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FINANCIAL ADVICE AND HOUSEHOLD FINANCIAL PORTFOLIOS*

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Abstract

We investigate the role of financial advice in shaping the composition of UK household portfolios. Advice is associated with a reallocation of wealth away from real estate and towards bonds and stocks, especially when households seek financial advice "for investments". Having a consultation with a stockbroker has a particularly large effect on the portfolio share in stocks. However, even free financial advice has a positive effect on the shares in bonds and stocks, compared to not receiving advice. Finally, we find a positive association between alternative measures of portfolio risk and the composition of the portfolio, whilst accounting for financial advice.

Keywords: Financial Advice; Financial Risk; Household Financial Portfolios.
JEL Classification: D81; G11; D14.

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1. Introduction

In this paper, we investigate the role of financial advice in shaping household financial portfolios. As financial services and products have become increasingly complex over time, the role of the financial advisor in assisting households to navigate financial markets and to aid their financial decision-making has attracted growing interest amongst both academics and policymakers. Furthermore, the existing literature has identified positive and negative effects associated with such advice, where negative effects may arise due to, for example, conflicts of interest between the client and the advisor. In the context of the quality of the advice provided, in an innovative recent study, Law and Zuo (2020) explore whether the economic conditions at the start of a financial advisor's career are predictive of future misconduct and find that advisors who start their careers in a recession are less likely to commit misconduct than advisors in the same firm and location, at the same point in time.

Specifically, we analyse UK household financial portfolios comprising financial assets (i.e. bonds and stocks) and non-financial assets (real estate and business), and we focus on exploring to what extent such portfolios are influenced by financial advice. The relatively recent changes to the financial regulatory body in the UK, with the establishment of the Financial Conduct Authority (replacing the Financial Services Authority) in 2013 make the UK a particularly interesting country to study. Moreover, the Financial Advice Market Review (FARM) Interim Consumer Research Report (see Farr et al., 2018) states that in 2018 around one in ten UK adults (4.5 million people) received regulated financial advice related to investments, saving into a pension or retirement planning in the last 12 months, compared to 3.2 million people in 2017. Hence, it is important to analyse the effects of such advice in the UK context. Furthermore, of the 46.5 million people who have not received regulated financial advice in the last 12 months, 18.2 million are estimated to have £10,000 or more in savings and/or investments, suggesting that there are many UK households, which may benefit from financial advice.

Our empirical analysis uses the nationally representative UK *Wealth and Assets Survey* to investigate the effects of a comprehensive range of facets of financial advice on portfolio shares. In addition, we explore the relationship between portfolio shares and portfolio risk, the latter being measured through ex-ante portfolio variance, as in Bucciol and Miniaci (2015), whilst taking the effects of financial advice into account.

We make four distinct contributions to the extant literature. First, there is a scarcity of evidence on the relationship between financial advice and household portfolios for the UK. All studies to date have used U.S. (e.g. Shum and Faig, 2006), German (e.g. Bhattacharya et al., 2012; Hackethal et al., 2012; Stolper, 2018), Dutch (e.g. Von Gaudecker, 2015; Kramer, 2016) or Italian data (e.g. Calcagno and Monticone, 2015). Hence, in the UK, there is limited knowledge regarding which households seek financial advice and how such financial advice influences their financial decisions. Our second contribution relates to the fact that much of the previous literature has focused on the returns from "advised" against "non-advised" portfolios. Our emphasis lies instead on how financial advice shapes the composition of the portfolio and the corresponding risk, given that ultimately the composition of the portfolio determines the associated return. Third, we extend the analysis beyond financial portfolios, placing attention on total asset portfolios, including real estate and business ownership. This is particularly relevant for the UK, where housing and "buy-to-let" are frequently regarded as relatively safe investments.

Finally, in contrast to much of the existing literature, which focuses on advice relating to investments and pensions, we are also able to account for the type of financial advice received, i.e. whether advice relates to areas such as investments, savings, pensions or debt. This is an important contribution given that it is clear that financial advice extends beyond investments and pensions and that households are frequently faced with decisions regarding a range of asset types. Moreover, our findings support the existence of considerable heterogeneity across the effects of the different types of financial advice. In addition, our nationally representative dataset uniquely allows comprehensive analysis of a wide range of characteristics of the financial advice such as: the type of financial

advisor; whether products were purchased following the advice; and how the financial advisor was paid for their services. Hence, in contrast to the existing literature, we are able to explore the effects of a relatively wide range of characteristics of the financial advice, moving beyond the receipt or otherwise of financial advice, in the context of a nationally representative sample of households.

