

Following a method proposed by Genesove and Mayer (2001), Beggs and Graddy (2009) use a two stage process to isolate anchoring bias in the art market from other effects that could be captured by the residual term in their regression. First, they use a hedonic price function to predict the market price of works of art and identify two biases in the estimation procedure: (1) anchoring bias, reflected in a deviation of the predicted sale price from the lagged sale price; and (2) unobserved characteristics, reflected in a deviation of a lagged predicted sale price from a corresponding lagged sale price. Second, the authors regress sale prices for works of art on the predicted sale prices and the proxies for anchoring bias and unobserved characteristics.

In the above studies, the aim is to isolate anchoring bias in the presence of many other plausible biases. Overall, these studies find significant anchoring effects. I follow these studies in examining whether self-reported house values are anchored on a published house price index. However, as I discuss below, unlike these studies, I address econometric issues concerning unobserved effects (arising from both property and individual characteristics) using two strategies. First, rather than using the log of both self-reported house values and the Nationwide house price index, I use logarithmic transformations of the change in both variables and fixed effects OLS regressions. This partially eliminates unobserved effects and measurement errors in both variables. Second, for robustness, and to address endogeneity issues, I use instrumental variables estimations using generalised methods of moment (GMM).

As noted earlier, house price data are typically estimated using hedonic regressions in which the actual house value is expressed as a function of its characteristics. The estimated equation is then used to estimate the house price for an average house conditioned on specific property characteristics, house type and geographic region. The hedonic model may be represented by equation (1) where the dependent variable, *MP*, is the market price for specific house unit, and the independent variables are the house characteristics, including property characteristics, PC (e.g. house design, number of bathrooms, number of bedrooms, type of garage, and property age); neighbourhood characteristics, NC (e.g. location of property and infrastructure); environmental characteristics, EC (e.g. noise pollution and air pollution); and a random error term, ϵ_{it}, which captures the residual errors.

$$MP_i = \beta_0 + \beta_1 PC_i + \beta_2 NC_i + \beta_3 EC_i + \epsilon_{it}. \quad (1)$$

The random error term may be attributed to two types of errors: ‘analyst errors’ and ‘transactor errors’ (Linneman, 1986). Transactor errors occur when home house values do not represent true house prices; for example, a home owner may be forced by personal circumstances to sell or buy a house at a price which could be higher or lower than the market price. Analyst errors include measurement errors and omitted variables that arise because the regression model may be misspecified – i.e. some important property characteristics may be excluded in the regression model. As argued by Linneman (1986), it is not possible to mathematically distinguish analysts’ errors from transactors’ errors. However, as transactors’ errors arise from sellers, the errors can be minimized by either including a variable that captures unplanned home relocation or by excluding such home owners from the dataset. In this case, the residual term should consist solely of analysts’ errors that arise from the imprecise hedonic regression model.

Given that the self-reported house value may be a good proxy for the market price, I could replace the dependent variable in Equation (1) with self-reported house values and calculate a house price index from the regression estimates. If self-reported house values are free from measurement errors and the model specifications are as described in Equation (1), the calculated house price index should not significantly vary from an index based on market prices. Previous studies examine the relationship between the two approaches to calculating house price indices and find that they have similar patterns and both indices differ only at market turning points when compared with a market wide house price index.[38] This is hardly unexpected because, as previously mentioned, house price indices represent the price of a ‘typical house’. Furthermore, self-reported house value equations would be imprecisely estimated if a homeowner is unable to estimate the market value of property attributes and is influenced by other factors including the house price index and individual characteristics.

Sketching these ideas empirically, I begin with the simple case where I regress the log of self-reported house value for individual i at time t, SP_{it}, on the log of the house price index for an equivalent house at time t, HP_t, and a time-specific effect, T, represented by Equation (2). If the coefficient α is not significantly different from unity, I conclude that self-reported house values are anchored on analysts’ house prices. Therefore, house prices reflect all the available market information and both property and individual characteristics do not explain variations in self-reported house values. Otherwise, the error term, μ_i, could be capturing unobserved effects including omitted variables and measurement errors.

$$SP_{it} = \alpha HP_t + \mathrm{T} + \mu_i + \epsilon_{it}. \tag{2}$$

Incorporating property characteristics for individual i, PC_i, and individual characteristics, IC_i, into Equation (2) allows the effect of these variables to influence

[38]Dipasquale and Somerville (1995) compare three price series: two price series constructed by the authors using purchase prices and self-reported house values from the American Housing Survey; and a national price index. They find that the three price series generally have similar patterns and only differ during market turning points. Using the same survey but comparing self-reported house value and a local house price index, Goodman and Ittner (1992) find that owners’ estimates were biased upwards. They find that the residual term is uncorrelated with individual characteristics, property attributes or regional effects. Similar results are reported by Kiel and Zabel (1999).

the self-reported house value, in Equation (3). This regression has three implications: (1) If homeowners place more weight on the market information reflected in house prices, α will be significantly different from zero and the parameters η and δ will be insignificant; (2) if homeowners' place more weight on the characteristics of their homes then the parameter η will be non-zero and the magnitude of α will vary; and (3) if homeowners' perceptions and abilities are correlated with self-reported values, the parameter δ will also be non-zero and α will vary.

$$SP_{it} = \alpha HP_t + \eta PC_i + \delta IC_i + \mathrm{T} + \mu_i + \epsilon_{it}. \tag{3}$$

The concern, however, is that the unobserved effects in Equation (3) may still be correlated with the house price index, property characteristics or individual characteristics. Specifically, self-reported house values may lag behind the house price index while omitted variables and measurement errors may be correlated with property characteristics. To circumvent this problem, I slightly modify Equation (3) and model the change in self-reported house value as a function of change in the house price index, in Equation (4). In addition, I use fixed effects OLS regressions to further eliminate unobserved individual effects and cluster standard errors at the individual level. This model is represented by:

$$\Delta SP_{it} = \alpha \Delta HP_t + \eta PC_{it} + \delta IC_{it} + \mathrm{T} + \epsilon_{it}. \tag{4}$$

To formally test for information asymmetries and the presence of factors that moderate anchoring effects, I examine how exposure to different information and new information could impact on the weight that homeowners assign to regional house prices. The assumption is that new information enables home owners to revise their home values towards their true market values so that the weight that is placed upon regional house prices could result in either an increase or decline. Whereas, varying exposure to market information could explain differences in self-reported house value and anchoring on house price indices, I speculate that this could arise in two ways: (1) ownership tenure (outright owner or ownership through a mortgage) including mortgage re-financing decisions and the purposes for which an additional loan is used; and (2) social factors including computer use and social engagement mechanisms.

Beginning with ownership tenure, I posit that, when compared to outright homeowners, mortgage holders are more likely to be interested in news about the performance of the housing market and general economic conditions and are therefore more likely to anchor on house price indices. As previously discussed, the interest in such news is driven by the need to closely monitor growth in housing wealth and, most importantly, mortgage repayment obligations. Thus, a regression that includes an interaction term between change in the house price index and the variable *under mortgage* in Equation (4) allows me to test this hypothesis. This regression, as represented by Equation (5) below, has two implications: (1) owning a home through a mortgage should have no direct effect on change in self-reported house value; and (2) the interaction term should be positive and significant – that is, holding other variables constant, owning a home through a mortgage increases the effect of the change in the house price index. The model is represented by:

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 \Delta HM_i + \alpha_3 (\Delta HP_t * HM_i) + \eta PC_{it} + \delta IC_{it} + \mathrm{T} + \epsilon_{it}. \tag{5}$$

Where HM_i represents the variable *under mortgage* for individual i and the other parameters are as defined before.

Second, I investigate both the main and conditional effects of mortgage refinancing and the use of the money raised, which could provide additional tests of anchoring bias. Specifically, it permits an examination of whether anchoring-and-adjustment bias is observable given the expected opposite implications of these variables on change in self-reported house value and their interactions with changes in the house price index. The conjecture is that since homeowners who refinance their mortgages receive a professional valuation of their homes I should expect to see less anchoring, when compared to both mortgage holders who do not refinance and outright owners (Equation (6)). Further, the purposes for which the additional loan is used have three implications: (1) if a homeowner who refinances and uses funds for home investment is able to adjust for an increase in home value, I should expect to see a positive correlation with change in self-reported house value (Equation (7)); (2) for those who use the money raised for other consumption purposes, I should expect to see an insignificant relationship with change in self-reported house value (Equation (8)); and (3) the interaction terms between change in house price index and both home investment and other consumption should be negatively correlated with change in self-reported house value (Equation (9)). The models are represented by:

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 EL_i + \alpha_3(\Delta HP_t * EL_i) + \eta PC_{it} + \delta IC_{it} + \mathrm{T} + \epsilon_{it}, \tag{6}$$

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 HM_i + \alpha_3(\Delta HP_t * HM_i) + \eta PC_{it} + \delta IC_{it} + \mathrm{T} + \epsilon_{it}, \tag{7}$$

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 OC_i + \alpha_3(\Delta HP_t * OC_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}, \tag{8}$$

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 HM_i + \alpha_3 OC_i + \alpha_1 \alpha(\Delta HP_t * HM_i * OC_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}. \tag{9}$$

Third, I examine the mediating role of computer use. I posit that homeowners who use a computer also frequently access the Internet, which increases access to news about the housing market and the likelihood of using on-line tools for calculating home values. Because this calculation is based on house price indices I expect to see a positive and significant effect in the interaction term between computer use and change in the house price index. The model is represented by:

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 CU_i + \alpha_3(\Delta HP_t * CU_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}. \tag{10}$$

Where CU_i represents computer use by individual i and other parameters are as defined before.

Finally, I investigate the role of three social engagement measures. These have four implications: (1) if homeowners are more trusting they are more likely to trust the producers of house price indices and so they are more likely to be anchored, as tested by Equation (11); (2) if homeowners who are involved in tenancy groups are able to learn about local house prices in their neighbourhood, I should expect them to be less anchored on house price indices, as tested by Equation (12); and (3) if homeowners who are religious view their home as a place to live in, rather than an investment, and get to learn about house prices through religious activities, then I expect that they will be less likely to be anchored, as tested by Equation (13). The models are as follows:

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 TR_i + \alpha_3(\Delta HP_t * TP_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}. \quad (11)$$

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 TG_i + \alpha_3(\Delta HP_t * TG_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}. \quad (12)$$

$$\Delta SP_{it} = \alpha_1 \Delta HP_t + \alpha_2 RB_i + \alpha_3(\Delta HP_t * RB_i) + \eta PC_{it} + \delta IC_{it} + \tau + \epsilon_{it}. \quad (13)$$

Where TP_i represents trust most people, TG_i represents membership of a tenancy group, and RB_i represents religious beliefs.

4.5 Empirical results

In this section, I report the results from the main empirical model. First, I present results from baseline fixed effects OLS regressions, in which I examine the roles of changes in the house price index, regional and time dummies, a set of property attributes, and a vector of individual characteristics on changes in self-reported house values. Second, I examine the influence of a number of extended specifications and sub-samples. Third, to address concerns regarding the distribution of the dependent variable, I present quantile regression estimates.

4.5.1 Baseline anchoring estimates

I begin by examining whether self-reported house values are anchored on house price indices using univariate analysis and specifications that include property characteristics and individual characteristics. I estimate fixed effects OLS regressions using equation (4) and extensions of this equation where the dependent variable is log of change in self-reported house value. Change in Nationwide house price index is the key independent variable, along with an array of other independent variables including property attributes, individual characteristics of the homeowner, time dummies and regional dummies.

In line with the literature concerning both hedonic pricing and behavioural models, these variables are known to influence asset pricing and household financial decisions, respectively. Property attributes include the variables *number of rooms*, *likes present neighbourhood*, *prefers to move house*, and type of accommodation. The individual characteristics that I control for include the variables *age*, *male*, *married*, *first degree and above qualification*, *employed* and income. Table 4.4 reports the coefficient estimates for five specifications from fixed effects OLS regressions. The standard errors are clustered at the individual level and are used to derive the levels of significance.

The underlying conjecture in these baseline regressions is that homeowners continually track changes in regional house prices and that they use these changes to interpolate changes in the value of their own homes. In column (1), I carry out a univariate analysis where I regress the log of change in self-reported house value on the log of change in Nationwide house price index. This regression indicates that house price index barely explains variations in the self-reported house values, with a low R^2 of 0.053. However, we know that house prices vary substantially across regions and that time-fixed effects may be correlated with house prices. When I include both regional and time dummies in column (2), the magnitude of the house price index coefficient reduces from 0.266 to

0.194 and the r^2 increases to 0.090. This result indicates that the house price index is invariant to the inclusion of property attributes and individual characteristics; generally, time dummies[39] have high magnitudes and are significant at the 1% level.

When I consider a specification with proxies for property attributes, in column (3), I find all the proxy variables to be significant, with the expected signs. The coefficient estimate of change in house price index remains virtually unchanged. The variations in the dependent variable explained by the independent variables in this specification also increase, to 0.105. In the fourth, extended, specification, I examine whether individual characteristics explain variations in self-reported house values or whether they may be proxies for house prices.

When I add these variables together with time and regional dummies, Column (4), both the R^2 and the coefficient estimate for change in house price index drop to 0.090 and 0.191 respectively. The proxies for individual characteristics are insignificant apart from the variables married and first degree and above which are significant at the 1% level the 10% level, respectively. As expected, time dummies appear to capture more information in the absence of property characteristics. In the final specification, in column (5), I bring together the two sets of variables in columns (1) and (2) in one regression. The coefficient for change in house price remains stable at 0.203 and the r^2 at 0.105. The coefficient estimates of the property attributes remain virtually unchanged in magnitude and significance, as compared to the results in column (3). When compared to the results in column (4), the coefficient estimates for individual characteristics become significant for the variable *has children* and *age square*.

[39] When we test whether time dummies or regional dummies are needed in this regression, we find that the joint effects for both are significantly different from zero at the 1% level.

Table 4.4 Baseline anchoring regressions - self-reported house value and regional house price

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables as described in Table 4.1are: in all columns, log of change in house price index; column (2, 3, 4 &5), time and regional dummies; column(3), property attributes; column (4), variables for individual characteristics; and column (5), and combination of the three sets of variables in column (2), (3) and (4). Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1)	(2)	(3)	(4)	(5)
Change in house price index	0.266***	0.194***	0.207***	0.191***	0.203***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Number or rooms			0.125***		0.125***
			(0.006)		(0.007)
Likes present neighbourhood			0.012**		0.011**
			(0.005)		(0.005)
Prefers to Move			-0.017***		-0.017***
			(0.002)		(0.002)
Detached			0.079***		0.085***
			(0.010)		(0.010)
Semi-detached			0.109***		0.113***
			(0.009)		(0.009)
Terraced			0.022**		0.026***
			(0.009)		(0.009)
Log of Income				-0.000	0.002
				(0.002)	(0.002)
Age square				0.000	0.000***
				(0.000)	(0.000)
Has Children				0.001	-0.011***
				(0.003)	(0.003)
Married				0.023***	0.015***
				(0.004)	(0.004)
Employed				-0.001	-0.000
				(0.003)	(0.003)
First degree & above				0.003	0.020**
				(0.010)	(0.010)
Region dummies (Base=North East)					
North West		0.048	0.037	0.038	0.027
		(0.033)	(0.033)	(0.033)	(0.033)
Yorkshire & Humber		0.092**	0.066*	0.081**	0.059
		(0.039)	(0.039)	(0.038)	(0.039)
East Midlands		0.106***	0.062	0.095**	0.056
		(0.040)	(0.039)	(0.040)	(0.039)
West Midlands		0.068*	0.043	0.060	0.034
		(0.039)	(0.037)	(0.038)	(0.037)
East of England		0.176***	0.140***	0.165***	0.129***
		(0.040)	(0.039)	(0.039)	(0.039)
London		0.191***	0.202***	0.183***	0.191***
		(0.039)	(0.038)	(0.039)	(0.038)
South East		0.144***	0.137***	0.133***	0.127***
		(0.038)	(0.037)	(0.038)	(0.037)
South West		0.096**	0.055	0.079**	0.042
		(0.038)	(0.038)	(0.038)	(0.038)
Wales		0.087**	0.042	0.072*	0.032
		(0.038)	(0.038)	(0.038)	(0.038)
Scotland		0.052	0.061	0.041	0.063
		(0.045)	(0.044)	(0.043)	(0.043)

Table 4.4 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)
Time dummies					
1995		-0.001	-0.002	-0.003	-0.005
		(0.006)	(0.006)	(0.006)	(0.006)
1996		0.027***	0.022***	0.025***	0.017***
		(0.005)	(0.005)	(0.005)	(0.005)
1997		0.039***	0.034***	0.037***	0.025***
		(0.005)	(0.005)	(0.005)	(0.005)
1998		0.045***	0.037***	0.042***	0.026***
		(0.005)	(0.005)	(0.005)	(0.005)
1999		0.063***	0.055***	0.062***	0.042***
		(0.005)	(0.005)	(0.006)	(0.006)
2000		0.083***	0.074***	0.081***	0.059***
		(0.005)	(0.005)	(0.006)	(0.006)
2001		0.071***	0.060***	0.067***	0.041***
		(0.005)	(0.005)	(0.006)	(0.007)
2002		0.159***	0.147***	0.154***	0.124***
		(0.005)	(0.005)	(0.007)	(0.007)
2003		0.145***	0.131***	0.141***	0.106***
		(0.005)	(0.005)	(0.008)	(0.008)
2004		0.148***	0.133***	0.144***	0.105***
		(0.005)	(0.005)	(0.008)	(0.009)
2005		0.080***	0.066***	0.075***	0.035***
		(0.005)	(0.005)	(0.009)	(0.009)
2006		0.061***	0.048***	0.054***	0.013
		(0.005)	(0.005)	(0.009)	(0.010)
2007		0.072***	0.058***	0.066***	0.021**
		(0.005)	(0.005)	(0.010)	(0.010)
2008		-0.040***	-0.051***	-0.047***	-0.093***
		(0.005)	(0.005)	(0.010)	(0.011)
Constant	0.067***	-0.093***	-0.337***	-0.100***	-0.405***
	(0.001)	(0.032)	(0.034)	(0.037)	(0.040)
Adjusted r^2	0.053	0.090	0.105	0.090	0.105
Observations	117303	117303	112958	110950	109160

Overall, these estimates confirm the main hypothesis (1) and indicate that changes in self-reported house values are anchored on changes in house price index.