2. Background

A large and growing body of literature has investigated the role of financial advisors and their influence on the returns received by investors, although, as stated by Kramer (2016), it remains an understudied area of research. Both positive and negative effects have been highlighted and, consequently, a final verdict on the role of financial advice has not yet been reached. As succinctly stated by Inderst and Ottaviani (2012), p.494, who develop a theoretical framework for modelling financial consumer protection in markets with advice: 'Financial advice could play an essential role in well-functioning markets for retail financial products, given that many consumers find it difficult to evaluate the complex products on offer. However, conflicts of interest, which are pervasive in some parts of the industry, can turn advice into a curse rather than a blessing for consumers, especially when consumers are not sufficiently wary.'

There are various reasons why financial advisors can have a positive influence on household finances. Firstly, financial advisors are generally better educated (at least in financial matters) than the average investors and have acquired more financial experience as well as having better knowledge of the various products available to potential investors. As reported by Kaustia et al. (2008), there could still be some behavioural biases, but these should be lower than those reported for the average investor. Moreover, their experience in financial markets should make them better prepared for possible financial shocks and should make them more financially rational even if they do not possess superior information. Secondly, financial advisors can take advantage of economies of scale, which

may lower costs related to the acquisition of information, as suggested by Hackethal et al. (2012).

Given the discussion above, it is natural to think that financial advisors should improve the layperson's financial position, in particular in terms of returns and portfolio risk. As shown in many studies, less sophisticated investors tend to hold portfolios that are not well diversified and would be defined as sub-optimal. The behavioural finance literature has revealed that individuals are prone to investment biases resulting in portfolio decisions that are at odds with standard portfolio theory (e.g. Benartzi and Thaler, 2007; Barber and Odean, 2000).

Notwithstanding the potential positive benefits for investors outlined above, the literature has also reported negative effects. For instance, Bergstresser et al. (2009) document a negative relationship between advisor involvement and investor performance in U.S. mutual funds. Hackethal et al. (2012) show that relying on a financial advisor may lower the risk-adjusted returns once the advisor's fee has been taken into account. Moreover, in an audit study, Mullainathan et al. (2012) find that advisors are unable to correct the client biases that make their portfolios sub-optimal.

Interestingly, Bhattacharya et al. (2012) explore the demand side of financial advice by analysing the response of approximately 8,000 retail customers to a large brokerage's offer of unbiased investment advice and find that those investors who are least likely to obtain the advice are those who need it the most. Furthermore, the small number of investors who do obtain the advice tend not to follow it, with only limited improvements in their portfolio efficiency observed. Similarly, Hackethal et al. (2012) find that the less financially sophisticated investors are the least likely to use a financial advisor. Similarly, in the context of Italy, Calcagno and Monticone (2015) find that the demand for financial advice is the lowest for those with the lowest levels of financial literacy and that a high level of financial literacy is inversely associated with the probability of delegating the portfolio choice. Hence, such findings suggest that there may be demand side as well as supply side issues at play in the provision of financial advice.

As stated by Hackethal et al. (2012), 'literature suggests an ambiguous effect of financial advice on net returns and risk profiles of client portfolios.' Our analysis will shed further light on the existence of such positive and negative effects in the context of UK financial portfolios for a nationally representative sample of households, where limited research on the role of financial advisors has been conducted. In addition, we explore the relationship between portfolio shares and financial risk, whilst accounting for the effects of financial advice. Thus, our findings related to financial risk in particular may serve to highlight areas in which the regulation of the provision of financial advice in the UK may be worthy of further consideration. We discuss policy implications further in Section 6 below.

3. Data and Methodology

Our empirical analysis is based on data from the UK *Wealth and Assets Survey* (WAS), which is a biennial longitudinal household survey measuring the personal and economic well-being of individuals and households by assessing levels of assets, debt, savings and planning for retirement. The WAS also provides information on a host of socio-demographic factors that we control for in our analysis. The survey started in 2006 and covers Great Britain: England; Wales; and Scotland.[1] We primarily analyse information from waves 4 and 5 (collected between 2012 and 2016), which yield a sample of $25,594$ observations comprising $18,384$ heads of household, i, observed over time, t, either once or twice (on average, we have 1.39 observations per household). In these two waves, a specific section of the questionnaire asks respondents a detailed set of questions about financial advice, the focus of our analysis. In the following sub-sections, we introduce firstly the outcomes of interest, the portfolio shares, and, secondly, the measures of financial advice.

[1]The WAS has been used to study a number of different areas related to household finance, including: the distribution of wealth, Crawford et al. (2016) and Vermeulen (2018); housing equity withdrawal, French et al. (2018); whether households exhibit constant or time-varying relative risk aversion when considering portfolio allocation, Paya and Wang (2016); the role of monetary policy on income and wealth inequality, Bunn et al. (2018); and the value of financial advice, Brancati et al. (2017).

3.1. Dependent Variables

We initially consider two broad sets of dependent variables: (1) financial portfolio shares (including bonds and stocks); and (2) total portfolio shares, which are made up of financial and non-financial (i.e. real and business) components.