4.5.2 Evidence using extended regression specifications and interaction terms

To further examine the relationship between self-reported house values and change in house price index, I extend the final specification in Table 4.4, Column (5), to include additional independent variables and interaction terms. Table 4.5 presents the results for the extended specifications. In Column (1), I include the variable financial expectations in the fixed effects OLS regression. This variable represents respondents' self-reported perceptions about their future financial situation. A similarly structured variable that reflects future financial situation has been used in the literature to proxy for financial expectations (Disney *et al.*, 2010a; Dawson and Henley, 2012). The idea is that, if the regional house price index is an indicator of the prevailing economic conditions and, by implication, individuals' financial expectations, the inclusion of this variable should reduce the influence of the change in the house price index. When I enter this variable, Column (1), the coefficient for *change in house price index* remains unchanged from that reported in Table 4.4, Column (5), while the variable *financial expectations* is insignificant. However, when I interact the two variables, Column (2), the coefficient for *change in house price index* drops from 0.205 to 0.179; the variable *financial expectations* becomes negative and significant at the 10% level; and the coefficient estimate for the interaction term is positive and highly significant (0.085). This result indicates that *financial expectations* has a weak direct association with *change in self-reported house values*; however, in line with Hypothesis (2), having favourable future financial expectations increases anchoring on the *change in the house price index*.

In the second extended specification, I examine whether ownership through a mortgage or otherwise influences the self-reported house value. In Column (3) I enter the dummy variable *under mortgage* to our final baseline regression specification and interact the two variables in Column (4). The results in Column (3) show that the variable *under mortgage* is positive and significant at the 5% level. In support of Hypothesis (3), however, the coefficient estimate for the interaction term (0.076), reported in Column (4), is positive and highly significant while the estimate for *change in house price index* drops to 0.152. In addition, the direct influence of the variable *under mortgage* becomes insignificant.

Table 4.5 Estimates using extended specifications and interaction terms

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables include log of change in house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Additional independent variables include financial expectations; dummy for ownership through a mortgage; overvaluation dummy; and interaction terms of these variables with change in regional house price. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in house price index	0.204***	0.179***	0.203***	0.152***	0.232***	0.280***	0.181***
	(0.007)	(0.008)	(0.007)	(0.011)	(0.007)	(0.010)	(0.017)
Financial expectations	0.003	-0.005*					-0.027**
	(0.002)	(0.003)					(0.012)
Financial expectations * Δ House price index		0.085***					0.164***
		(0.013)					(0.061)
Under mortgage			0.008**	0.002			0.005
			(0.004)	(0.004)			(0.007)
Under mortgage * Δ House price index				0.076***			0.121***
				(0.012)			(0.021)
Overvalue					0.203***	0.213***	0.213***
					(0.005)	(0.005)	(0.008)
Overvalue * Δ House price index						-0.076***	-0.020
						(0.011)	(0.020)
Financial expectations * Under mortgage							0.018
							(0.012)
Financial expectations * Under mortgage * Δ House price index							-0.110*
							(0.064)
Financial expectations * Overvalue							0.033**
							(0.013)
Financial expectations * Overvalue * Δ House price index							-0.075
							(0.074)
Under mortgage * Overvalue							-0.006
							(0.008)
Under mortgage * Overvalue * Δ House price index							-0.085***
							(0.025)
Financial expectations * Under mortgage * Overvalue							-0.021
							(0.015)
Number or rooms	0.127***	0.126***	0.125***	0.124***	0.066***	0.066***	0.067***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.012**	0.012**	0.011**	0.011**	0.003	0.003	0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)

Table 4.5 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prefers to Move	-0.017***	-0.017***	-0.017***	-0.017***	-0.011***	-0.010***	-0.010***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Detached	0.083***	0.083***	0.085***	0.087***	0.091***	0.088***	0.087***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)
Semi-detached	0.111***	0.112***	0.113***	0.114***	0.038***	0.035***	0.033***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Terraced	0.025***	0.024***	0.026***	0.027***	0.041***	0.040***	0.038***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.002	0.002	0.002	0.002	0.003*	0.003*	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.011***	-0.011***	-0.012***	-0.012***	-0.010***	-0.010***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.014***	0.014***	0.014***	0.014***	0.012***	0.012***	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	-0.001	-0.001	-0.001	-0.001	0.000	-0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.019*	0.019*	0.020**	0.020**	0.022**	0.022**	0.020*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Region dummies (Base=North East)							
North West	0.037	0.041	0.027	0.028	0.025	0.029	0.043
	(0.033)	(0.033)	(0.033)	(0.033)	(0.034)	(0.034)	(0.033)
Yorkshire & Humber	0.073*	0.077**	0.059	0.060	0.046	0.049	0.068*
	(0.038)	(0.039)	(0.039)	(0.039)	(0.040)	(0.040)	(0.038)
East Midlands	0.065*	0.067*	0.056	0.056	0.023	0.024	0.034
	(0.039)	(0.039)	(0.039)	(0.039)	(0.041)	(0.040)	(0.039)
West Midlands	0.044	0.045	0.034	0.035	0.024	0.027	0.038
	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)	(0.037)	(0.037)
East of England	0.140***	0.143***	0.128***	0.128***	0.102***	0.104***	0.117***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	(0.039)	(0.038)
London	0.203***	0.205***	0.191***	0.190***	0.216***	0.218***	0.233***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)
South East	0.140***	0.140***	0.127***	0.127***	0.128***	0.128***	0.140***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)	(0.037)	(0.036)
South West	0.053	0.055	0.042	0.042	0.042	0.045	0.058
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)
Wales	0.041	0.043	0.031	0.030	0.015	0.017	0.027
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)
Scotland	0.075*	0.081*	0.063	0.063	0.059	0.064	0.081*
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.042)	(0.042)

Table 4.5 Continued

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Time dummies							
1995	-0.004	-0.004	-0.005	-0.003	-0.008	-0.007	-0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
1996	0.018***	0.018***	0.017***	0.018***	0.008	0.009*	0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1997	0.026***	0.026***	0.025***	0.026***	0.016***	0.018***	0.020***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1998	0.030***	0.030***	0.026***	0.028***	0.020***	0.022***	0.027***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
1999	0.046***	0.046***	0.042***	0.044***	0.036***	0.037***	0.042***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2000	0.063***	0.063***	0.059***	0.061***	0.048***	0.050***	0.056***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2001	0.044***	0.044***	0.041***	0.043***	0.032***	0.034***	0.040***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
2002	0.126***	0.127***	0.124***	0.127***	0.108***	0.110***	0.116***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
2003	0.110***	0.111***	0.106***	0.109***	0.090***	0.091***	0.100***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
2004	0.111***	0.111***	0.106***	0.109***	0.086***	0.087***	0.096***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2005	0.041***	0.041***	0.035***	0.038***	0.009	0.010	0.019*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
2006	0.019*	0.019*	0.013	0.016	-0.018*	-0.016	-0.006
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2007	0.028***	0.029***	0.022**	0.025**	-0.014	-0.013	-0.002
	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
2008	-0.084***	-0.085***	-0.092***	-0.090***	-0.132***	-0.131***	-0.120***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Constant	-0.404***	-0.403***	-0.411***	-0.403***	-0.447***	-0.458***	-0.454***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.041)	(0.041)	(0.040)
Adjusted r^2	0.105	0.106	0.105	0.106	0.148	0.149	0.151
Observations	105121	105121	109160	109160	109160	109160	105121

In the third extended specification, I introduce the variable *overvalue* which represents the tendency of homeowners to either undervalue or overvalue their homes relative to regional house prices. Generally, as discussed in the data section, I find minimal transitions between the two states over the panel period; most homeowners consistently overvalue or undervalue their homes. Because I model change in self-reported house value as a function of change in regional house price, I expect that both property characteristics and individual characteristics should capture variation in self-reported house values with or without anchoring. This is difficult to model econometrically considering the few observable property characteristics in the survey. To circumvent this shortcoming, I include the variable *overvalue* and an interaction term with *change in house price index* in the final baseline regression specification. In so doing, I expect these adjustments to capture additional variation in the data and to isolate the effect of persistent overvaluation on our estimates that may influence the role of the *change in the house price index* both directly and interactively.

The results in Column (5) show that the dummy captures additional variation as compared to the previous results; the r^2 increases from 11% to 15%. The coefficient for the change in the house price index increases to 0.232. As expected, the results for property characteristics are mixed. While the coefficient estimates decline for the variables *number of rooms*, *prefers to move* and *semi-detached* house type, the coefficient estimates for the variable *terraced house* type increase and *likes present neighbourhood* become insignificant. Another interesting finding is the influence of individual characteristics where the variables log of income and *higher degree and above* become significant at the 5% level. Most importantly, when I interact the overvaluation dummy with the *change in the house price index*, the coefficient estimates increase sharply for *change in house price index* (0.280) and only slightly for the overvaluation dummy. The interaction term is negative and significant suggesting that change in self-reported house value is low for homeowners who both anchor on changes in the house price index and who overvalue their homes.

In Column (7), I bring these additional variables and interaction terms together in one regression. The coefficient estimate of change in house price index drops to 0.181 and remains significant at the 1% level; the coefficient estimate for the variable *overvalue* remains unchanged; the level of significance of *financial expectations* increases to the 5% level; and the coefficient estimate of the variables *under mortgage* becomes insignificant. As for the interaction terms, I find that the interactions between *change in house price index* and the variable *financial expectations* is twice the magnitude reported in Column (2); that the interactions between *change in house price index* and the variable *under mortgage* increases to 0.121; that the interactions between *change in house price index* and *overvalue* becomes insignificant; and the interaction term for the variables *change in house price index*, *under mortgage* and *overvalue* is negative and highly significant. In summary, these results show that conditional on changes in the house price index, homeownership through a mortgage and greater financial expectations, are positively associated with changes in the self-reported house values while the tendency to overvalue has an insignificant relationship with changes in the self-reported house value.

4.5.3 Effect of mortgage refinancing

In the previous section, holding a mortgage and financial expectations provided compelling evidence regarding their indirect relationships with changes in the self-reported house value, when considered alongside changes in the house price index. An assumption that is made concerning the variable *under mortgage* is that all mortgage holders receive the same set of information, which inclines them to anchor on the house price index. In this section, I relax this assumption and consider the behaviour of mortgage holders who also refinance their mortgages, the manner in which they use the raised funds and the influence of having greater financial expectations. Table 4.6 reports the estimates from fixed effects OLS regressions for the whole sample of homeowners using a reduced form of the regression in Column (7) of Table 4.5, where I include all explanatory variables and a few interaction terms (those with 5% or below levels of significance). In Columns (1) to (6) of Table 4.6, I run separate regressions for the variables *taken out extra loan*, *home investment*, *other consumption* and the interactions among these variables with *change in the house price index* and bring them together in one regression in Column (7).

In Column (1), I include the dummy variable *taken out extra loan*, which takes the value 1 for respondents who refinanced their mortgages during the panel period and 0 otherwise. The results show that the variable is highly significant and is positively correlated with the change in the self-reported house value. The coefficient estimates for *change in house price index* and other explanatory variables in Table 4.6 are comparable with the results in Table 4.5, Column (7). However, the variable *financial expectations* becomes significant at the 1% level and the coefficient of its interaction with *change in house price index* drops in magnitude but remains highly significant. This result suggests that the decision to refinance a mortgage provides additional information about changes in self-reported housing wealth and future financial expectations. When I interact this variable with changes in the house price index, Column (2), the findings support Hypothesis (4a).

Table 4.6 Effect of refinancing through home improvement and consumption

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables include log of change in house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Additional independent variables include mortgage refinancing dummy; home improvement dummy; other consumption dummy; and interaction terms of these variables with change in regional house price. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in house price index	0.189***	0.189***	0.189***	0.190***	0.189***	0.189***	0.190***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Taken extra loan	0.020***	0.028***					
	(0.004)	(0.004)					
Taken out extra loan * Δ House price index		-0.077***					
		(0.020)					
Extra loan – Home investment			0.035***	0.043***			0.081***
			(0.004)	(0.005)			(0.008)
Home investment * Δ House price index				-0.077***			-0.045
				(0.024)			(0.032)
Home investment * Financial expectations * Δ House price index							-0.106***
							(0.041)
Extra Loan – Other consumption					-0.011**	-0.001	0.046***
					(0.005)	(0.006)	(0.009)
Other consumption * Δ House price index						-0.090***	-0.037
						(0.029)	(0.036)
Other consumption * Financial expectations * Δ House price index							-0.142***
							(0.050)
Home investment * Other consumption							-0.115***
							(0.032)
Home investment * overvalue							-0.049***
							(0.009)
Other consumption * overvalue							-0.068***
							(0.011)
Home investment * other consumption * overvalue							0.111***
							(0.035)
Financial expectations	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Financial expectations * Δ House price index	0.067***	0.067***	0.067***	0.067***	0.067***	0.067***	0.075***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)

Table 4.6 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Under Mortgage	0.001	0.000	0.001	0.001	0.002	0.002	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Under mortgage * Δ House price index	0.111***	0.116***	0.111***	0.114***	0.111***	0.113***	0.111***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Overvalue	0.209***	0.209***	0.209***	0.209***	0.210***	0.210***	0.212***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Δ House price index	-0.024	-0.024	-0.024	-0.024	-0.024	-0.024	-0.027
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Overvalue * Financial expectations	0.014***	0.014***	0.014***	0.014***	0.014***	0.014***	0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Under mortgage * Δ House price index	-0.084***	-0.084***	-0.085***	-0.084***	-0.084***	-0.083***	-0.079***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Number or rooms	0.066***	0.066***	0.065***	0.066***	0.066***	0.066***	0.066***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.004	0.003	0.004	0.004	0.004	0.004	0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Prefers to Move	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Detached	0.087***	0.087***	0.087***	0.087***	0.087***	0.087***	0.086***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Semi-detached	0.033***	0.033***	0.033***	0.033***	0.033***	0.033***	0.033***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Terraced	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.020*	0.020*	0.020*	0.020*	0.020*	0.020*	0.020**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

Table 4.6 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Region dummies (Base=North East)							
North West	0.044	0.046	0.045	0.045	0.043	0.045	0.046
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Yorkshire & Humber	0.069*	0.071*	0.070*	0.071*	0.069*	0.071*	0.071*
	(0.038)	(0.038)	(0.038)	(0.039)	(0.038)	(0.038)	(0.038)
East Midlands	0.035	0.037	0.035	0.037	0.034	0.036	0.037
	(0.039)	(0.040)	(0.039)	(0.040)	(0.039)	(0.039)	(0.039)
West Midlands	0.040	0.041	0.040	0.041	0.039	0.041	0.041
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
East of England	0.118***	0.119***	0.119***	0.120***	0.117***	0.119***	0.121***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
London	0.234***	0.234***	0.234***	0.235***	0.233***	0.234***	0.234***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
South East	0.141***	0.141***	0.141***	0.142***	0.140***	0.141***	0.141***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.037)	(0.037)
South West	0.059	0.060	0.060	0.061	0.058	0.060	0.060
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Wales	0.028	0.029	0.028	0.029	0.028	0.029	0.029
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Scotland	0.079*	0.081*	0.079*	0.081*	0.080*	0.082**	0.084**
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)
Time dummies							
1995	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006	-0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
1996	0.011**	0.011**	0.011**	0.011**	0.011**	0.011**	0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1997	0.019***	0.019***	0.020***	0.019***	0.020***	0.020***	0.020***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1998	0.027***	0.027***	0.027***	0.027***	0.027***	0.027***	0.027***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
1999	0.042***	0.042***	0.042***	0.042***	0.042***	0.043***	0.042***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2000	0.056***	0.056***	0.056***	0.056***	0.057***	0.057***	0.056***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2001	0.039***	0.039***	0.039***	0.039***	0.040***	0.040***	0.039***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
2002	0.114***	0.114***	0.115***	0.115***	0.116***	0.116***	0.115***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)

Table 4.6 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2003	0.098***	0.098***	0.099***	0.099***	0.100***	0.100***	0.099***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2004	0.095***	0.095***	0.095***	0.095***	0.097***	0.097***	0.096***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2005	0.017*	0.017*	0.018*	0.018*	0.019*	0.019*	0.018*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2006	-0.008	-0.008	-0.007	-0.007	-0.006	-0.006	-0.007
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2007	-0.003	-0.003	-0.002	-0.003	-0.001	-0.001	-0.002
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
2008	-0.121***	-0.121***	-0.120***	-0.120***	-0.120***	-0.120***	-0.120***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Constant	-0.453***	-0.454***	-0.452***	-0.453***	-0.451***	-0.453***	-0.455***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Adjusted r^2	0.152	0.152	0.152	0.152	0.151	0.151	0.153
Observations	105121	105121	105121	105121	105121	105121	105121

The main effect of refinancing slightly increases in magnitude and the interaction term is negative and highly significant. The coefficient estimate for *change in house price index*, other explanatory variables and interaction terms remain unchanged.

To examine whether the purpose for taking an extra loan influences change in self-reported house value and whether it is also correlated with *change in the house price index*, I replace the variable *taken out extra loan* with the variable *home investment* in Column (3). The variable equals one for homeowners who use mortgage refinancing for home improvements or home extensions. The results show that the variable *home investment* is highly significant and larger in magnitude, when compared to *taken out extra loan* in Column (2). This result indicates that mortgage holders who refinance their mortgages and invest in their homes are able to incorporate the value of home improvements and extensions into their estimates of the self-reported house value. Next, I interact the variable *home investment* with the change in the house price index in Column (4). Independently, the variable *home investment* is still significant and the coefficient increases to 0.043 from 0.035. Although the coefficient for *change in house price index* increases marginally, the coefficient for the interaction term is large, negative, and highly significant, which confirms Hypothesis (4b). This implies that, among individuals who refinance their mortgages (when compared to those who do not) the anchoring effect reduces as they are able to adjust for new information from the professional valuation as well as the increase in their home value arising from the home improvements or extension.

To confirm the results in Column (4), I now consider the alternative use of an extra loan using the variable *other consumption*, which equals 1 if a homeowner uses an extra loan for car purchase, other consumption, or any other specified reason, and the value 0 otherwise. Clearly, from the results reported in Column (5) and in line with Hypothesis (4b), the variable *other consumption* is negatively correlated with the change in the self-reported house value and its inclusion in the regression has no impact on the coefficient estimate for *change in house price index*. Furthermore, when I interact the two variables, *change in house price index* and *other consumption*, in Column (6), the latter becomes insignificant but the interaction term is negative and highly significant. Again, this finding supports the argument that mortgage refinancing enables homeowners to learn more about the value of their homes. However, unlike using funds for home improvements or an extension, other uses of the extra loan provide no information that is of value in assessing the self-reported house value.

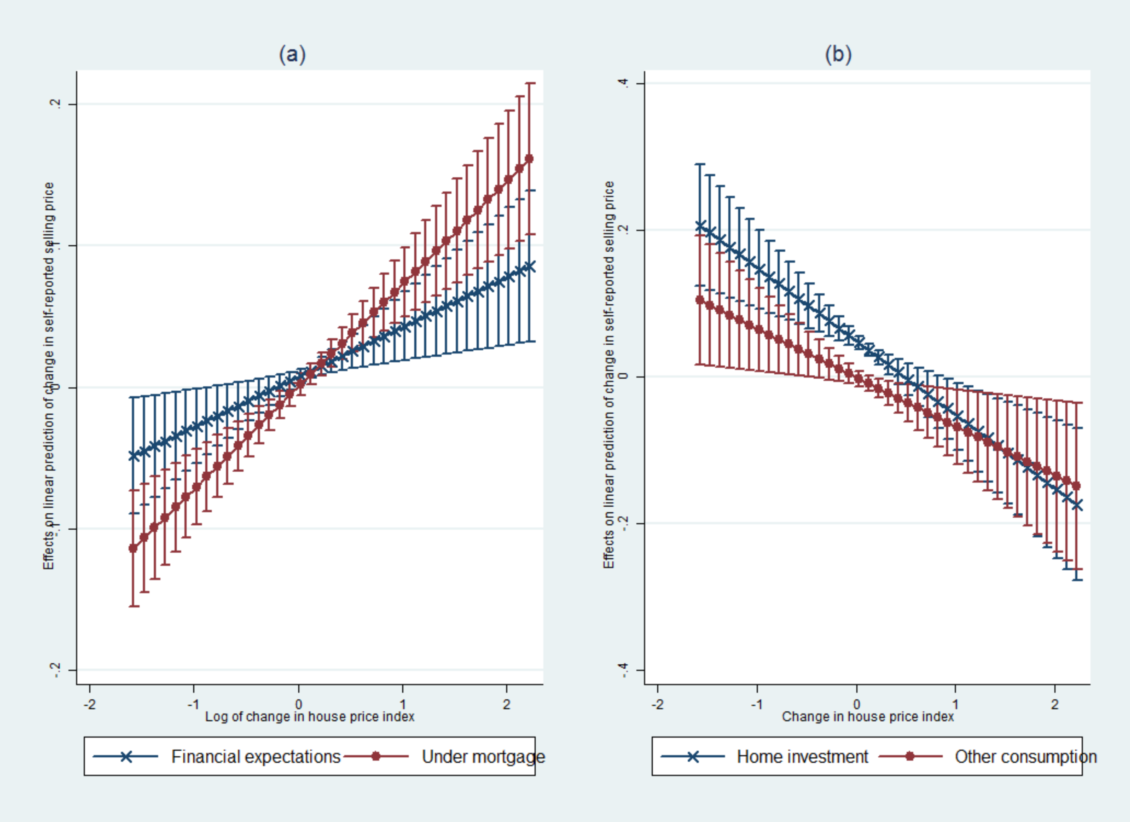
In the final specification in Column (7) I include the two variables *home investment* and *other consumption*, and both two-way and three-way interaction terms for these variables with change in house price index and *financial expectations*. The objective in this regression is to see how the three variables are correlated and their interaction effects. The idea is that homeowners who refinance their mortgages may do so because they have favourable future financial expectations about economic conditions (say low interest rates) and this could also be associated with expected increase in house prices, as suggested by the results in Column (1). An implication of this is that we might expect homeowners who refinance and have greater financial expectations to be more anchored on changes in the house price index and possibly ignore professional valuations. When compared to the results in Columns (4) and (6), I find that the coefficients for the main effects of *change in house price index* increases slightly; that for *home investment* almost doubles; and for *other consumption* it is about four times larger. A Wald test of the hypothesis that the coefficient estimates for *home investment* and *other consumption* are not significantly different is rejected at the 1% level, which implies that *home investment* has a greater effect on the change in self-reported house values relative to *other consumption*.

Regarding the coefficients for the interaction terms, I find that the two-way interaction terms between change in house price index and both *home investment* and *other consumption* become insignificant while the interaction between *home investment* and *other consumption* is negative and highly significant. However, the three-way interaction terms for changes in the house price index and *financial expectations* with *home investment* or *other consumption* are negative and highly significant. In line with hypothesis (4c), a Wald test of the hypothesis that the two coefficient estimates are not significantly different is not rejected. This indicates that, irrespective of the purpose for which the funds raised are used, anchoring on changes in the house price index reduces among homeowners who refinance their mortgages and have greater financial expectations.

Taken together, these results provide further support to our main conjecture and indicate that mortgage refinancing attenuates anchoring on regional house prices and is correlated with self-reported house values. Figure 4.4 displays marginal effects on the linear prediction of change in self-reported house value for the variables *financial expectations* and *under mortgage* in Panel A and the variables *home investment* and *other consumption* in Panel B. Panel A shows that, for homeowners who own their home through a mortgage, there is a positive and almost linear relationship between changes in the house price index and the predicted change in the self-reported house value. Conversely, Panel B shows that, for homeowners who refinance their mortgages, the predicted change in the self-reported house value has an opposite effect.

Figure 4.4 Effect of financial expectations, mortgage holding and refinancing across change in house price index

This figure plots marginal effects of the variables financial expectations, under mortgage, home investment and other consumption on change in self-reported house value against change in house price index. The average marginal effects are calculated using the estimates in Table 4.6, Column (8). The vertical lines represent 95% confidence level bands.



4.5.4 Estimates using sub-samples

In this section, I gather more evidence to test the robustness of the results using sub-samples. So far, the evidence shows that ownership through a mortgage increases anchoring; home investment reduces anchoring; tendency to overvalue explains changes in the self-reported house value, and that regional effects are significant for London, the East of England and the South East. Thus, the aim is to investigate whether, across sub-samples, there are variations in both anchoring on the house price index and the interactive effects of mortgage refinancing. I first split the sample into two sub-samples: households that undervalue their homes and those that overvalue relative to regional house prices. This is important because, relative to regional house prices, approximately 58% of homeowners tended to overvalue their homes and the *overvalue* dummy variable captures a lot of variation in the data (these results are reported in Table 4.5). I also split the sample further in two UK regions: rest of the United Kingdom; and the East of England, London and the South East. Within these sub-samples I run regressions for the whole sample, outright owners and mortgage holders using the specification in Column (7) of Table 4.6. The estimates are reported in Table 4.7 and Table 4.8.

Table 4.7 presents estimates for the sub-sample of homeowners who, relative to the house price index, undervalue their homes, Columns (1) to (3), and those who overvalue their homes, Columns (4) to (6); for each sub-sample the estimates are presented for the full sample, outright homeowners and mortgage holders. Generally, the coefficient estimate for our key variable, *change in house price index*, is high across the sub-samples of undervaluing homeowners as compared to the overvaluing owners. Furthermore, most of the other explanatory variables and interaction terms have varying effects across the sub-samples. Within each valuation sub-sample, the estimate for homeowners who own their homes through a mortgage is larger than the estimate for outright owners. Indeed the estimate of *change in house price index* for undervaluing mortgage holders is almost twice that for overvaluing mortgage holders, which is consistent with the interaction term for the variables, *overvalue*, *under mortgage* and *change in house price index* in Table 4.6. Regarding the use of the funds raised from mortgage refinancing, I find that for undervaluing homeowners the estimate for the variable *home investment* is about double the estimate for overvaluing homeowners.

Table 4.7 Estimates using sub-samples of both home valuation relative to house price index and housing tenure

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables as described in Table 4.1are log of house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Robust standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variables	Undervalue relative to house price index			Overvalue relative to house price index		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
Change in house price index	0.189***	0.183***	0.318***	0.148***	0.138***	0.175***
	(0.017)	(0.019)	(0.016)	(0.014)	(0.014)	(0.013)
Extra loan – Home investment	0.068***		0.069***	0.034***		0.033***
	(0.010)		(0.010)	(0.006)		(0.006)
Home investment * Δ House price index	-0.057		-0.063	-0.007		-0.006
	(0.047)		(0.047)	(0.043)		(0.043)
Home investment * Financial expectations * Δ House price index	-0.077		-0.078	-0.163***		-0.155***
	(0.070)		(0.072)	(0.055)		(0.055)
Extra Loan – Other consumption	0.038***		0.039***	-0.017**		-0.013
	(0.010)		(0.010)	(0.008)		(0.008)
Other consumption * Δ House price index	-0.044		-0.052	-0.054		-0.051
	(0.059)		(0.063)	(0.047)		(0.047)
Other consumption * Financial expectations * Δ House price index	-0.169**		-0.155**	-0.100		-0.091
	(0.074)		(0.078)	(0.064)		(0.064)
Home investment * Other consumption	-0.052***		-0.058***	-0.001		-0.001
	(0.018)		(0.018)	(0.014)		(0.014)
Under Mortgage	-0.014**			0.003		
	(0.006)			(0.005)		
Under mortgage * Δ House price index	0.121***			0.036**		
	(0.022)			(0.016)		
Financial expectations	-0.004	-0.008	-0.004	0.001	0.006	0.004
	(0.004)	(0.011)	(0.005)	(0.003)	(0.007)	(0.003)
Financial expectations * Δ House price index	0.082***	0.148**	0.074***	0.077***	0.022	0.069***
	(0.024)	(0.063)	(0.026)	(0.019)	(0.041)	(0.020)
Number or rooms	0.054***	-0.007	0.065***	0.087***	0.069***	0.084***
	(0.012)	(0.025)	(0.013)	(0.010)	(0.021)	(0.010)
Likes present neighbourhood	0.007	0.004	0.006	0.003	-0.010	0.007
	(0.007)	(0.013)	(0.009)	(0.008)	(0.021)	(0.008)
Prefers to Move	-0.003	0.012	-0.009**	-0.015***	0.003	-0.022***
	(0.004)	(0.007)	(0.004)	(0.003)	(0.006)	(0.004)

Table 4.7 Continued

Independent variables	Undervalue relative to house price index			Overvalue relative to house price index		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
Detached	0.077***	-0.003	0.052***	0.065***	0.039	0.065***
	(0.016)	(0.038)	(0.018)	(0.016)	(0.040)	(0.016)
Semi-detached	0.064***	0.009	0.053***	0.029*	0.038	0.026*
	(0.016)	(0.040)	(0.017)	(0.015)	(0.038)	(0.015)
Terraced	0.025*	-0.002	-0.004	-0.006	-0.016	0.005
	(0.014)	(0.033)	(0.015)	(0.017)	(0.044)	(0.017)
Log of Income	0.000	-0.001	0.000	0.004*	0.002	0.006**
	(0.002)	(0.004)	(0.003)	(0.002)	(0.005)	(0.002)
Age square	-0.000	0.000	-0.000***	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.006	0.007	-0.015***	-0.017***	-0.039**	-0.020***
	(0.006)	(0.021)	(0.006)	(0.005)	(0.019)	(0.005)
Married	0.020***	-0.002	0.026***	0.004	0.004	0.010
	(0.007)	(0.013)	(0.008)	(0.006)	(0.011)	(0.008)
Employed	0.001	0.014	-0.003	-0.005	-0.014*	-0.003
	(0.005)	(0.010)	(0.006)	(0.004)	(0.008)	(0.005)
First degree & above	0.008	0.031	0.012	0.045***	0.094**	0.043***
	(0.017)	(0.061)	(0.019)	(0.013)	(0.038)	(0.014)
Region dummies						
North East	-0.126	0.379	0.012	-0.157**	-0.147	0.068
	(0.103)	(0.241)	(0.107)	(0.075)	(0.168)	(0.068)
North West	-0.105	0.277	0.076	-0.103*	0.017	0.074
	(0.088)	(0.351)	(0.072)	(0.059)	(0.082)	(0.061)
Yorkshire & Humber	-0.057	0.380*	0.114	-0.059	0.153	0.108
	(0.087)	(0.227)	(0.095)	(0.064)	(0.093)	(0.067)
East Midlands	0.059	0.311*	0.302***	-0.178***	-0.096	-0.004
	(0.086)	(0.178)	(0.085)	(0.061)	(0.102)	(0.067)
West Midlands	0.135	0.735***	0.226***	-0.166***	0.035	-0.017
	(0.089)	(0.270)	(0.086)	(0.058)	(0.043)	(0.061)
East of England	-0.093	0.220***	0.298	-0.075	0.025	0.086
	(0.153)	(0.010)	(0.196)	(0.056)	(0.076)	(0.061)
London	0.331***	1.099***	0.304***	-0.006	0.107	0.173***
	(0.087)	(0.340)	(0.078)	(0.062)	(0.088)	(0.064)
South East	0.166**	0.531**	0.311***	-0.054	0.074	0.105*
	(0.081)	(0.251)	(0.080)	(0.056)	(0.074)	(0.062)

Table 4.7 Continued

Independent variables	Undervalue relative to house price index			Overvalue relative to house price index		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
South West	0.170**	0.648***	0.348***	-0.129**	0.070	-0.016
	(0.081)	(0.244)	(0.092)	(0.056)	(0.079)	(0.060)
Wales	0.046	0.630**	0.246**	-0.131**	0.481***	0.039
	(0.101)	(0.245)	(0.106)	(0.059)	(0.173)	(0.061)
Time dummies						
1994	0.020	-0.003	-0.101***	-0.188***	0.134***	0.169***
	(0.019)	(0.045)	(0.031)	(0.017)	(0.044)	(0.026)
1995	0.008	0.014	-0.095***	-0.014*	0.136***	0.146***
	(0.008)	(0.043)	(0.029)	(0.007)	(0.040)	(0.024)
1996	0.033***	0.040	-0.065**	-0.005	0.156***	0.154***
	(0.008)	(0.040)	(0.027)	(0.007)	(0.037)	(0.023)
1997	0.047***	0.052	-0.043*	0.002	0.144***	0.175***
	(0.008)	(0.037)	(0.025)	(0.007)	(0.034)	(0.021)
1998	0.049***	0.049	-0.032	0.012	0.164***	0.184***
	(0.008)	(0.034)	(0.023)	(0.008)	(0.031)	(0.019)
1999	0.070***	0.080**	-0.013	0.020**	0.183***	0.191***
	(0.009)	(0.031)	(0.020)	(0.009)	(0.029)	(0.018)
2000	0.076***	0.082***	0.004	0.052***	0.214***	0.223***
	(0.010)	(0.029)	(0.019)	(0.009)	(0.026)	(0.016)
2001	0.082***	0.080***	0.015	0.018*	0.193***	0.190***
	(0.011)	(0.025)	(0.016)	(0.010)	(0.022)	(0.014)
2002	0.149***	0.146***	0.085***	0.103***	0.271***	0.281***
	(0.012)	(0.024)	(0.015)	(0.011)	(0.020)	(0.013)
2003	0.171***	0.168***	0.111***	0.058***	0.231***	0.238***
	(0.013)	(0.020)	(0.014)	(0.013)	(0.017)	(0.011)
2004	0.184***	0.171***	0.134***	0.047***	0.221***	0.231***
	(0.014)	(0.019)	(0.013)	(0.014)	(0.016)	(0.010)
2005	0.136***	0.147***	0.077***	-0.042***	0.145***	0.136***
	(0.016)	(0.015)	(0.010)	(0.014)	(0.012)	(0.008)
2006	0.104***	0.101***	0.057***	-0.053***	0.137***	0.129***
	(0.017)	(0.013)	(0.009)	(0.015)	(0.010)	(0.007)
2007	0.110***	0.104***	0.070***	-0.055***	0.140***	0.125***
	(0.018)	(0.011)	(0.008)	(0.017)	(0.009)	(0.007)
Constant	-0.236***	-0.525**	-0.185**	-0.171***	-0.445***	-0.395***
	(0.067)	(0.218)	(0.082)	(0.060)	(0.146)	(0.082)
Adjusted r^2	0.148	0.095	0.182	0.121	0.087	0.135
Observations	44054	16540	27514	61067	22233	38834

The estimate for the variable *other consumption* is significant and positive among undervaluing homeowners and negative for the full sample of overvaluing homeowners.