3.1.1. Financial Portfolio Shares

We focus on the share of bonds and the share of stocks in the household's financial portfolio. Bonds are defined as the sum of: fixed term investment bonds; national savings products; UK bonds or gilts; overseas bonds or gilts; insurance products; and other investments. We define stocks as the sum of: investment Individual Savings Accounts (ISAs), a form of UK investment that is exempt from tax on its returns; unit investment trusts; employee shares; employee options; UK shares; overseas shares; and other stock investments. The two dependent variables capturing the financial asset shares are defined as the value of bonds and the value of stocks over financial wealth, FW_{it}, for household i at time t, which is defined as follows:

$$FW_{it} = Deposits_{it} + Bonds_{it} - Loans_{it} + Stocks_{it} \tag{1}$$

where deposits are the sum of: current accounts; savings accounts; and cash ISAs. Loans are defined as the sum of: outstanding credit card balances; outstanding store card balances; outstanding mail order accounts; hire purchase agreements; formal loans excluding loans from a student loan company; and students loans from a student loan company.

3.1.2. Total Portfolio Shares

For the total portfolio shares, we construct four total portfolio metrics. Firstly, we start by calculating the value of the total (or complete) wealth, TW_{it}, for household i at time t, which is defined as follows:

$$TW_{it} = FW_{it} + RealEstate_{it} + Business_{it} + Pensions_{it} \tag{2}$$

Where FW_{it} is the financial wealth as defined in Equation 1. Real estate wealth is the sum of the total value of: the main residence; other houses excluding the main residence; buy to let houses; buildings; UK land; overseas land; other property; and collectables. From this, we deduct the value of mortgages on primary and other residences as well as equity release. Business wealth is defined as the sum of main business wealth and other business wealth net of debt minus main business debts. The last component is the total value of the household's pension. The four total asset share variables are defined as the value of bonds, stocks, business wealth and real estate over the value of the total portfolio, TW_{it}.

Table I Panel A provides an overview of the portfolio composition of UK households, where it is apparent that our share variables all lie on the unit interval.[2] As expected, the largest share of the total portfolio is allocated to real estate (38%), with the share allocated to bonds and shares both being much smaller at 22%. Focusing on the financial shares, the allocations to bonds and stocks are 16% and 14%, respectively. Turning to the difference in portfolio composition between households that received financial advice and those that did not, it is apparent that the former exhibits higher total portfolio shares across all asset categories. A similar pattern is apparent when focusing on financial portfolios, with a particularly marked difference in the shares of stocks across those who received financial advice and those that did not. This pattern is represented graphically by the kernel density plots in Figure A.1.[3]

[2]The percentage of observations at zero for each dependent variable is as follows: 51.5% for the share of bonds in the financial portfolio; 64.3% for the share of stocks in the financial portfolio; 14.1% for the share of bonds in the total portfolio; 16.9% for the share of stocks in the total portfolio; 22.5% for the share of business wealth in the total portfolio; and 6.9% for the share of business wealth in the total portfolio.

[3]In terms of the relative dispersion, the standard deviation of the total portfolio composition of households that received financial advice is 0.156 as compared to 0.097 for those that did not receive such advice.

3.2. Measures of Financial Advice

As noted above, in waves 4 and 5 of the WAS, detailed information is available on financial advice. Specifically, respondents are asked: *"Can I just check, have you received any expert financial advice in the last two years?"*, where across the two waves, 16.15% reported that they have received advice from an expert, see Table I Panel B. A subsequent question asks respondents: *"In the last two years, how many times have you received expert financial advice?"*, where the average is 0.29 (ranging between 0 and 50), with 3% having received advice on three or more occasions. The corresponding figures for those who received financial advice are 1.79 and 9%, respectively. Finally, in a follow-up question, respondents are asked about the specific type of advice received: *"thinking about the time you received expert financial advice, what was the main financial reason for seeking the advice?"*, where the responses are as follows, see Table I Panel B (the figures in parenthesis are for those households who received financial advice): investments 6.67% (41.27%); savings 1.82% (11.29%); pensions 2.53% (15.64%); debt 2.28% (14.10%) and other reasons, such as changes in life circumstances 2.86% (17.70%). Hence, we initially control for financial advice, F_{it}, in three ways: a binary indicator denoting whether financial advice has been received; the number times financial advice has been received; and, finally, a set of dummy variables denoting the type of financial advice received.

We then explore a range of variables, which provide further details regarding the financial advice received, defined as binary indicators, s_{it}. Specifically, those respondents who received expert financial advice were asked whether this involved a consultation with a financial advisor. Table I Panel B shows that only 9.26% of those who received financial advice did not have such a consultation. If the provision of financial advice did involve a consultation, the respondent was asked *"thinking about this financial advisor, what type of organisation did they work for?"*. We distinguish between: financial advisors who work for a bank or building society; those who are a sole financial advisor or work for a firm of financial advisors; those who work for a stockbroker or wealth manager; and, finally,

an 'other' category, which includes financial advisors who work for insurance companies, accountants, solicitors, charity or another type of agency. Table I Panel B reveals that, out of those receiving financial advice, a consultation with a sole financial advisor or an advisor working for a firm of advisors is the most prevalent at 51.06%, whilst consulting a stockbroker is the least common form of consultation at 3.48%.

Respondents were also asked about product recommendations and product purchase associated with the consultation, where we control for whether: no products were recommended; products were recommended but none were purchased; one product was purchased; and finally, a selection of products were purchased. Respondents were then asked: *"how was the advisor paid for their services?"*, where for those who purchased a product, we control for: a one-off fee; by commission; a combination of fees and commission; as part of an on-going charge; the advice and other services were free; and, finally, 'other' which includes a combination of the previous categories. Receiving free advice (20%) and paying on commission (20.94%) are the most populated categories, see Table I Panel B.

3.3. Other Covariates

Following the existing literature on household portfolios, we control for a wide range of head of household characteristics including: male; marital status; being in very good health; and highest level of educational attainment defined as degree level or above, other qualifications (where no qualifications form the omitted category). We also control for the labour market status of the head of household, specifically whether they are employed or self-employed (all other categories form the omitted category). All models also include head of household age categories (where aged under 25 is the reference category). With respect to household characteristics, controls are included for: whether there are any children in the household; the number of adults in the household; and whether the house is owned outright or via a mortgage. In terms of monetary controls, we include the natural logarithm of household income from employment (i.e. labour income) and benefits (i.e.

non-labour income), as well as financial wealth (as defined above). Finally, we also control for the wave of interview. These control variables are given in the vector $\mathbf{X}_{it}$.[4]

The WAS also includes information on attitudes towards risk, which has attracted considerable attention in the existing literature. Respondents are asked the following *"Here are some things some people have said about savings and stock market investments. Please tell me to what extent you agree or disagree with each. It is better to play it safe with your savings even if investing in higher risk investments could make you more money?"*, where responses are on scale from 1 (strongly agree) to 5 (strongly disagree). The most risk tolerant, labelled as "high risk tolerance", are defined as those who either disagree or strongly disagree with the above statement, comprising 9.4% of responses. Secondly, we define "mid risk tolerance" for those respondents who neither agree nor disagree with the statement, comprising 16.2% of responses. The omitted risk attitudes category consists of respondents who agree (42.4%) or strongly agree (31.81%).[5]

For further context, Table II presents correlation coefficients and associated levels of statistical significance between the dependent variables, receipt of financial advice and risk attitudes. In general, financial advice is positively correlated with the portfolio shares. Specifically, the share of bonds with respect to financial wealth is found to be positively correlated with financial advice and inversely related to risk tolerance. Turning to the total portfolio composition, there is some evidence of contrasting correlations across the variables: for example, real estate and financial advice (which is characterised by a positive correlation) and real estate and risk tolerance (where the correlation is negative). Given such patterns in the data, in the following analysis, we investigate whether financial advice

[4]Following the cohort history specifications of Malmendier and Nagel (2011) and Bucciol and Miniaci (2015), all models include two variables capturing the historical return and standard deviation of the stock market when the head of household was aged between 20 and 24. We used Datastream monthly time series data for the stock market total return index.

[5]In Table A.I in the Appendix, summary statistics are provided for all the covariates used in our analysis, where: 61% of heads of household are male; 28% have a degree and 41% are in paid employment. The final two columns of Table A.I show the average of all variables according to whether financial advice was received or not. Amongst the control variables, noticeably labour income and wealth are higher for those who have received financial advice, whereas, conversely, non-labour income is lower. Heads of household who have received financial advice are also more likely to be home owners.

serves as a substitute or complement for risk attitudes.

3.4. Methodology

Each of the dependent variables defined above are denoted as y_{it}, where we model Equation (3) by OLS using the WAS cross-sectional sample weights and clustering the standard errors at the household level:

$$y_{it} = \alpha + \mathbf{X}_{it}\boldsymbol{\beta} + \gamma F_{it} + \phi s_{it} + \pi(F_{it} \times s_{it}) + \epsilon_{it} \tag{3}$$

We condition each outcome on a range of controls given in the vector $\mathbf{X}_{it}$ (as defined above in Section 3.3) and a binary indicator s_{it} (defined below). Our primary focus is on whether our comprehensive set of measures of financial advice (denoted as F_{it}) has a statistically significant effect, as well as the direction of any effect given the mixed findings on the role of financial advice in the existing literature, and the economic magnitude of any effects compared to those of other key covariates. Specifically, our interest is in the sign, statistical significance and magnitude of γ.[6]

In our baseline specifications, we do not allow for multiplicative effects, i.e. π=0. However, in the extended models, we also explore such heterogeneity. Specifically, the effects of financial advice are interacted with the risk attitudes measures to explore the effects on the financial and complete portfolio shares (where in this case s_{it} is a binary indicator for risk tolerance). Given that attitudes towards risk have attracted considerable attention in the household finance literature, this is conducted in order to ascertain whether financial advice serves as a substitute or complement for risk tolerance, focusing on the sign of π and its magnitude relative to γ. In addition, given the focus in the existing literature on the relationship between education, financial literacy and finance advice, we also explore the effects of the interaction between education and financial advice.