Further, the results for the other explanatory variables are mixed but consistent between the two groups. Notably, the coefficient estimate for the variable *first degree and above* is highly significant among overvaluing households. As for the interaction terms, the results also vary across sub-samples. The interaction term for *change in house price index*, *financial expectations* and *home investment* is insignificant among undervaluing homeowners and is negative and significant among overvaluing homeowners. In contrast, the interaction term for *change in house price index*, *financial expectations* and *other consumption* is negative and significant among undervaluing homeowners but is insignificant among overvaluing homeowners.

The interaction term between *home investment* and *other consumption* is negative and significant among undervaluing homeowners but is insignificant among overvaluing homeowners, which is also consistent with the findings in Table 4.6. In sum, these results indicate that the dummy variable overvalue captures a lot of variations in homeowners characteristics and differentiates the influence of mortgage refinancing on changes in self-reported home house values.

Second, as implied by the consistent pattern in regional dummies in which I find significant effects for London, the East of England and the South East and insignificant effects in other regions, it appears that anchoring bias varies across regions. For example, homeowners living in London, the East of England and the South East may be able to determine the true market value of their homes because the two regions have both a vibrant property market and a higher concentration of market information. This implies that homeowners in such regions are able to sufficiently adjust their price estimates for new information and are thus less reliant on house price information and have lower anchoring bias.

To explore this idea, I split the sample into two: *the rest of the UK*; and *London, the East of England,* and *the South East*. Here, I examine whether the relationship between changes in self-reported house values and changes in the house price index in *the rest of the UK* is stronger than in *London, the East of England,* and *the South East*. The results reported in Table 4.8 are consistent with this conjecture.

With regard to the use of the funds raised from mortgage refinancing, the results for both home investment and other consumption and their respective interaction terms are consistent with the results in Table 4.5 and Table 4.6 for the rest of the UK sub-sample. However, for the *London, the East of England and the South East* sub-sample, none of the mortgage refinancing variables is significant apart from home investment, which has a low magnitude. Furthermore, the effects of financial expectations and its interaction with the change in the house price index are both insignificant while the year effects are high for mortgage holders and for the full sample among homeowners in *London, the East of England* and *the South East*.

Table 4.8 Estimates using sub-samples of both regional and housing tenure

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of self-reported house value. The independent variables as described in Table 1 are log of house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Robust standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	Rest of the United Kingdom			London, South East & East of England		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
Change in house price index	0.185*** (0.018)	0.201*** (0.021)	0.289*** (0.016)	0.144*** (0.031)	0.163*** (0.035)	0.261*** (0.022)
Extra loan – Home investment	0.082*** (0.008)		0.079*** (0.009)	0.066*** (0.022)		0.062*** (0.023)
Home investment * Δ House price index	-0.057 (0.040)		-0.057 (0.040)	-0.019 (0.049)		-0.019 (0.051)
Home investment * Financial expectations * Δ House price index	-0.103** (0.052)		-0.094* (0.052)	-0.123* (0.066)		-0.112* (0.067)
Extra Loan – Other consumption	0.061*** (0.010)		0.058*** (0.010)	0.012 (0.018)		0.008 (0.018)
Other consumption * Δ House price index	-0.011 (0.044)		-0.003 (0.045)	-0.049 (0.060)		-0.051 (0.061)
Other consumption * Financial expectations * Δ House price index	-0.241*** (0.063)		-0.235*** (0.064)	-0.017 (0.079)		0.003 (0.079)
Home investment * Other consumption	-0.164*** (0.047)		-0.168*** (0.048)	-0.005 (0.034)		-0.005 (0.034)
Home investment * Overvalue	-0.047*** (0.010)		-0.044*** (0.010)	-0.048** (0.023)		-0.045* (0.024)
Other consumption * Overvalue	-0.069*** (0.012)		-0.062*** (0.012)	-0.058*** (0.021)		-0.052** (0.021)
Home investment * Other consumption * Overvalue	0.155*** (0.049)		0.159*** (0.050)	-0.009 (0.041)		-0.016 (0.041)
Under Mortgage	0.003 (0.005)			-0.010 (0.007)		
Under mortgage * Δ House price index	0.111*** (0.021)			0.124*** (0.034)		
Overvalue * Under mortgage * Δ House price index	-0.080*** (0.028)			-0.084** (0.039)		

Table 4.8 Continued

Independent variable	Rest of the United Kingdom			London, South East & East of England		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
Financial expectations	-0.015***	-0.017	-0.014***	-0.004	0.002	-0.007
	(0.004)	(0.011)	(0.005)	(0.010)	(0.025)	(0.011)
Financial expectations * Δ House price index	0.093***	0.071*	0.085***	0.040*	0.079	0.025
	(0.018)	(0.041)	(0.019)	(0.024)	(0.058)	(0.025)
Overvalue	0.202***	0.218***	0.193***	0.233***	0.284***	0.206***
	(0.006)	(0.010)	(0.007)	(0.013)	(0.026)	(0.015)
Overvalue * Δ House price index	-0.007	-0.029	-0.086***	-0.044	-0.086**	-0.121***
	(0.023)	(0.022)	(0.017)	(0.035)	(0.036)	(0.024)
Overvalue * Financial expectations	0.019***	0.033***	0.019***	0.006	0.001	0.014
	(0.005)	(0.013)	(0.006)	(0.011)	(0.027)	(0.012)
Number or rooms	0.061***	0.052***	0.062***	0.075***	0.075**	0.076***
	(0.008)	(0.017)	(0.009)	(0.013)	(0.031)	(0.013)
Likes present neighbourhood	0.004	-0.018	0.008	-0.002	-0.003	-0.004
	(0.006)	(0.015)	(0.007)	(0.010)	(0.022)	(0.011)
Prefers to Move	-0.014***	-0.003	-0.019***	0.002	0.015	-0.005
	(0.003)	(0.005)	(0.003)	(0.005)	(0.010)	(0.006)
Detached	0.083***	0.036	0.077***	0.093***	0.100***	0.079***
	(0.012)	(0.030)	(0.012)	(0.016)	(0.034)	(0.017)
Semi-detached	0.035***	0.011	0.028**	0.018	0.027	0.021
	(0.011)	(0.028)	(0.011)	(0.015)	(0.032)	(0.015)
Terraced	0.037***	0.017	0.029***	0.044***	0.070**	0.037**
	(0.011)	(0.030)	(0.011)	(0.014)	(0.033)	(0.015)
Log of Income	0.003	0.003	0.002	0.001	-0.003	0.004
	(0.002)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)
Age square	0.000***	0.000***	-0.000	0.000	0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.008**	-0.038**	-0.014***	-0.011**	-0.005	-0.019***
	(0.004)	(0.018)	(0.004)	(0.006)	(0.018)	(0.007)
Married	0.006	-0.001	0.008	0.013*	-0.006	0.018*
	(0.005)	(0.010)	(0.006)	(0.008)	(0.015)	(0.010)
Employed	-0.002	0.001	-0.006	-0.001	-0.002	-0.004
	(0.004)	(0.007)	(0.004)	(0.006)	(0.011)	(0.007)
First degree & above	0.009	0.097**	0.006	0.041*	0.049	0.032
	(0.012)	(0.039)	(0.012)	(0.021)	(0.067)	(0.021)

Table 4.8 Continued

Independent variable	Rest of the United Kingdom			London, South East & East of England		
	Full sample	Outright owners	Mortgage holders	Full sample	Outright owners	Mortgage holders
	(1)	(2)	(3)	(4)	(5)	(6)
Time dummies						
1995	-0.017**	0.100***	-0.022**	0.122***	0.025	0.004
	(0.008)	(0.032)	(0.010)	(0.021)	(0.023)	(0.013)
1996	-0.014**	0.109***	-0.014*	0.165***	0.075***	0.048***
	(0.006)	(0.030)	(0.008)	(0.019)	(0.019)	(0.011)
1997	-0.014**	0.101***	-0.005	0.199***	0.083***	0.099***
	(0.006)	(0.027)	(0.009)	(0.018)	(0.019)	(0.012)
1998	0.000	0.123***	0.010	0.195***	0.073***	0.104***
	(0.007)	(0.025)	(0.009)	(0.017)	(0.022)	(0.013)
1999	0.010	0.126***	0.027***	0.218***	0.132***	0.117***
	(0.008)	(0.023)	(0.010)	(0.015)	(0.024)	(0.015)
2000	0.023***	0.154***	0.039***	0.260***	0.152***	0.173***
	(0.008)	(0.021)	(0.011)	(0.014)	(0.028)	(0.018)
2001	0.014*	0.146***	0.036***	0.214***	0.102***	0.134***
	(0.009)	(0.018)	(0.012)	(0.013)	(0.029)	(0.020)
2002	0.092***	0.218***	0.122***	0.289***	0.180***	0.212***
	(0.009)	(0.017)	(0.014)	(0.013)	(0.033)	(0.022)
2003	0.096***	0.233***	0.121***	0.192***	0.058	0.139***
	(0.010)	(0.014)	(0.015)	(0.012)	(0.036)	(0.025)
2004	0.100***	0.227***	0.136***	0.166***	0.052	0.103***
	(0.011)	(0.013)	(0.017)	(0.012)	(0.041)	(0.027)
2005	0.013	0.164***	0.041**	0.116***	0.021	0.051*
	(0.012)	(0.010)	(0.018)	(0.011)	(0.043)	(0.029)
2006	-0.021*	0.115***	0.021	0.129***	0.027	0.073**
	(0.012)	(0.009)	(0.019)	(0.009)	(0.045)	(0.030)
2007	-0.025*	0.111***	0.022	0.163***	0.073	0.103***
	(0.013)	(0.008)	(0.020)	(0.009)	(0.048)	(0.033)
2008	-0.134***	-0.101***	-0.084***	-0.116***	-0.105**	-0.039
	(0.014)	(0.035)	(0.021)	(0.022)	(0.050)	(0.035)
Constant	-0.372***	-0.598***	-0.246***	-0.523***	-0.422***	-0.283***
	(0.040)	(0.137)	(0.053)	(0.064)	(0.113)	(0.052)
Adjusted r^2	0.167	0.128	0.185	0.140	0.114	0.151
Observations	78027	28902	49125	27094	9871	17223

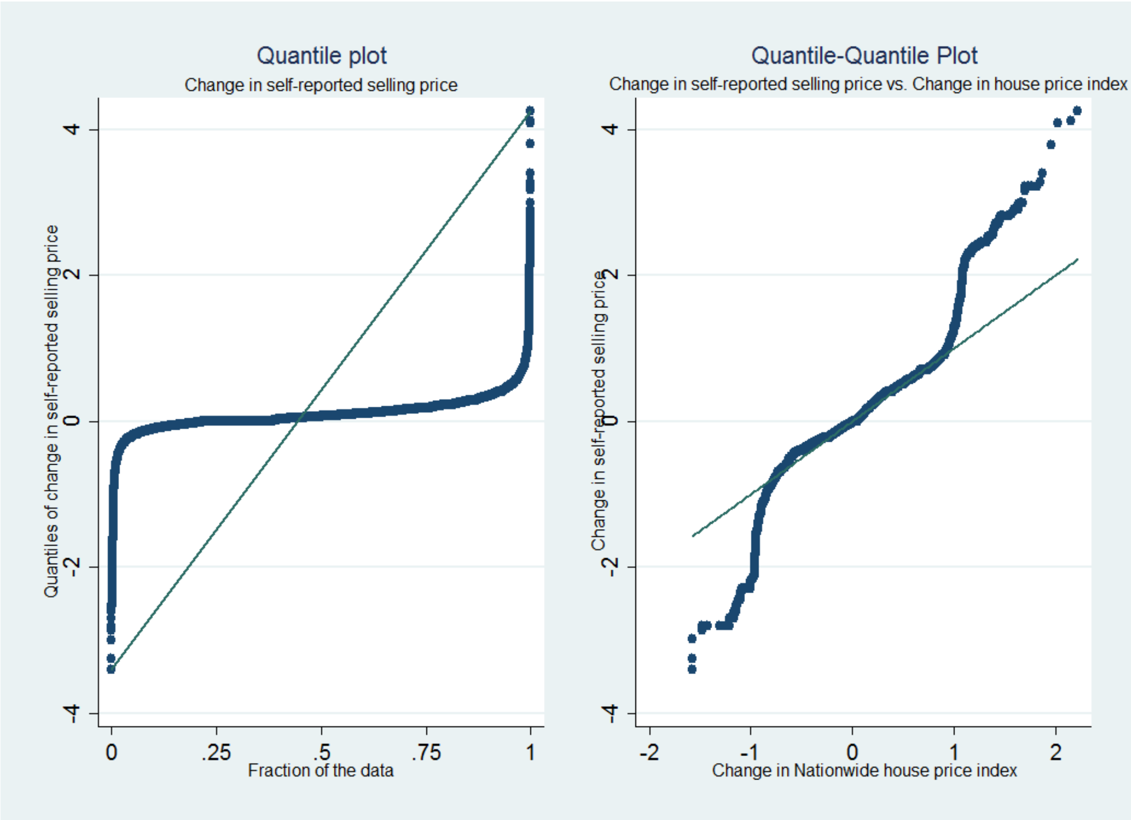
4.5.5 Quantile regression estimates

From the summary statistics discussed earlier it is evident that self-reported house values are widely distributed with a mean of £ 139,000 and a median of £ 100,000 while the minimum and maximum values are £ 10,000 and £ 7.5 million respectively. This distribution could imply that our estimates are biased by the presence of outliers and/or that there are heterogeneous relationships among our variables. Figure 4.5 demonstrates the plausibility of our concern. Graph A plots the ordered values of change in self-reported house values against the quantiles of a uniform distribution of the variable. From this graph, the distribution of change in self-reported house values is further from the reference line as you move downwards and upwards from the median. Graph B plots the quantiles of change in self-reported house values against the quantiles of change in house price index. The relationship between change in self-reported house values and change in house price index is not linear below the 10th quantile and above the 75th quantile. As suggested in the literature (see for example Buchinsky, 1998; Koenker and Hallock, 2001), I test whether the coefficient estimates for change in house price index varies across quantiles by conditioning the regressions on the 10th, 25th, 50th, 75th and 95th quantiles. The results are reported in Table 4.9 and are based on the specifications in Column (7) of Table 4.6.

The results for our key independent variable *change in house price index*, increases from the 10th quantile regression (0.106) through to the 95th quantile regression (0.286) apart from the 25th quantile regression where it drops to 0.056 and thereafter increases. The variable *home investment* is positive and significant across all the quantile regressions while *other consumption* is only significant at the median quantile regression and below.

Figure 4.5 Quantile distribution plots

This figure plots quantiles of self-reported house value in Graph A, and the quantiles on quantiles of self-reported house value against house price index during 1993-2008. The straight line is the reference line The self-reported house values are from the BHSP and house price index is from the Nationwide house price index series.



The interaction term between *home investment* and *change in house price index* is negative and significant at the median and 95th quanitle regressions; the interaction of the two variables with *financial expectation* is significant for the median and 75th quantile regressions. This contrasts with the interaction term between *other consumption* and *change in house price index*, which is barely significant at the 10% level for the 25th and 75th quantile regressions while the interaction term that includes *financial expectations* is negative and significant in all quantiles apart from the 75th quantile regression.

Table 4.9 Quantile regressions estimates

Table presents quantile regression estimates at the 10th, 25th, 50th, 75th and 95th quantiles. The dependent variable is log of change in self-reported house value. The independent variables as described in Table 4.1are log of change in regional house price; a set of property attributes; a set of individual characteristics (some not shown); region dummies and time dummies (not shown). Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

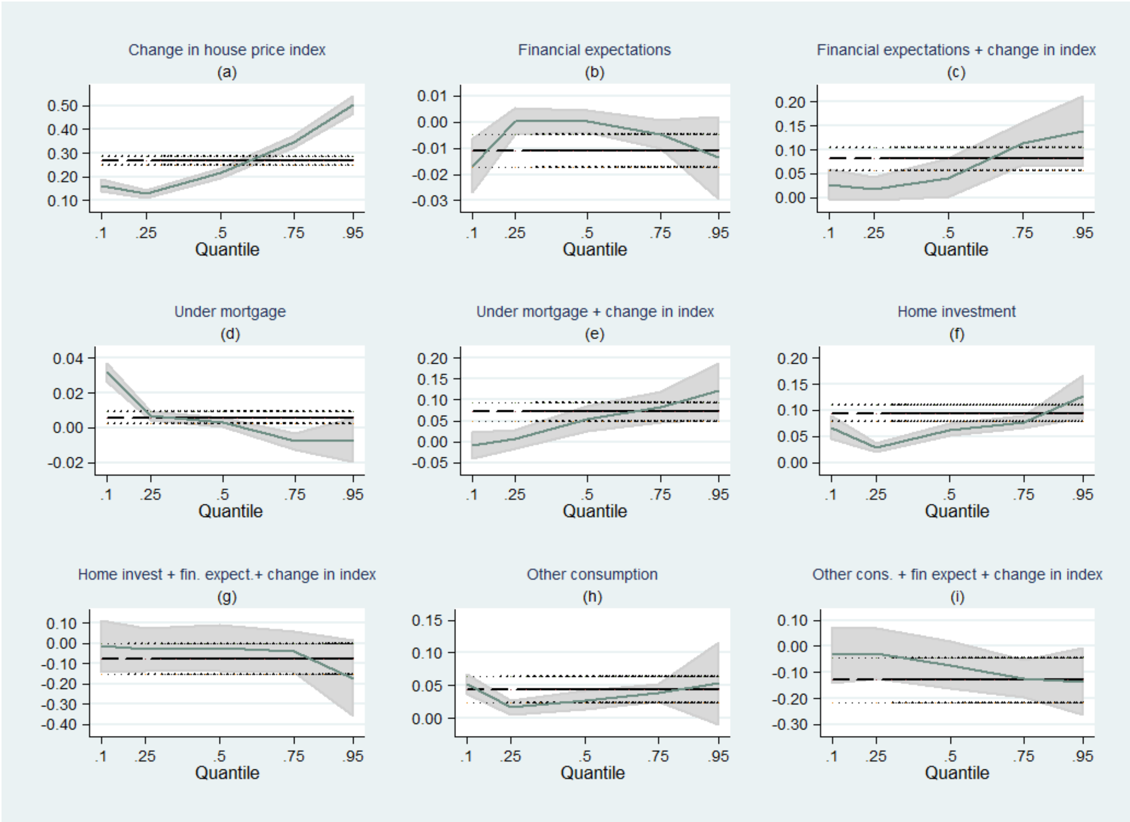
Independent variable	10th Quantile	25th Quantile	Median	75th Quantile	95th Quantile
	(1)	(2)	(3)	(4)	(5)
Change in house price index	0.106***	0.056***	0.070***	0.130***	0.286***
	(0.008)	(0.004)	(0.005)	(0.007)	(0.020)
Extra loan – Home investment	0.056***	0.030***	0.033***	0.060***	0.094***
	(0.007)	(0.004)	(0.004)	(0.006)	(0.017)
Home investment * Δ House price index	-0.021	0.018*	0.058***	-0.025	-0.104**
	(0.020)	(0.011)	(0.012)	(0.017)	(0.050)
Home investment * Financial expectations * Δ House price index	-0.017	-0.022	-0.069***	-0.056**	-0.060
	(0.031)	(0.017)	(0.019)	(0.026)	(0.078)
Extra Loan – Other consumption	0.028***	0.013***	0.013**	0.003	0.029
	(0.008)	(0.005)	(0.005)	(0.007)	(0.021)
Other consumption * Δ House price index	-0.013	0.026*	0.004	-0.040*	-0.010
	(0.025)	(0.014)	(0.015)	(0.021)	(0.062)
Other consumption * Financial expectations * Δ House price index	-0.118***	-0.053***	-0.049**	-0.034	-0.268***
	(0.036)	(0.020)	(0.022)	(0.030)	(0.090)
Home investment * Other consumption	-0.037**	-0.027***	-0.036***	-0.029*	-0.070
	(0.018)	(0.010)	(0.011)	(0.015)	(0.046)
Financial expectations	-0.016***	-0.004***	-0.004***	-0.008***	-0.031***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.007)
Financial expectations * Δ House price index	0.026***	0.036***	0.063***	0.111***	0.187***
	(0.010)	(0.006)	(0.006)	(0.009)	(0.025)
Under Mortgage	0.021***	0.006***	-0.000	-0.011***	-0.015***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.005)
Under mortgage * Δ House price index	0.008	0.015***	0.046***	0.093***	0.173***
	(0.009)	(0.005)	(0.006)	(0.008)	(0.023)
Under mortgage * Financial expectations * Δ House price index	-0.024**	-0.015**	-0.044***	-0.084***	-0.131***
	(0.011)	(0.006)	(0.007)	(0.010)	(0.029)
Home investment * Overvalue	-0.029***	0.003	0.013***	-0.018***	-0.115***
	(0.008)	(0.004)	(0.005)	(0.007)	(0.020)
Other consumption * Overvalue	-0.035***	-0.013**	-0.014**	-0.014*	-0.092***
	(0.010)	(0.006)	(0.006)	(0.008)	(0.025)
Overvalue	0.063***	0.032***	0.042***	0.061***	0.141***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.005)
Overvalue * Δ House price	-0.006	0.002	-0.002	-0.039***	-0.074***
	(0.010)	(0.005)	(0.006)	(0.008)	(0.025)
Financial expectations * Overvalue	0.011***	0.003*	0.006***	0.016***	0.079***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.008)
Financial expectations * Overvalue * Δ House price index	0.029**	-0.002	-0.028***	-0.067***	-0.106***
	(0.013)	(0.007)	(0.008)	(0.011)	(0.032)
Number or rooms	-0.022***	-0.012***	-0.005***	-0.001	0.053***
	(0.003)	(0.001)	(0.002)	(0.002)	(0.006)
Likes present neighbourhood	0.011***	0.006***	-0.001	-0.008***	-0.023***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.008)
Prefers to Move	0.010***	0.001	-0.003***	-0.010***	-0.046***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
Detached	0.046***	0.015***	0.009***	0.002	-0.031***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.008)
Semi-detached	0.042***	0.011***	-0.001	-0.013***	-0.063***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.007)
Terraced	0.053***	0.020***	0.016***	0.012***	-0.022***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.007)
Log of Income	-0.001	0.000	0.000	0.001	0.006***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.002)
Age square	-0.000***	-0.000**	-0.000	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sex	0.001	0.000	0.000	-0.000	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Cohort	-0.000*	0.000	0.000	0.001***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)

Table 4.9 Continued

Independent variable	10th Quantile (1)	25th Quantile (2)	Median (3)	75th Quantile (4)	95th Quantile (5)
Has Children	0.007***	0.002**	0.002	0.006***	-0.005
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
Married	0.017***	0.006***	0.001	-0.006***	-0.025***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
Employed	0.005***	0.002**	0.001	-0.004***	-0.016***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)
First degree & above	-0.010***	-0.002**	-0.003**	-0.004***	0.020***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.005)
Region dummies (Base=North East)					
North West	0.005	0.005**	0.008***	0.012***	-0.004
	(0.004)	(0.002)	(0.002)	(0.003)	(0.010)
Yorkshire & Humber	0.007*	0.007***	0.010***	0.018***	0.001
	(0.004)	(0.002)	(0.003)	(0.004)	(0.010)
East Midlands	0.009**	0.008***	0.009***	0.017***	-0.022**
	(0.004)	(0.002)	(0.003)	(0.004)	(0.011)
West Midlands	0.007*	0.010***	0.011***	0.014***	-0.031***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.010)
East of England	0.003	0.008***	0.015***	0.020***	-0.023**
	(0.004)	(0.002)	(0.003)	(0.003)	(0.010)
London	0.016***	0.021***	0.034***	0.056***	0.052***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.011)
South East	0.015***	0.016***	0.023***	0.036***	0.013
	(0.004)	(0.002)	(0.002)	(0.003)	(0.010)
South West	0.009**	0.013***	0.018***	0.024***	-0.008
	(0.004)	(0.002)	(0.003)	(0.003)	(0.010)
Wales	0.004	0.007***	0.016***	0.030***	0.012
	(0.004)	(0.002)	(0.002)	(0.003)	(0.010)
Scotland	0.010***	0.007***	0.013***	0.027***	0.036***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.010)
Time dummies					
1994	0.038***	0.061***	0.043***	0.047***	0.119***
	(0.005)	(0.003)	(0.003)	(0.004)	(0.013)
1995	0.042***	0.052***	0.031***	0.030***	0.126***
	(0.005)	(0.003)	(0.003)	(0.004)	(0.012)
1996	0.087***	0.095***	0.056***	0.048***	0.113***
	(0.005)	(0.003)	(0.003)	(0.004)	(0.012)
1997	0.106***	0.106***	0.073***	0.077***	0.109***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.011)
1998	0.108***	0.108***	0.073***	0.079***	0.112***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.011)
1999	0.130***	0.121***	0.096***	0.106***	0.148***
	(0.004)	(0.002)	(0.003)	(0.004)	(0.011)
2000	0.139***	0.129***	0.116***	0.142***	0.186***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.010)
2001	0.133***	0.126***	0.104***	0.117***	0.155***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.009)
2002	0.184***	0.182***	0.201***	0.236***	0.275***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.009)
2003	0.160***	0.164***	0.186***	0.228***	0.286***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.009)
2004	0.156***	0.166***	0.188***	0.245***	0.326***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.009)
2005	0.104***	0.110***	0.095***	0.128***	0.216***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.009)
2006	0.124***	0.115***	0.094***	0.103***	0.145***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.009)
2007	0.128***	0.120***	0.101***	0.114***	0.129***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.009)
2008	0.484	-0.181	-0.371	-1.930***	-12.529***
	(0.448)	(0.248)	(0.279)	(0.379)	(1.128)
Adjusted r^2					
Observations	105111	105111	105111	105111	105111

Figure 4.6 Quantile plots of key variables

The coloured solid line plots the coefficient estimates in Table 4.9 across the 10th, 25th, 50th, 75th and 95th quantiles for the variables change in house price index, financial expectations, under mortgage, home investment, other consumption and their interaction terms. The shaded area represents 95% confidence bands. The parallel lines represent coefficients from OLS regressions (solid line) and their corresponding 95% confidence bands (dotted lines).



In addition, the coefficient estimates for *financial expectations* (positive) and its interaction with change in house price index (negative) are significant and their magnitudes increase across all quantile regressions. In general, the control variables have mixed results; the coefficient estimates are positive (negative) and increase (decrease) across quantiles.

Figure 4.6, maps the coefficients from the quantile regressions in Table 4.9 for the variables change in house price index, *financial expectations*, *under mortgage*, *home investment*, other consumption and their interaction terms. The coloured solid lines represent the quantile coefficients and the shaded area represents the 95% confidence bands. The parallel dark solid line lines represent the coefficients using OLS regressions and the dotted lines are the 95% confidence level bands. The graphs confirm our concern. For example, the coefficients for *change in house price index* are significant across quantiles and the line drops below the 25th quantile but steadily increases thereafter.

The influence of financial expectations is significant between the 25th and 75th quantiles while its interaction with changes in the house price index is significant and increases for quantiles below the 75th quantile. In sum, these results indicate that anchoring bias persists in the quantile regressions as well as in the linear regression model, though the latter model underestimates the effects of the independent variables.

4.5.6 Social Factors and anchoring

In the next stage of the empirical analysis, I investigate the influence of social factors. As observed earlier, the literature suggests that homeowners are more likely to be socially engaged compared to renters (DiPasquale and Glaeser, 1999). Considering that it could be through such activities that homeowners learn, discuss and exchange opinions about house market trends, I would expect to see varying effects on anchoring depending on the channel of engagement. These are important social factors that may influence anchoring, as observed by Epley and Gilovich (2010). In Table 4.10 I interact the variables *religious, trusting*, *tenancy group member* and *computer use* with changes in the house price index using the final specifications in Column (7) of Table 4.6 for comparison.

Table 4.10 Anchoring and social moderators

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables include log of change in house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Additional independent variables include mortgage refinancing dummy; home improvement dummy; other consumption dummy; and interaction terms of these variables with change in regional house price. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1)	(2)	(3)	(4)	(5)
Change in house price index	0.214***	0.188***	0.197***	0.172***	0.197***
	(0.017)	(0.017)	(0.016)	(0.016)	(0.018)
Religious * Δ House price index	-0.039***				-0.037***
	(0.011)				(0.012)
Trusting * Δ House price index		0.009			0.010
		(0.012)			(0.012)
Tenancy group member * Δ House price index			-0.030*		-0.022
			(0.016)		(0.016)
Computer use				-0.001	-0.001
				(0.003)	(0.003)
Computer use * Δ House price index				0.059***	0.056***
				(0.012)	(0.012)
Extra loan – Home investment	0.081***	0.081***	0.081***	0.081***	0.081***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Home investment * Δ House price index	-0.047	-0.045	-0.045	-0.045	-0.046
	(0.031)	(0.032)	(0.031)	(0.031)	(0.031)
Home investment * Financial expectations * Δ House price index	-0.104**	-0.109***	-0.106***	-0.106***	-0.106***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Extra Loan – Other consumption	0.046***	0.047***	0.046***	0.046***	0.047***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Other consumption * Δ House price index	-0.041	-0.042	-0.036	-0.045	-0.053
	(0.036)	(0.036)	(0.036)	(0.035)	(0.035)
Other consumption * Financial expectations * Δ House price index	-0.139***	-0.139***	-0.142***	-0.141***	-0.134***
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Home investment * Other consumption	-0.115***	-0.115***	-0.115***	-0.113***	-0.114***
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Home investment * overvalue	-0.049***	-0.048***	-0.049***	-0.048***	-0.048***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Other consumption * overvalue	-0.068***	-0.069***	-0.068***	-0.067***	-0.067***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Home investment * other consumption * overvalue	0.112***	0.112***	0.111***	0.109***	0.110***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Financial expectations	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Financial expectations * Δ House price index	0.073***	0.075***	0.074***	0.071***	0.069***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Under Mortgage	0.001	0.000	0.001	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Under mortgage * Δ House price index	0.105***	0.108***	0.108***	0.094***	0.085***
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
Overvalue	0.211***	0.210***	0.211***	0.211***	0.210***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Δ House price index	-0.025	-0.031	-0.026	-0.035*	-0.035*
	(0.019)	(0.020)	(0.019)	(0.019)	(0.020)
Overvalue * Financial expectations	0.015***	0.016***	0.015***	0.015***	0.016***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Under mortgage * Δ House price index	-0.078***	-0.075***	-0.079***	-0.074***	-0.070***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Number or rooms	0.066***	0.066***	0.065***	0.066***	0.065***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.003	0.003	0.003	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Prefers to Move	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Detached	0.087***	0.086***	0.087***	0.084***	0.084***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Semi-detached	0.033***	0.033***	0.033***	0.032***	0.033***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)

Table 4.10 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)
Terraced	0.038***	0.038***	0.038***	0.037***	0.037***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.002	0.003	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.011***	-0.011***	-0.010***	-0.010***	-0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.010**	0.010**	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.020**	0.019*	0.020**	0.020**	0.019*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Region dummies (Base=North East)					
North West	0.045	0.046	0.046	0.047	0.047
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
Yorkshire & Humber	0.071*	0.072*	0.071*	0.073*	0.073*
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
East Midlands	0.037	0.037	0.036	0.039	0.039
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
West Midlands	0.041	0.041	0.041	0.041	0.041
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
East of England	0.120***	0.121***	0.120***	0.120***	0.120***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
London	0.234***	0.233***	0.234***	0.231***	0.231***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
South East	0.140***	0.141***	0.141***	0.140***	0.140***
	(0.037)	(0.037)	(0.036)	(0.036)	(0.036)
South West	0.060	0.060	0.059	0.060	0.060
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Wales	0.030	0.031	0.030	0.031	0.031
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Scotland	0.084**	0.083**	0.084**	0.085**	0.085**
	(0.042)	(0.042)	(0.041)	(0.041)	(0.042)
Time dummies					
1995	-0.005	-0.006	-0.006	-0.006	-0.007
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
1996	0.010**	0.011**	0.010**	0.010**	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1997	0.020***	0.019***	0.019***	0.020***	0.020***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1998	0.027***	0.027***	0.027***	0.027***	0.027***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
1999	0.042***	0.042***	0.042***	0.042***	0.042***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2000	0.056***	0.056***	0.056***	0.056***	0.056***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)
2001	0.039***	0.039***	0.039***	0.039***	0.038***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
2002	0.115***	0.115***	0.115***	0.114***	0.113***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2003	0.099***	0.098***	0.099***	0.097***	0.097***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2004	0.095***	0.095***	0.095***	0.094***	0.093***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2005	0.018*	0.018*	0.018*	0.018*	0.018*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2006	-0.006	-0.007	-0.007	-0.008	-0.008
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
2007	-0.003	-0.003	-0.002	-0.003	-0.004
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
2008	-0.120***	-0.120***	-0.120***	-0.118***	-0.118***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Constant	-0.456***	-0.455***	-0.455***	-0.454***	-0.454***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Adjusted r^2	0.153	0.153	0.153	0.153	0.154
Observations	104783	103630	105101	105099	103486

Overall, the results show that the variables *computer use* and *religious* influence anchoring and are not directly correlated with changes in self-reported housing wealth. The coefficient estimate for the interaction between *religious* and *change in house price index* is negative and highly significant. This finding suggests that through religious activities homeowners learn about local house prices and other market information and are thus less anchored. The variable *trusting* is insignificant while *tenancy group membership* is significant in the separate regressions in Columns (2) and (3) respectively; however both variables are insignificant in the combined regression in Column (5). An interesting finding is that *computer use* reduces the coefficient for the *change in house price index* and has no direct effect on the self-reported house value but has a positive effect through the *change in the house price index*. This implies that online information sources are biased towards house price indices. For example, most mortgage providers have online tools which enable homeowners to calculate an estimated value of their homes based on house price indices. However, homeowners are cautioned that they should consult professional assessors in order for them to get the true value of their homes.