For those heads of household who had a consultation with a financial advisor, we also

[6]The results which follow are robust to using a tobit estimator.

consider the effects of: (i) the type of organisation the financial advisor worked for; (ii) whether products were purchased; and, finally, (iii) how the financial advisor was paid. The responses are defined as the binary indicator s_{it}, see Table I Panel B for summary statistics.

In order to explore the robustness of our findings, in more stringent specifications, we also employ panel fixed effects estimators, where $7,210$ heads of household are observed twice in order to take account of time invariant unobserved effects, i.e. $\alpha = \alpha_i$. In addition, one potential issue with estimating Equation (3) concerns reverse causality between the dependent variables and financial advice. To further investigate this, we restrict the sample to those heads of household who were also present in wave 1 of the WAS, where there was a similar question on financial advice, with $12,209$ observations.[7] Hence, as argued by Angrist and Pischke (2009), in order to mitigate the potential for reverse causality, we replace F_{it} with F_{it-k}, with financial advice predating the outcome variables, i.e. the asset shares.

4. Results

The discussion of our empirical findings is presented in three subsections as follows: (i) the estimates of the effects of financial advice on financial and total portfolios; (ii) an examination of heterogeneity - explicitly in risk tolerance and educational attainment; and (iii) the effects of further characteristics of the financial advice.

4.1. Financial Advice and Household Portfolios

The results from estimating Equation (3) are summarised in Table III, where we present the findings for: the receipt of financial advice (Panel A); the type of financial advice

[7]The specific question is: *"In the last five years, have you received any professional advice about planning your personal finances? By that I mean things like planning for retirement, tax planning, or investing money. But please do not include any advice related to running a business or mortgages."* Hence, the reference period of the advice is longer than that in waves 4 and 5 of the WAS.

received (Panel B); and the number of times financial advice was received (Panel C). In Panel A, we also present the results relating to our risk tolerance measure for purposes of comparison. Hence, for brevity, we only report the estimates of the key parameters of interest, namely: financial advice, i.e. γ; and risk tolerance, i.e. ϕ. The findings related to the other explanatory variables are in line with the existing literature and can be found in the Appendix for reference (see Table A.II). In Table III, we firstly present the effects on the total portfolio shares (columns 1 to 4) followed by the financial portfolio shares (columns 5 and 6).

It is apparent that receipt of financial advice is positively associated with all asset shares (total and financial) with the exception of real estate assets, where financial advice is inversely associated with the value of real estate assets as a share of total wealth. Furthermore, the effects of financial advice are strongly statistically significant across all asset types. In the case of total portfolio shares, we can see that the magnitude of the effect in absolute terms is highest for the share of real estate, which is closely followed by the share of stocks. Given that we have controlled for outstanding loans, the inverse association between the share of real estate and financial advice may reflect the fact that financial advice in the UK is generally received in the context of mortgage debt, which will be lower or even zero for those holding a high degree or 100% of equity in their housing assets. The effect of financial advice on the share of business assets is in contrast relatively small, although the effect is positive and statistically significant.

Turning to financial wealth, we can see that financial advice has a particularly large coefficient for the share of stocks (0.109) compared to the share of bonds (0.040). Specifically, this corresponds to an average increase in the shares of stock and bond holdings of 12.53% and 3.97%, respectively.[8] Finally, if we compare these effects with those of risk tolerance, it is apparent that high risk tolerance is negatively associated with the share

[8]This is calculated from the elasticity: $\left(\frac{\partial y}{\partial F} \times \frac{\overline{F}}{\overline{y}}\right) \times 100\%$. The mean values of portfolio composition and financial advice (as reported in Table I) are denoted by $\overline{y}$ and $\overline{F}$, respectively, and $\frac{\partial y}{\partial F}$ is given by the estimate of γ from Equation (3).

of bond holdings and positively associated with the share of stocks, with a coefficient of 0.050. This result is in line with standard finance theory, which predicts that the higher is the individual's tolerance to risk, the higher (lower) will be the investment in risky (safe) assets.