4.6 Robustness checks

In this section, I check for the consistency of the results by re-estimating the results using two-way clustered standard errors, and by using the *regional* Halifax house price index and both the Nationwide and the Halifax *national* house price indices. In addition, I use GMM estimators to address possible endogeneity issues.

4.6.1 Estimates using two-way clustered standard errors

I begin by examining whether the results are robust when I use regional level one-way clustering and two-way clustering of standard errors. This is because individual level clustering and one-way clustered standard errors may bias my estimates downwards in two ways. First, the regional house price index is reported at regional level and by house type, which suggests that standard errors clustered at individual level ignore correlations among observations at regional level and by house type. However, the regional level clusters (eleven UK regions) or house types (four types) are less than the parameters estimated and are thereby insufficient to calculate a robust covariance matrix. To circumvent this problem and to allow observations in the same region or house type to be correlated, I generate a unique value for each pair of region-house types which provides 44 non-nested region-house type clusters. In addition, I generate a unique value for each pair of region-year to allow observations in the same region or year to be correlated.

Second, although regional level clusters account for within region clustering, it is also important to account for household-level clustering to allow for correlations in household observations over time. Following the literature (e.g. Acemoglu and Pischke, 2003; Cameron *et al.*, 2008; Cameron *et al.*, 2011), I use two-way clustered standard errors at household level and at both region-housetype and region-year clusters. Table 4.11 reports comparative results based on the final model in Table 4.6, Column (7) – replayed in Column (1) with the standard errors clustered at household level. In Column (2), the standard errors are calculated using household and region-house type clusters while household and region-year clusters are used in Column (3).[40]

[40] To implement this, I use the Stata command, *xtivreg2*, which provides for two-way clustering and supports simple fixed effects models (Schuffer, 2010).

Table 4.11 Estimates using two-way clustered standard errors

Table reports OLS fixed effects regressions based on the full model in Table 4.6 with one-way clustered standard errors (column (1)); two-way clustered standard errors at the individual level and at both region and house type level; and two-way clustered standard errors at the individual level and at both region and year level. The dependent variable is log of change in self-reported house value. The independent variables include log of change in house price; a set of property attributes; a set of individual characteristics (some not shown); and time dummies (not shown). Additional independent variables include mortgage refinancing dummy; home improvement dummy; other consumption dummy; and interaction terms of these variables with change in regional house price. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variables	(1) One-way clustering (individual level)	(2) Two-way clustering (individual and region-house type)	(3) Two-way clustering (individual and region-year)
Change in house price index	0.190***	0.190***	0.190***
	(0.016)	(0.023)	(0.022)
Extra loan – Home investment	0.081***	0.081***	0.081***
	(0.008)	(0.012)	(0.012)
Home investment * Δ House price index	-0.045	-0.045	-0.045
	(0.032)	(0.040)	(0.037)
Home investment * Financial expectations * Δ House price index	-0.106***	-0.106**	-0.106**
	(0.041)	(0.047)	(0.050)
Extra Loan – Other consumption	0.046***	0.046***	0.046***
	(0.009)	(0.011)	(0.012)
Other consumption * Δ House price index	-0.037	-0.037	-0.037
	(0.036)	(0.038)	(0.042)
Other consumption * Financial expectations * Δ House price index	-0.142***	-0.142***	-0.142**
	(0.050)	(0.055)	(0.056)
Home investment * Other consumption	-0.115***	-0.115**	-0.115**
	(0.032)	(0.054)	(0.049)
Home investment * overvalue	-0.049***	-0.049***	-0.049***
	(0.009)	(0.012)	(0.014)
Other consumption * overvalue	-0.068***	-0.068***	-0.068***
	(0.011)	(0.014)	(0.014)
Home investment * other consumption * overvalue	0.111***	0.111**	0.111**
	(0.035)	(0.055)	(0.052)
Financial expectations	-0.011***	-0.011**	-0.011***
	(0.004)	(0.005)	(0.004)
Financial expectations * Δ House price index	0.075***	0.075***	0.075***
	(0.014)	(0.017)	(0.016)
Under Mortgage	0.001	0.001	0.001
	(0.004)	(0.004)	(0.005)
Under mortgage * Δ House price index	0.111***	0.111***	0.111***
	(0.018)	(0.024)	(0.023)
Under mortgage * Overvalue * Δ House price index	-0.079***	-0.079***	-0.079***
	(0.023)	(0.030)	(0.029)
Overvalue	0.212***	0.212***	0.212***
	(0.005)	(0.011)	(0.008)
Overvalue * Δ House price index	-0.027	-0.027	-0.027
	(0.019)	(0.031)	(0.025)
Overvalue * Financial expectations	0.015***	0.015***	0.015***
	(0.005)	(0.005)	(0.005)
Number or rooms	0.066***	0.066***	0.066***
	(0.007)	(0.009)	(0.009)
Likes present neighbourhood	0.004	0.004	0.004
	(0.005)	(0.005)	(0.006)
Prefers to Move	-0.010***	-0.010***	-0.010***
	(0.002)	(0.003)	(0.003)
Detached	0.086***	0.086***	0.086***

Independent variables	(1) One-way clustering (individual level)	(2) Two-way clustering (individual and region-house type)	(3) Two-way clustering (individual and region-year)
	(0.010)	(0.016)	(0.013)
Semi-detached	0.033***	0.033***	0.033***
	(0.009)	(0.012)	(0.012)
Terraced	0.038***	0.038***	0.038***
	(0.009)	(0.012)	(0.012)
Log of Income	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)
Age	0.004	0.004	0.004
	(0.004)	(0.005)	(0.005)
Age square	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Has Children	-0.010***	-0.010**	-0.010***
	(0.003)	(0.004)	(0.004)
Married	0.010**	0.010*	0.010**
	(0.004)	(0.005)	(0.005)
Employed	-0.001	-0.001	-0.001
	(0.003)	(0.002)	(0.003)
First degree & above	0.020*	0.020	0.020**
	(0.010)	(0.013)	(0.008)
Region dummies (Base=North East)			
North West	0.046		0.046
	(0.033)		(0.038)
Yorkshire & Humber	0.071*		0.071
	(0.038)		(0.047)
East Midlands	0.037		0.037
	(0.039)		(0.044)
West Midlands	0.041		0.041
	(0.037)		(0.041)
East of England	0.120***		0.120***
	(0.038)		(0.044)
London	0.234***		0.234***
	(0.037)		(0.047)
South East	0.141***		0.141***
	(0.037)		(0.042)
South West	0.060		0.060
	(0.037)		(0.044)
Wales	0.030		0.030
	(0.037)		(0.042)
Scotland	0.084**		0.084*
	(0.042)		(0.047)
Time dummies			
1995	-0.009	-0.009	-0.009
	(0.007)	(0.014)	(0.013)
1996	0.003	0.003	0.003
	(0.009)	(0.017)	(0.016)
1997	0.008	0.008	0.008
	(0.012)	(0.020)	(0.021)
1998	0.012	0.012	0.012
	(0.016)	(0.023)	(0.024)
1999	0.023	0.023	0.023
	(0.020)	(0.029)	(0.030)
2000	0.034	0.034	0.034
	(0.023)	(0.034)	(0.035)
2001	0.012	0.012	0.012
	(0.027)	(0.040)	(0.038)
2002	0.085***	0.085*	0.085*
	(0.031)	(0.048)	(0.046)
2003	0.064*	0.064	0.064

Independent variables	(1) One-way clustering (individual level)	(2) Two-way clustering (individual and region-house type)	(3) Two-way clustering (individual and region-year)
	(0.035)	(0.049)	(0.050)
2004	0.057	0.057	0.057
	(0.039)	(0.055)	(0.056)
2005	-0.024	-0.024	-0.024
	(0.043)	(0.055)	(0.059)
2006	-0.053	-0.053	-0.053
	(0.047)	(0.061)	(0.063)
2007	-0.053	-0.053	-0.053
	(0.050)	(0.063)	(0.067)
2008	-0.174***	-0.174**	-0.174**
	(0.054)	(0.068)	(0.074)
Constant	-0.612***		
	(0.159)		
r2_a	0.153	0.152	0.153
r2c		0.152	0.153
Number of clusters (individuals)		12854	12854
Number of clusters (region-house type or region-year)		44	165
Observations	105121	103259	103259

Overall, the results are consistent with the results in section 4.5. The standard errors reported in both Columns (2) and (3) are largely 50% higher than those in Column (1) but the coefficient estimates remain highly significant and only drop to the 5% level for a few covariates including the variables *financial expectations* and its interaction with *change in house price index* and both *home investment* and *other consumption*.

4.6.2 Evidence using the Nationwide national house price index

Next, I examine whether the results are robust when I use the Nationwide national level house price index. National house price indices might be more apparent to homeowners than local indices because, as suggested by Shiller (2007), most homeowners observe trends in national house prices and may also be influenced by perceptions about world house prices. Moreover, as we saw in Section 4.3, the correlation between changes in the self-reported house value and the Nationwide *national* house price index is higher than that with the Nationwide *regional* house price index.

This approach provides a further and stronger test of anchoring since aggregate national house price indices conceal important regional variations in house prices (Case and Shiller, 2003; Himmelberg et al., 2005). In the data, house prices vary considerably across regions and ignoring these differences could bias self-reported housing wealth. In other words, if individuals anchor their self-reported housing wealth on aggregate national house prices I would expect to see a higher anchoring bias because of the mistaken notion that national indices reveal trends in house prices more accurately. This is supported by the significant regional effects that I find in the baseline regression and the graphical analysis depicted in Figure 4.2. If, in general, house price changes tend to move in one direction, I should expect to see large coefficient estimates when I use national data.

The Nationwide house price data sets contain aggregate national house prices, which I use for my investigations. Table 4.12 presents the results using the specifications in Table 4.6. The results show that our key variable, *change in house price index*, remains virtually unchanged from the results in Table 4.6. Similarly, the main effects of *home investment* and *other consumption* are consistent with the results in Table 4.6. However, the interaction terms for *home investment* and *other consumption* with both the *change in the house price index* and *financial expectations* decline in significance, suggesting a weak association with changes in self-reported home house values. This result may be associated with the increased importance of financial expectations and its interaction with changes in the house price index on self-reported home house values. In other words, there is a strong correlation between the national house price index and future financial expectations. This is also reflected in the interaction between *under mortgage* and the change in the house price index, which increases in magnitude.

Table 4.12 Estimates using Nationwide UK aggregate house price data

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables as described in Table 4.1are: in all columns, log of regional change in house price index; column (2, 3, 4 &5), time dummies; column (3), property attributes; column (4), socio-economic and demographic variables; and column (5), combination of the three sets of variables in column (2), (3) and (4), and dummy variables for respondents who have taken additional loan and who have a comfortable financial situation. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in house price index	0.180***	0.180***	0.180***	0.180***	0.180***	0.179***	0.181***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Taken extra loan	0.020***	0.032***					
	(0.004)	(0.005)					
Taken out extra loan * Δ House price index		-0.121***					
		(0.030)					
Extra loan – Home investment			0.034***	0.046***			0.089***
			(0.004)	(0.006)			(0.008)
Home investment * Δ House price index				-0.117***			-0.072
				(0.037)			(0.048)
Home investment * Financial expectations * Δ House price index							-0.131**
							(0.055)
Extra Loan – Other consumption					-0.010*	0.005	0.056***
					(0.005)	(0.006)	(0.009)
Other consumption * Δ House price index						-0.145***	-0.086*
						(0.042)	(0.049)
Other consumption * Financial expectations * Δ House price index							-0.141*
							(0.072)
Home investment * Other consumption							-0.132***
							(0.032)
Home investment * overvalue							-0.060***
							(0.009)
Other consumption * overvalue							-0.077***
							(0.011)
Home investment * other consumption * overvalue							0.142***
							(0.035)
Financial expectations	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Financial expectations * Δ House price index	0.112***	0.113***	0.112***	0.112***	0.112***	0.113***	0.120***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)
Under Mortgage	0.000	-0.000	0.000	-0.000	0.001	0.001	0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)

Table 4.12 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Under mortgage * Δ House price index	0.149***	0.156***	0.149***	0.154***	0.149***	0.152***	0.151***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Overvalue	0.188***	0.188***	0.187***	0.187***	0.188***	0.188***	0.190***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Δ House price index	0.043*	0.043*	0.043*	0.043*	0.043*	0.043*	0.040
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Overvalue * Financial expectations	0.013***	0.013***	0.013***	0.013***	0.013***	0.013***	0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Under mortgage * Δ House price index	-0.074**	-0.074**	-0.074**	-0.074**	-0.073**	-0.072**	-0.068**
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Number or rooms	0.072***	0.071***	0.071***	0.071***	0.072***	0.072***	0.071***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.008	0.008	0.008	0.008	0.008	0.008	0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Prefers to Move	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***	-0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Detached	0.082***	0.082***	0.082***	0.082***	0.082***	0.083***	0.082***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Semi-detached	0.070***	0.069***	0.069***	0.069***	0.069***	0.069***	0.069***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Terraced	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.009***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.010**	0.010**	0.009**	0.009**	0.010**	0.010**	0.009**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	-0.001	-0.001	-0.001	-0.001	-0.000	-0.000	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.011	0.011	0.011	0.011	0.011	0.011	0.011
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

Table 4.12 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Region dummies (Base=North East)							
North West	0.040	0.042	0.041	0.041	0.039	0.041	0.042
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Yorkshire & Humber	0.062	0.063	0.062	0.063	0.061	0.064	0.064
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
East Midlands	0.032	0.033	0.032	0.033	0.031	0.033	0.034
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
West Midlands	0.038	0.039	0.038	0.039	0.037	0.038	0.039
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
East of England	0.115***	0.116***	0.116***	0.117***	0.115***	0.116***	0.118***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.038)	(0.039)	(0.039)
London	0.190***	0.190***	0.190***	0.191***	0.189***	0.191***	0.190***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.038)	(0.039)	(0.039)
South East	0.113***	0.113***	0.113***	0.114***	0.112***	0.114***	0.114***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
South West	0.042	0.043	0.043	0.044	0.041	0.043	0.043
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Wales	0.037	0.037	0.037	0.038	0.037	0.039	0.039
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Scotland	0.067	0.069	0.067	0.068	0.067	0.070	0.071
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Time dummies							
1995	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
1996	0.011**	0.011**	0.011**	0.011**	0.011**	0.012**	0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1997	0.011**	0.010*	0.011**	0.010**	0.011**	0.011**	0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1998	0.041***	0.040***	0.041***	0.041***	0.041***	0.041***	0.041***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
1999	0.051***	0.051***	0.052***	0.051***	0.052***	0.052***	0.052***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2000	0.066***	0.066***	0.067***	0.066***	0.067***	0.067***	0.067***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
2001	0.051***	0.051***	0.052***	0.051***	0.052***	0.052***	0.052***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
2002	0.119***	0.119***	0.119***	0.119***	0.121***	0.121***	0.121***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)

Table 4.12 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2003	0.117***	0.117***	0.118***	0.118***	0.119***	0.119***	0.118***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2004	0.102***	0.102***	0.102***	0.102***	0.104***	0.104***	0.103***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2005	0.032***	0.032***	0.033***	0.032***	0.034***	0.034***	0.033***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2006	0.003	0.003	0.004	0.003	0.005	0.005	0.004
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
2007	0.012	0.012	0.013	0.013	0.014	0.014	0.013
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
2008	-0.087***	-0.087***	-0.086***	-0.087***	-0.085***	-0.086***	-0.086***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Constant	-0.430***	-0.431***	-0.429***	-0.430***	-0.429***	-0.431***	-0.433***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Adjusted r^2	0.150	0.150	0.150	0.151	0.150	0.150	0.151
Observations	105498	105498	105498	105498	105498	105498	105498

4.6.3 Evidence using the Halifax house price index

So far, I have used Nationwide house price information in the analysis as the main proxy for anchoring on trends in house prices. However, other indices exist, including Halifax and Office of National Statistics house price data sets. I use the Halifax house price data because the constructed index uses a methodology that is similar to that used by the Nationwide; the indices are derived using regression estimates of actual market prices based on agreed mortgage contracts against property characteristics. However, the samples used by the two mortgage providers vary and the Halifax house price data that I use are not standardised to take into account quarterly changes in sample composition. This notwithstanding, I find a 0.217 correlation between the regional house price indices for the Halifax and the Nationwide while the correlations between the self-reported house value and the two data sets are 0.119 and 0.233 respectively. However, using the national level house price indices, the correlation between the two indices is 0.713, which is three times higher. Table 4.13 reports the estimates using the specifications in Table 4.6. In Panel A, I report estimates for the Halifax regional house price index and in Panel B I use the Halifax national house price index.