Turning to the effects of the type of financial advice received by the household presented in Panel B, we distinguish between five categories: financial advice for investments, savings, pensions, debt and other reasons. With respect to advice for investments, savings and pensions, the pattern of the effects generally mirrors that for the receipt of financial advice with the exception of the share of business assets, where the effects are now statistically insignificant. Among these categories of financial advice, the largest coefficients are found for advice for investment for both total wealth and financial wealth. Advice for debt is statistically insignificant across the asset shares, which accords with expectations given the focus on asset shares, whilst advice for other reasons follows the general pattern for the first three types of advice discussed above.

The results in Panel C shed light on whether the number of times financial advice was received influences the asset shares, i.e. the effects of an intensity measure. To account for potential non-linearities, this measure is entered in the model as a quadratic polynomial. As expected, the effect of the absolute value is positive and statistically significant for all asset types across both the total and financial shares, with the exception of real estate, where the effect, as in Panels A and B, is negative. In addition, the pattern in terms of the relative magnitudes of the effects of this frequency measure is in line with the previous findings, with particularly large effects observed for stocks and real estate. The squared term takes the opposite sign thereby suggesting concavity, i.e. diminishing returns to advice. The general picture that emerges from this analysis is that financial advice is positively associated with the portfolio shares of bonds, stocks and business wealth, while it is inversely associated with the share of real estate, up to a turning point of receiving advice twice.[9] After receiving advice twice, any further advice is associated

[9]The turning point is the specific number of times advice was received that leads to a marginal effect

with decreasing the shares of bonds, stocks and business wealth, and increasing the share of real estate.

Overall, the above analysis is consistent with evidence presented in the existing literature. For example, for the U.S., Shum and Faig (2006) report positive effects of financial advice on stock ownership.[10] In order to explore the robustness of our findings, we re-estimate Equation (3) using fixed effects to control for unobserved time invariant household characteristics. The results of this analysis on the sub-sample of households with repeated observations are shown in the Appendix, see Table A.III, where the structure of Panels A to C mirrors that of Table III. The null hypothesis that the fixed effect is equal to zero is rejected in all estimates. However, the positive effects of the receipt of advice (Panel A), type of advice (Panel B), and the frequency of financial advice received (Panel C) generally mirror that found in Table III.

In order to explore the robustness of our findings to reducing the potential for reverse causality, in Table A.III Panel D, we condition the total and financial portfolio shares at time t on financial advice received during wave 1 of WAS, i.e. t-k. Hence, the financial advice predates the portfolio shares. Once again, the finding that the receipt of financial advice influences portfolio allocations remains as does the pattern in terms of the direction and magnitudes of the effects across the different asset shares. Given that, on average, there is an 8 year gap between wave 1 and waves 4 and 5 of WAS, the similar magnitudes found when comparing point estimates between Tables III and A.III suggest that the effects of financial advice are long lasting.

of zero, and is obtained from the comparison between the linear and squared terms. For instance, for the total portfolio share in stocks, the turning point is $0.224/(2 \times 0.061) = 1.84$.

[10]Existing research has found positive effects on financial portfolios stemming from receiving financial advice. For example, for Dutch investors, Kramer (2012) finds that the portfolios of advised investors are more diversified and perform better. Similarly, for Germany, Bhattacharya et al. (2012) find an improvement in the performance of portfolios for those investors who have taken financial advice.

4.2. Heterogeneity

To further understand the effect that financial advice has on a household's financial portfolio, we explore the existence of heterogeneity in the effects in terms of the head of household's risk attitudes and education, see Table IV. Our focus reflects the attention paid to risk attitudes and education in the existing literature on portfolio allocation. We estimate two additional models, where receipt of financial advice is interacted with the head of household's risk tolerance (Panel A) and the head of household's level of education (Panel B). This allows us to explore the existence of any heterogeneity that may be hidden in the previous set of results. Focusing on the first set of results in Panel A, some interesting patterns are apparent. Firstly, receiving financial advice and having a head of household with low risk tolerance is inversely associated with the share of the total portfolio allocated to real estate. This is in line with the previous evidence in Table III. Secondly, there is a marked positive correlation between the amount of stocks held in the portfolio and the receipt of financial advice when interacted with risk attitudes. In particular, focusing on the share of financial wealth, the effect is monotonically increasing in the level of risk tolerance. Finally, receiving financial advice and having a head of household characterised by low risk tolerance is positively associated with the share of bonds in the portfolio.

In Table IV Panel B, we investigate the interaction between the receipt of financial advice and the level of education of the head of household. Firstly, a positive and increasing (decreasing) association between the head of household's level of education and stock (bond) holdings as a share of financial wealth is observed when interacted with receipt of financial advice. In the case of real estate, as found in Table III, receipt of financial advice is inversely associated with the share allocated to this form of asset for every level of education. For total portfolio shares, there is some evidence that financial advice has larger effects for those with no qualifications, who, as argued by Calcagno and Monticone (2015), are likely to be the least financially literate.