Consistent with the results obtained using the Nationwide house price data, I find that the coefficient for the regional house price in Panel A is positive and highly significant; however, the coefficient estimate is about four times smaller. The main effects of the variables *home investment* and *other consumption* are consistent with the results in Table 4.6 but their interactions with both the change in the house price index and *financial expectations* are barely significant at the 10% level for the interaction with *home investment* and insignificant for the interaction with *other consumption*.

Table 4.13 Estimates using Halifax UK aggregate house price data

Table reports the estimation results from OLS fixed effects regressions in which the dependent variable is log of change in self-reported house value. The independent variables include log of change in house price; a set of property attributes; a set of socio-economic and demographic variables; and time dummies. Additional independent variables include financial expectations; dummy for ownership through a mortgage; overvaluation dummy; and interaction terms of these variables with change in regional house price. Standard errors are reported in parentheses and the levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Regional house price index							
Change in house price index	0.046***	0.046***	0.046***	0.046***	0.046***	0.046***	0.047***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Taken extra loan	0.019***	0.022***					
	(0.004)	(0.004)					
Taken out extra loan * Δ House price index		-0.022***					
		(0.006)					
Extra loan – Home investment			0.034***	0.036***			0.069***
			(0.004)	(0.004)			(0.006)
Home investment * Δ House price index				-0.012			-0.005
				(0.008)			(0.011)
Home investment * Financial expectations * Δ House price index							-0.031*
							(0.016)
Extra Loan – Other consumption					-0.010*	-0.005	0.039***
					(0.005)	(0.005)	(0.008)
Other consumption * Δ House price index						-0.043***	-0.051***
						(0.009)	(0.012)
Other consumption * Financial expectations * Δ House price index							-0.015
							(0.017)
Home investment * Other consumption							-0.097***
							(0.027)
Home investment * overvalue							-0.051***
							(0.009)
Other consumption * overvalue							-0.070***
							(0.012)
Home investment * other consumption * overvalue							0.110***
							(0.031)
Financial expectations	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Financial expectations * Δ House price index	0.018***	0.019***	0.019***	0.019***	0.018***	0.019***	0.021***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)

Table 4.13 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Regional house price index							
Under Mortgage	0.006	0.005	0.006	0.006	0.007*	0.007*	0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Under mortgage * Δ House price index	0.017***	0.019***	0.017***	0.018***	0.017***	0.019***	0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue	0.140***	0.140***	0.140***	0.140***	0.140***	0.140***	0.143***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Overvalue * Δ House price index	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Overvalue * Financial expectations	0.006	0.006	0.006	0.006	0.006	0.006	0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Under mortgage * Δ House price index	0.030***	0.031***	0.030***	0.030***	0.031***	0.031***	0.032***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Number or rooms	0.083***	0.083***	0.083***	0.083***	0.083***	0.083***	0.083***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.012**	0.012**	0.012**	0.012**	0.012**	0.012**	0.012**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Prefers to Move	-0.011***	-0.011***	-0.011***	-0.011***	-0.012***	-0.011***	-0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Detached	0.152***	0.152***	0.152***	0.152***	0.152***	0.152***	0.152***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Semi-detached	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***	0.088***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Terraced	0.055***	0.055***	0.055***	0.055***	0.055***	0.055***	0.055***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.012***	-0.012***	-0.012***	-0.012***	-0.012***	-0.012***	-0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.007*	0.007*	0.007	0.007	0.007*	0.007*	0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.023**	0.023**	0.023**	0.023**	0.023**	0.023**	0.024**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

Table 4.13 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Regional house price index							
Region dummies (Base=North East)							
North West	0.019	0.019	0.019	0.019	0.017	0.018	0.019
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Yorkshire & Humber	0.060	0.060	0.061	0.061	0.060	0.060	0.061
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
East Midlands	0.033	0.034	0.034	0.034	0.032	0.033	0.034
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
West Midlands	0.015	0.015	0.016	0.016	0.015	0.015	0.016
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
East of England	0.108***	0.108***	0.109***	0.109***	0.108***	0.108***	0.108***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
London	0.203***	0.203***	0.203***	0.203***	0.202***	0.202***	0.203***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
South East	0.117***	0.118***	0.118***	0.118***	0.117***	0.117***	0.118***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
South West	0.027	0.027	0.027	0.027	0.026	0.026	0.027
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Wales	0.005	0.005	0.006	0.006	0.005	0.006	0.007
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Scotland	0.041	0.042	0.041	0.042	0.042	0.042	0.043
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Time dummies	yes	yes	yes	yes	yes	yes	yes
Constant	-0.445***	-0.445***	-0.445***	-0.444***	-0.444***	-0.444***	-0.446***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Adjusted r^2	0.117	0.117	0.117	0.117	0.117	0.117	0.118
Observations	105443	105443	105443	105443	105443	105443	105443

Table 4.13 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: National aggregate house price index							
Change in house price index	0.350***	0.349***	0.350***	0.350***	0.349***	0.349***	0.350***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)
Taken extra loan	0.018***	0.035***					
	(0.004)	(0.005)					
Taken out extra loan * Δ House price index		-0.178***					
		(0.033)					
Extra loan – Home investment			0.032***	0.048***			0.078***
			(0.004)	(0.006)			(0.007)
Home investment * Δ House price index				-0.155***			-0.113**
				(0.040)			(0.050)
Home investment * Financial expectations * Δ House price index							-0.103*
							(0.058)
Extra Loan – Other consumption					-0.012**	0.009	0.054***
					(0.005)	(0.006)	(0.008)
Other consumption * Δ House price index						-0.215***	-0.172***
						(0.044)	(0.053)
Other consumption * Financial expectations * Δ House price index							-0.086
							(0.074)
Home investment * Other consumption							-0.104***
							(0.023)
Home investment * overvalue							-0.054***
							(0.009)
Other consumption * overvalue							-0.086***
							(0.011)
Home investment * other consumption * overvalue							0.130***
							(0.029)
Financial expectations	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Financial expectations * Δ House price index	0.132***	0.133***	0.132***	0.132***	0.132***	0.134***	0.140***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)
Under Mortgage	-0.004	-0.005	-0.004	-0.004	-0.003	-0.003	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Under mortgage * Δ House price index	0.170***	0.181***	0.170***	0.176***	0.171***	0.176***	0.175***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Overvalue	0.192***	0.192***	0.192***	0.192***	0.192***	0.192***	0.195***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)

Table 4.13 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: National aggregate house price index							
Overvalue * Δ House price index	0.146***	0.146***	0.146***	0.146***	0.146***	0.146***	0.142***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Overvalue * Financial expectations	0.013***	0.013***	0.013***	0.013***	0.013***	0.013***	0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Overvalue * Under mortgage * Δ House price index	-0.041	-0.040	-0.041	-0.041	-0.040	-0.039	-0.030
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Number or rooms	0.071***	0.071***	0.071***	0.071***	0.072***	0.072***	0.071***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Likes present neighbourhood	0.008	0.008	0.008	0.008	0.008	0.008	0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Prefers to Move	-0.011***	-0.011***	-0.010***	-0.011***	-0.011***	-0.011***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Detached	0.043***	0.043***	0.043***	0.043***	0.043***	0.043***	0.043***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Semi-detached	0.066***	0.066***	0.066***	0.066***	0.066***	0.066***	0.066***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Terraced	0.070***	0.070***	0.070***	0.070***	0.070***	0.070***	0.070***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Log of Income	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	-0.010***	-0.009***	-0.010***	-0.010***	-0.009***	-0.009***	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Married	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Employed	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First degree & above	0.015	0.015	0.015	0.015	0.015	0.016	0.015
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Region dummies (Base=North East)							
North West	0.042	0.043	0.042	0.043	0.041	0.042	0.044
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.035)	(0.035)
Yorkshire & Humber	0.073*	0.073*	0.073*	0.073*	0.072*	0.074*	0.075*
	(0.038)	(0.039)	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)
East Midlands	0.069*	0.070*	0.069*	0.070*	0.068*	0.070*	0.071*
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)

Table 4.13 Continued

Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: National aggregate house price index							
West Midlands	0.048	0.047	0.048	0.048	0.047	0.048	0.049
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)
East of England	0.116***	0.116***	0.117***	0.117***	0.115***	0.117***	0.117***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
London	0.159***	0.159***	0.159***	0.159***	0.158***	0.159***	0.159***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
South East	0.111***	0.112***	0.112***	0.112***	0.111***	0.112***	0.113***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
South West	0.060	0.060	0.060	0.060	0.059	0.060	0.060
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Wales	0.043	0.042	0.044	0.043	0.043	0.045	0.044
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	(0.038)
Scotland	0.068	0.069	0.068	0.068	0.068	0.070	0.071
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Time dummies	yes	yes	yes	yes	yes	yes	yes
Constant	-0.378***	-0.379***	-0.378***	-0.378***	-0.377***	-0.379***	-0.380***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
Adjusted r^2	0.168	0.168	0.168	0.168	0.168	0.168	0.169
Observations	105498	105498	105498	105498	105498	105498	105498

Unlike the results in Table 4.6, greater *financial expectations* has no effect on changes in self-reported house values and the magnitude of its interaction with the *change in the house price index* declines. Similarly, the variable *under mortgage* remains insignificant and, for its interaction with the *change in the house price index*, the magnitude of the coefficient estimate is more than six times smaller. In addition, the coefficient estimates for property characteristics increase and holding a *first degree and above* qualification becomes significant. Overall, when compared to the results in Table 4.6, the explanatory power of these regressions as captured by the pseudo R^2 drops to 12% from 15%. These findings suggest that there is less anchoring on the Halifax house price index.

In Panel B, I replace the regional Halifax house price index with the Halifax national house price index. Surprisingly, this variable enters with a large coefficient and the explanatory power of the regressions rises to 16%. This result is consistent with the high correlation between the aggregate self-reported housing wealth and the Halifax aggregate national house price index displayed in Table 4.3 and Figure 4.1. The results for the main effects of the variables *home investment* and *other consumption* are consistent with the previous results. However, the two-way interactions of these variables with the *change in the house price index* become significant while the three-way interactions with both the *change in house price index* and *financial expectations* become insignificant.

Consistent with the results where I use the Nationwide national house price index reported in Table 4.12, the main effects of the variables *financial expectations* is significant, *under mortgage* is insignificant and the interaction terms of both variables with the *change in the house price index* are significant. The results clearly show the important roles played by greater *financial expectations*, ownership through a mortgage, and overvaluation relative to regional house prices, *home investment,* and *other consumption*. I also observe that the Halifax regional house price index has weaker explanatory power (11%) than the national house price index (16%).

4.6.4 Instrumental variables regression estimates

In the previous analyses, identification of anchoring bias was based on the assumption that fixed effects OLS regressions and modelling changes in both house price indices and self-reported house values eliminates omitted variable bias and unobserved individual effects. However, as I discuss below, there are also endogeneity issues that may bias our fixed effects coefficient estimates and could also imply that there is no causal relationship. The concern about, and the need to account for, endogenous explanatory variables is raised in many fields in the finance literature, including empirical studies in household finance (e.g. Brown et al., 2008; Georgarakos and Pasini, 2011) and corporate finance (e.g. Bennedsen et al., 2007; Wintoki et al., 2012). In this section I address possible endogeneity issues using both difference and system GMM (Holtz-Eakin et al., 1988; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998).

Endogeneity could occur because, first, both self-reported house prices and house price indices are simultaneously affected by property attributes, individual characteristics, and regional factors. These are key explanatory variables in hedonic regression estimates that are used for calculating house price indices and are also important determinants of self-reported house values. Given that both house price indices and self-reported house values are jointly determined by property characteristics, there may be no causal relationship between the two variables. Second, it may also be the case that current observations of self-reported house values could be influenced by their past values. In other words, homeowners may rely on past values as reference points in determining and updating their estimation of current house values. Thus, in a dynamic OLS regression, I would expect that past changes in self-reported house values will explain a lot of variation in current change in self-reported house values and may also be correlated with the explanatory variables. Third, current values of changes in the house price index (among other explanatory variables) may be influenced by past observations of self-reported house values. If homeowners estimate their house values using local property listing prices (Goodman and Ittner, 1992) and house price movements are driven by investor psychology (Shiller, 2007) then there is reason to expect that past changes in self-reported house values may influence the current change in house price index.

In the results reported in Table 4.14 I demonstrate the potential endogenous relationship and use both difference and system GMM to test the consistency of our OLS regression results. In all the regressions reported, I use a balanced panel from the BHPS homeowners' sample and standard errors are clustered at the individual level. For the GMM regressions, lagged values of one period and two periods are used as instruments. To eliminate individual effects while minimizing loss of data, I use a forward orthogonal deviations transformation (Arellano and Bover, 1995) rather than first-differencing.

In Column (1), I report the original fixed effects OLS regression using a balanced panel for comparison purposes. The first evidence of endogeneity is seen in Column (2), where I include a one period lag of the dependent variable.

Table 4.14 Instrumental variables regression estimates

Table reports the instrumental variables (IV) estimates. The results are based on a balanced panel of 450 respondents in the BHPS and Nationwide house price index both covering the period 1993 to 2008. The individual characteristics come from the BHPS and include log of change in house price; a set of property attributes; a set of socio-economic and demographic variables; and region and time dummies. Regional house price index is from the Nationwide. AR(1) and AR(2) are the Arellano and Bond tests for first-order and second-order serial correlation under the null of no serial correlation. The Hansen test of over-identification is under the null that all instruments are valid. P-values are based on robust, individual level clustered standard errors and are reported in parentheses. The levels of significance are indicated by * (* p<0.10, ** p<0.05, *** p<0.01).

Independent variable	(1) Static OLS	(2) Dynamic OLS	(3) Difference GMM	(4) System GMM
Change in house price index	0.309***	0.217***	0.254***	0.189***
	(0.045)	(0.042)	(0.068)	(0.041)
Lagged change in self-reported housing wealth		-0.248***	-0.184***	-0.185***
		(0.031)	(0.032)	(0.035)
Extra loan – Home investment	0.036	0.042*	0.036	0.079**
	(0.029)	(0.022)	(0.042)	(0.035)
Home investment * Financial expectations * Δ House price index	-0.305***	-0.258***	-0.245**	-0.335***
	(0.092)	(0.090)	(0.123)	(0.090)
Extra Loan – Other Consumption	0.031	0.058*	0.048	0.152***
	(0.035)	(0.030)	(0.072)	(0.053)
Other consumption * Financial expectations * Δ House price index	0.042	-0.111	-0.083	-0.108
	(0.172)	(0.096)	(0.173)	(0.138)
Home investment * Other consumption	0.040	0.016	0.129	0.022
	(0.060)	(0.062)	(0.191)	(0.107)
Home investment * overvalue	-0.006	-0.012	-0.019	-0.065
	(0.034)	(0.026)	(0.069)	(0.053)
Other consumption * overvalue	-0.037	-0.077**	-0.023	-0.192***
	(0.044)	(0.037)	(0.102)	(0.073)
Home investment * other consumption * overvalue	-0.115	-0.062	-0.269	-0.100
	(0.072)	(0.073)	(0.240)	(0.134)
Financial expectations	-0.011	-0.024	-0.025	-0.012
	(0.018)	(0.020)	(0.030)	(0.023)
Financial expectations * Δ House price index	0.091	0.078	0.022	0.087
	(0.060)	(0.067)	(0.078)	(0.072)
Under Mortgage	0.026	0.001	0.044	-0.063**
	(0.019)	(0.022)	(0.091)	(0.028)
Under mortgage * Δ House price index	-0.095*	-0.084	-0.196**	-0.081
	(0.055)	(0.054)	(0.079)	(0.056)
Overvalue	0.179***	0.166***	0.439***	0.214***
	(0.026)	(0.027)	(0.071)	(0.029)
Overvalue * Financial expectations	0.032	0.034	0.041	0.031
	(0.020)	(0.022)	(0.030)	(0.026)
Number or rooms	0.084***	0.086***	-0.062	-0.082
	(0.026)	(0.030)	(0.124)	(0.051)
Likes present neighbourhood	0.065**	0.045	-0.019	0.038
	(0.033)	(0.028)	(0.138)	(0.059)
Prefers to Move	0.017	0.008	0.004	-0.033
	(0.012)	(0.012)	(0.041)	(0.028)
Detached	0.124***	0.128***	0.091	0.224***
	(0.039)	(0.046)	(0.191)	(0.076)
Semi-detached	0.096**	0.084*	-0.171	0.164**
	(0.037)	(0.043)	(0.200)	(0.070)
Terraced	0.105***	0.093**	0.089	0.262***
	(0.037)	(0.046)	(0.190)	(0.077)

Table 4.14 Continued

Independent variable	(1) Static OLS	(2) Dynamic OLS	(3) Difference GMM	(4) System GMM
Log of Income	0.001	-0.006	-0.046*	-0.011
	(0.005)	(0.006)	(0.026)	(0.012)
Age square	0.000	0.000**	-0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Has Children	0.004	0.017	-0.072	-0.019
	(0.016)	(0.017)	(0.062)	(0.025)
Married	0.000	0.020	0.099	0.021
	(0.017)	(0.018)	(0.076)	(0.029)
Employed	-0.014	-0.005	0.118	-0.005
	(0.014)	(0.015)	(0.081)	(0.031)
First degree & above	0.051	0.058	0.089	0.019
	(0.034)	(0.041)	(0.200)	(0.029)
Region dummies				
North East	-0.001	0.050	0.767	-0.033
	(0.107)	(0.136)	(1.086)	(0.046)
North West	0.028	0.014	0.251	0.004
	(0.108)	(0.142)	(1.125)	(0.042)
Yorkshire & Humber	0.409**	0.419**	1.298	0.021
	(0.170)	(0.167)	(1.100)	(0.047)
East Midlands	0.040	-0.148	0.753	-0.075
	(0.133)	(0.138)	(1.189)	(0.056)
West Midlands	-0.003	-0.102	0.076	-0.014
	(0.108)	(0.127)	(1.102)	(0.063)
East of England	0.170**	0.136	0.614	-0.028
	(0.085)	(0.101)	(1.059)	(0.045)
London	0.244***	0.255**	0.700	0.085
	(0.093)	(0.111)	(1.134)	(0.055)
South East	0.118	0.066	0.098	0.040
	(0.102)	(0.118)	(1.040)	(0.038)
South West	0.123	0.072	0.468	0.057
	(0.101)	(0.119)	(1.066)	(0.055)
Wales	0.089	-0.014	0.087	0.076*
	(0.107)	(0.134)	(1.139)	(0.046)
Time dummies	yes	yes	yes	yes
Constant	-0.631***	-0.644***		-0.084
	(0.160)	(0.181)		(0.157)
Adjusted r^2	0.194	0.228		
Instruments			310	475
Arellano-Bond test for AR(1) (p value)			0.000	0.000
Arellano-Bond test for AR(2) (p value)			0.339	0.319
Hansen test of over- identification (p value)			0.453	0.875
Observations	4504	3798	3211	3798

Strikingly, not only does the explanatory power, r^2, increase from 19% to 23% but the magnitude for *change in house price index* declines from 0.309 to 0.217 and remains significant at the 1% level. This finding implies that past self-reported house values variations in current values and are correlated with the explanatory variables; the lagged dependent variable is negative and highly significant. Column (3) reports results from difference GMM with the full set of instruments. The regional house price index remains virtually unchanged and is significant at the 1% level. However, the coefficient estimates for property characteristics decline or become insignificant and their effects appear to be captured by the dummy variable *overvalue*, which increases by more than two and half times. The specification tests show that, for AR(2) I cannot reject the null hypothesis of no second-order serial correlation; for the Hansen J test, I cannot reject the null hypothesis that the instruments are valid.

In Column (5), I replicate the specifications in Columns (3) using system GMM. The coefficient estimate for *change in house price index* drops to 0.189 and this finding is consistent with the results reported in Table 4.13. The lagged dependent variable remains unchanged from the results in Column (3). The variables *home investment* and *other consumption* become significant while the three-way interaction term for the variables *home investment*, *financial expectations* and change in house price index increases in magnitude. Although, the dummy variable *overvalue* declines in magnitude, property characteristics (house type) become significant. Again, the statistical tests for specification show that, for AR(2) the null hypothesis of no second-order serial correlation cannot be rejected; for the Hansen J test, the null hypothesis that our instruments are valid also cannot be rejected. In sum, the results are consistent and suggest that self-reported house values are anchored on house price indices and that mortgage refinancing mitigates anchoring effects.

4.7 Conclusion

The literature concerning house prices dwells mainly on how households respond to changes in house prices and shows mixed results for the impact of house price changes on consumption, indebtedness and saving behaviour. A strand of the literature explores the relationship between house prices and behavioural biases such as money illusion and loss aversion, and the role of psychological expectations on market sentiments and momentum in house prices. However, little attention is devoted to how households derive their self-reported housing wealth and the relationship with house price indices.

This study examines whether homeowners anchor their self-reported housing wealth on hedonic predictions of house prices and their ability (or otherwise) to sufficiently adjust for new information and variations in the exposure to different sets of information. First, I investigate whether changes in house price indices can explain changes in self-reported house values over and above the influence of property and individual characteristics. Second, given that housing is the most talked about investment and that most homeowners actively engage in house price watching, I examine the direct and interactive influence of greater financial expectations and ownership type (outright or under a mortgage). Third, I investigate whether anchoring on changes in house price indices is mitigated by additional information acquired during mortgage refinancing and whether the use of money raised for home investment or other consumption has direct and interactive influences on changes in self-reported housing wealth. Finally, I examine whether social factors such as religion, trust, social group involvement and computer use also influence anchoring bias.

Using published house price indices and BHPS household data between 1993 and 2008, I find evidence of anchoring bias among homeowners, which is mitigated by exposure to additional information. In particular, I find that a 10% change in the Nationwide house price index leads to a 2% change in the self-reported house value. This result is robust whether I control for property attributes, individual characteristics, or both, in the OLS fixed effects regressions. Having greater financial expectations or holding a mortgage increases anchoring effects and leads to 8% and 11% increases in change in self-reported housing wealth, respectively. However, homeowners who refinance their mortgages and have greater financial expectations are less anchored on changes in house price indices; those who use funds raised for home investment report housing wealth that are 10% lower while those who use the money for other consumption report 14% lower self-reported housing wealth. Further, I find that the combined effect of computer use and changes in the house price index leads to a 5% change in self-reported house values while the combined effect of religion and changes in house price index leads to a 4% decline in self-reported housing wealth. I therefore conclude that homeowners are anchored on changes in house price indices and that the level of anchoring is influenced by ownership type, financial expectations, mortgage refinancing, and social factors.

Further, the estimates from quantile regressions show that the effects of change in the house price index, greater financial expectations and holding a mortgage increase along quantiles. Anchoring effect increases above the 75th quantile and decline below the 10th quantile. The results are also consistent for the influence of mortgage refinancing and the use of the money raised for home investment and other consumption. Further robustness checks using national house prices and an alternative price index (the Halifax index) demonstrate that anchoring bias persists regardless of the data used. Moreover, the results using GMM estimators are also consistent and I conclude that there is a causal relationship. That is, changes in house price indices lead to changes in self-reported housing wealth.

The main implication of these findings is that, while house price indices may provide a general indication of trends in house prices, homeowners should be aware that the values of their homes may vary substantially from the index. In particular, those who own their homes through a mortgage and do not refinance, should be encouraged to regularly seek a professional valuation as this will help eliminate the illusion of perceived increased housing wealth, which may impact on other financial decisions. This is even more important considering that anchoring effects dominate other individual characteristics known to influence financial decisions. Another implication concerns the interactive influence of computer use which may be linked with online house valuation tools provided by mortgage providers and estate agents. Again homeowners should be warned about this because online valuation tools rely heavily on indices and other arbitrary assumptions in deriving estimates of house values. Moreover, the findings in this Chapter suggest the need for governments and regulators to provide more information to homeowners about indices and local house prices.

Anchoring on price indices and mortgage refinancing also have important implications for the housing market and the economy at large. The finding that greater future financial expectations increases anchoring on house price indices suggests a link with housing market booms and busts, which could be amplified by the contagion effect of market psychology (Shiller, 1990; Case and Shiller, 2003). Furthermore, because homeowners speculate on future increase in house prices (Choi *et al.*, 2013), favourable future financial expectations might also encourage investment in home extensions or improvement and other non-housing consumption. In addition, evidence suggests that an increase in house price increases the marginal propensity of consumption for both housing and non-housing goods (Aoki *et al.*, 2004). Anchoring on a house price index might therefore exacerbate this effect and can explain cyclical movements in consumption.

The findings in this Chapter provide a variety of future research opportunities. First, it is arguable that regional and national house price indices may fail to capture variations at smaller regional levels; thus, future research exploring the influence of house price indices at county or district levels will provide further robustness check to these results. Second, given that previous studies link housing wealth shocks to financial decisions (e.g. Campbell and Cocco, 2007) future research should investigate whether this relationship is also associated with anchoring. The finding that anchoring increases across quantiles, with the 95th quantile regression having a coefficient that is twice that calculated at the 75th quantile, suggests that anchoring may determine investment decisions among homeowners with large housing wealth. Moreover, as we saw in Chapter Three, housing increases the impact of mental accounting on portfolio choice and this provides further support for a possible link between portfolio choice and anchoring on house price indices.

Chapter 5 Conclusion

In this thesis, I investigate the roles of two behavioural biases on household financial decisions and a key factor influencing both of these biases and household financial decisions, namely social engagement. The study documents the influence of mental accounting on portfolio choice, how homeowners anchor their self-reported housing wealth on a published house price index and how social engagement affects a key household financial decision, namely stock market participation.

Chapter Two examines the influence of five social engagement mechanisms on stock market participation. I posit that *weak ties* are more productive channels of social interaction than *strong ties* and that the variety and intensity of social engagement mechanisms increase the probability of participating in the stock market. The evidence shows that the effect of a *strong tie* is captured by other social engagement mechanisms and that people who engage in social groups, who are more trusting, and who identify themselves with a right-wing political party are more likely to participate in the stock market. Those for whom religion makes a difference in their lives and those who shift their political affiliation to a right-wing political party are less likely to participate in the stock market. In this analysis, I use a short panel consisting of three waves in the BHPS and I find little variation in the transition between participation and non-participation in the stock market. For these reasons, I only use pooled probit regressions, as a consequence of which it is difficult to establish causality and to overrule the existence of endogeneity. Nevertheless, I test the consistency of the results using a lagged dependent variable, an alternative definition of stock market participation and poisson regressions - and the conclusions remain unchanged.

Given that I examine the probability of ownership of a financial asset, namely stocks, future research examining the effects of social engagement on the portfolio share in financial assets based on WAS data can provide a further test of the consistency of these results. It would also be useful to examine whether the trading behaviour of socially engaged investors differs from that of socially disengaged investors and whether they make investment mistakes. Barber and Odean (2002), for example, find that US stock market participants who switch from phone-based to online trading, when compared to those who do not switch, tend to trade more frequently and that their post-switch performance is worse. They argue that such investors are overconfident about their abilities. In the context of this study, because socially engaged investors are more informed about financial markets, I might expect them to trade more frequently and thus to make errors.

In Chapter Three, I investigate the roles of mental accounting together with financial advice and housing tenure on both ownership and portfolio share in three asset classes: risky assets, fairly safe assets and safe assets. The conjecture is that mental accounting can explain variations in the ownership of, and portfolio share in, the three asset classes and that the effect of mental accounting is also influenced by the provision of financial advice and housing tenure. I find that households that exhibit single mental accounts, when compared to households that exhibit no mental account, or those that exhibit multiple mental accounts, are less likely to own a risky asset and have low portfolio share in risky assets. When compared to households that exhibit no mental accounts, households that exhibit a single mental account and those that exhibit multiple mental accounts are more likely to own a fairly safe asset and to have a high portfolio share in fairly safe assets; however, they have a low portfolio share in safe assets. Among households that exhibit single and multiple mental accounts, financial advice and housing tenure reduce portfolio share in fairly safe assets and increase the share in safe assets. These results are consistent across sub-samples, reparameterized variables and when poisson regressions are used.

By using a panel period that coincides with the global economic crisis, the results provide evidence of its impact: a positive impact on ownership of and portfolio share in a fairly safe asset and a negative impact on ownership of and portfolio share in a risky asset. Using only two panel periods is a limitation of the study because, first, it is hard to control for unobserved individual effects and to address the problem of endogenous regressors. Although I use multivariate regressions to control for correlations in the error terms across the three asset classes, the error terms in individual regressions may still be correlated with the explanatory variables. Thus, my conclusions should be interpreted as associations and do not suggest causality. Second, it is not known how these households would otherwise behave during normal economic conditions. This can be the subject of future research as more waves of the WAS become available. It would also be interesting to examine the trading behaviour of households across mental accounts. As suggested by Shefrin and Thaler (1988), the urge to spend money from a 'current income' mental account is high relative to a 'future income' mental account and this might apply to households that exhibit multiple mental accounts as compared to those that exhibit a single mental account.

Chapter Four investigates whether changes in self-reported housing wealth are anchored on a published house price index and whether anchoring is mediated by housing tenure, mortgage refinancing and how money raised from refinancing is used. The idea is that, given the prevalence of house price indices, the perception that housing is an investment, and the substantial share of housing wealth as a proportion of total household wealth, homeowners might be anchored on house price indices at the expense of other market information. In support of this conjecture, I find that homeowners who own a home through a mortgage are more likely to be anchored on published house price indices and this effect is net of the interactive effects of house price indices with financial expectations and the tendency to overvalue house prices. However, among mortgage holders, those who refinance their mortgages are less anchored and refinancing has a direct effect on the change in self-reported housing wealth. Moreover, those who use the money raised from refinancing to invest in home improvements and extensions are less likely to be anchored and this has a direct positive influence on self-reported housing wealth. Computer use has a negative effect on the change in self-reported housing wealth and increases anchoring, while religion reduces anchoring.

An important concern in identifying anchoring effects is that both self-reported housing wealth and the house price index may be simultaneously determined by individual characteristics and property characteristics. Although I take advantage of the long panel and use a fixed effects OLS model, this could still be problematic. I therefore address this problem by using GMM estimators and my conclusions remain unchanged. One limitation of this study provides an opportunity for future research. Because I use regional house price indices, the study does not capture variations in the index within smaller geographical regions such as county level and district level. Future research can strengthen these results by using alternative house price indices reported at the county and district levels. Furthermore, the question as to whether anchoring on house price indices is also reflected in homeowners investment decisions is worthy of investigation. This is a plausible argument given that studies that use published house prices to proxy for increases in housing wealth find a positive relationship between consumption and house prices (Campbell and Cocco, 2007). Indeed, the finding in Chapter Three concerning the interactive effects of housing and mental accounting on portfolio choice supports a possible relationship between portfolio choice and anchoring on house price indices.

Overall, the findings in this thesis will be of interest to investors, financial advisors and policy makers. The finding that the variety and intensity of social engagement enhances stock market participation indicates that policy makers and financial institutions should put more effort into providing information about both financial markets and financial products to those who are less socially engaged. The evidence that trust compensates for left-wing political party identity suggests that building trust about financial markets may encourage people who hold ‘anti-market’ political views to participate in the stock market. Regarding the influence of mental accounting, investors should be aware of the benefits and pitfalls of mental accounts. For example, the finding that households that exhibit single mental accounts and those that exhibit both multiple mental accounts and have access to multiple sources of financial advice are less likely to own risky assets, and have a low share of risky assets, suggests that these households hold sub-optimal portfolios. Therefore, as suggested by Baptista (2012), both investors and financial advisors should be aware of the implications of mental accounting when constructing portfolios.

Concerning anchoring on published house price indices, homeowners should be aware that house price indices only provide a broad picture about trends in the housing market and are not necessarily precise measures of changes in the value of their own homes. The finding that mortgage holders who refinance, when compared to those who do not refinance, are less likely to be anchored on house prices indices suggests that homeowners should consult, for example, chartered valuers to obtain professionally estimated house values. This is particularly important when reviewing and considering investment plans as this will ensure realistic assessment of total household wealth and portfolio rebalancing. In addition, the finding that homeowners who use a computer are more anchored highlights the importance of warning homeowners about the dangers of relying on online information and home value calculators that are usually provided on the websites of mortgage companies and estate agencies.

The findings also have important implications for the operations of both financial markets and housing markets. Regarding financial markets, although few individual investors participate directly in the stock market, as seen in both Chapters Two and Three, and although their participation might not have a substantial impact on the market, the observed increase in and a shift towards *indirect* stock market participation suggests a possible impact on market volatility due to greater reliance on investment intermediaries. This conclusion is supported by previous evidence which shows a tendency for fund managers to exhibit herding behaviour (Dennis and Strickland, 2002) and for asset allocation decisions concerning indexed funds to follow market trends (Griffin *et al.*, 2011). On the other hand, the finding that homeowners who have greater financial expectations are more anchored on house price indices, both of which are associated with growth in self-reported house values, implies that the housing market is likely to be more volatile during economic booms or downturns; positive (negative) stories about expected price increases (decreases) rapidly spread among homeowners through word-of-mouth (Shiller, 1990; Case and Shiller, 2003). This could in turn exacerbate booms and busts in the market because of the contagion effect of market psychology.

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