4.3. Additional Financial Advice Variables

A key advantage of the WAS for our analysis is that it contains more detailed information on financial advice than has typically been available in the literature in the context of a nationally representative dataset. This allows us to undertake comprehensive analysis of the effects of a wide range of characteristics of the financial advice received by households. In what follows, we consider the effects of: (i) the type of advisor providing the financial advice; (ii) whether products were purchased following the advice; and (iii) how the financial advice was paid for.

To investigate each of these facets of financial advice, we estimate the multiplicative form of Equation (3), where in each regression the reference category for the interactions shown is a household which does not receive financial advice. Tables V to VI present the results for the total portfolio shares (columns 1 to 4) followed by the financial portfolio shares (columns 5 and 6), where the reported coefficients from Equation (3) are the estimates of $(\phi+\pi)$.

Table V Panel A presents the results relating to the type of consultation that households had in order to obtain financial advice. Interestingly, even having received financial advice but without a formal consultation is positively associated with the shares of bonds and stocks and inversely associated with the share of real estate, as found in Table III. Clearly, having a consultation with a stockbroker has a particularly large effect on the share of stocks in both the total portfolio and the financial portfolio at 0.095 and 0.357, respectively (although only a small fraction of households consult a stockbroker, see Table I Panel B). Having had a consultation with an independent (or firm of) financial advisor(s) has a larger effect on the stock component of both the total and financial portfolios as compared to that of a building society. The finding that advice received through a stockbroker and advice from independent financial advisors have the dominant effects on portfolio allocation in terms of stocks is consistent with economies of scale with lower costs related to the acquisition of information for those with expertise in financial markets, as

well as better knowledge of available products and training than investors, as discussed in Hackethal et al. (2012) and Inderst and Ottaviani (2012).

We now consider the effects of whether any products were purchased following the consultation with a financial advisor, see Table V Panel B. Interestingly, even if no products were recommended during the consultation, there are positive effects on the shares of both bonds and stocks held in the total and financial portfolios. This suggests that imparting knowledge through a consultation is influential even if products were not recommended. A similar result is also apparent if no products were purchased (but they were recommended) following the consultation for financial portfolio shares. For the financial portfolio shares, buying one or a selection of products have the largest effects on bonds (stocks) at 0.44 and 0.062 (0.078 and 0.203), respectively.

Finally, in Table VI, we investigate the effects of how the consultation was paid for. It is noticeable that, compared to having no financial advice, even free financial advice has a positive association with total and financial portfolio shares when considering bonds and stocks. Focusing on the share of stocks in the total and financial portfolios, it is apparent that, although financial advice paid for by a one-off-fee is positively associated with these shares (relative to households not having any financial advice), this effect is smaller compared to that of financial advice received through a consultation paid via commission or an ongoing charge. This suggests that the portfolios of household investors, who are less attached to the market (as captured by paying a one-off-fee), are affected the least.[11]

[11]We also explore the effects of whether respondents were satisfied with the advice received, where the majority of respondents reported being satisfied with the advice. The magnitude of the association between the portfolio shares and financial advice (as well as the statistical significance) is larger for those who were more satisfied with the advice, relative to those who were less satisfied. In a similar vein, we have explored the effects of whether the respondent would trust an independent financial advisor for advice about saving for retirement. This question is asked to all respondents regardless of whether or not they have received financial advice and allows us to investigate the effects of trust in financial advisors more generally on household portfolio shares. Consistent with findings in the existing literature, e.g. see Balloch et al. (2015), trust is positively related to both total and financial portfolio allocations (with the exception of real estate where the effect is negative). However, when we interact trust with the receipt of financial advice, there are generally no significant differences on portfolio allocations (although both the effects remain positive and significant, with the exception of real estate where the association is negative).

5. Portfolio Risk Composition

5.1. Methodology

One of the key insights from the findings presented in the previous section is that the financial and total portfolio shares of a household that has received financial advice are substantially different from those of a comparable household that has not received such advice. In summary, receiving financial advice is associated with lower holdings of real estate and larger holdings of bonds and shares. As a result, there is a change in the source of risk for the portfolio. The real component decreases and, correspondingly, the financial component is characterised by a statistically significant increase. Consequently, having found that financial advice has important effects on portfolio shares, we now consider the implications of this for portfolio risk.

In order to capture portfolio risk, we follow Bucciol and Miniaci (2015). Consider an environment where household $i = 1, ..., N$ has to allocate its wealth in a portfolio comprising one risk-free asset and a set of n risky assets. At time t, the risky portfolio shares are $w_{it} = [w_{it,1} w_{it,2} ... w_{it,n}]'$, and all the (risky and risk-free) shares sum to one. Moreover, information on the historical variances and covariances of the risky asset returns in excess of the risk-free asset return is contained in matrix Σ_t at time t. We can then calculate the expected portfolio variance at time t for household i as follows:

$$\sigma_{it}^2 = w_{it}' \Sigma_t w_{it}. \tag{4}$$

We distinguish between financial portfolios comprising deposits, bonds net of loans, and stocks ($n = 2$ risky assets) and total portfolios comprising deposits, bonds net of loans, stocks, real estate and business wealth ($n = 4$ risky assets), as defined above. We measure variances and covariances from historical time series of annual excess returns, using a 20-year rolling time span; for details see the Appendix. We refer to the *financial variance*,

σ_{it}^{f2}, and the *complete variance*, σ_{it}^{c2}, as the variance obtained from the application of Equation (4) to the financial and total portfolios, respectively. These two variables have means (standard deviations) of 0.003 and 0.004 (0.006 and 0.003), respectively.

The complete portfolio includes two distinct types of asset (i.e. financial and non-financial). Without loss of generality, we assume that the first $m < n$ assets are financial, and the remaining $n - m$ assets are non-financial. We then split the complete variance into two components: the *financial component* σ_{it}^{fc}, capturing the portion of the complete variance originating from the financial assets,

$$\sigma_{it}^{fc} = \sum_{j=1}^{m} w_{it,j}\sigma_{it,j} \tag{5}$$

and the *non-financial component* σ_{it}^{nc}, capturing the portion of the complete variance originating from the non-financial assets,

$$\sigma_{it}^{nc} = \sum_{j=m+1}^{n} w_{it,j}\sigma_{it,j} \tag{6}$$

where $\sigma_{it,j}$ is the covariance between the portfolio return and the return on asset j,

$$\sigma_{it,j} = w_{it,j}^2\sigma_{t,jj} + \sum_{k\neq j} w_{it,j}w_{it,k}\sigma_{t,jk} \tag{7}$$

and $\sigma_{t,jk}$ is the covariance at time t between the excess returns on assets j and k. The financial and non-financial components shown in Equations (5) and (6) can be negative as well as positive. The corresponding means (standard deviations) are 0.003 and 0.001 (0.003 and 0.001), respectively. In terms of portfolio risk, the most volatile risk metric is the complete variance, σ_{it}^{c2}.

Having defined portfolio risk, we now turn to exploring the relationship between portfolio composition, portfolio risk and financial advice. The initial premise is that households are able to exert direct control over their portfolios but only indirect control over the associated risk. Specifically, households can directly change the composition of their

portfolio, i.e. they can buy or sell any particular financial instrument, but they can only have a limited and indirect effect on the overall risk. This risk is determined by the actions of numerous agents (such as investors and policy makers), over which the household has no direct control. Hence, when analysing portfolio composition and its relationship with the portfolio's risk, it is important to acknowledge that portfolio risk is influenced not only by the amount of risky and/or safe assets in the portfolio but also by events that lie outside of the household's control. Moreover, in general, the household's decision to buy or sell a financial asset is based on the risk profile of that particular asset. Hence, portfolio composition and risk are likely to be jointly determined.

In this setting, the financial advisor has a direct effect on the household's portfolio allocation (as demonstrated by the findings in Section 4) but only an indirect effect on portfolio risk. To capture this set-up, we jointly estimate portfolio composition and portfolio risk as a system, see Roodman (2011), as follows:

$$y_{1it} = \alpha_1 + \mathbf{X}_{it}\boldsymbol{\beta}_1 + \gamma_1 F_{it} + \epsilon_{1it} \tag{8.1}$$

$$y_{2it} = \alpha_2 + \mathbf{X}_{it}\boldsymbol{\beta}_2 + \gamma_2 F_{it} + \epsilon_{2it} \tag{8.2}$$

$$y_{3it} = \alpha_3 + \mathbf{X}_{it}\boldsymbol{\beta}_3 + \gamma_3 F_{it} + \epsilon_{3it} \tag{8.3}$$

$$y_{4it} = \alpha_4 + \mathbf{X}_{it}\boldsymbol{\beta}_4 + \gamma_4 F_{it} + \epsilon_{4it} \tag{8.4}$$

$$\sigma_{it} = \alpha_5 + \mathbf{X}_{it}\boldsymbol{\beta}_5 + \sum_{j=1}^{k} \phi_j y_{jit} + \epsilon_{5it} \tag{9}$$

where y_{kit} is the k^{th} portfolio share, σ_{it} denotes one of the above measures of portfolio risk and financial advice is given by F_{it}. Portfolio risk depends upon each of the portfolio shares, where it is only affected indirectly by financial advice. When we consider aspects of the portfolio as a share of financial wealth, $k = 2$ (i.e. y_1=$Bonds/FW$ and y_2=$Stocks/FW$). Conversely, when focusing on the portfolio composition as shares

of total wealth, $k = 4$ (i.e. y_1=$Bonds/TW$, y_2=$Stocks/TW$, y_3=$RealEstate/TW$ and y_4=$Bonds/TW$).

5.2. Results

The results of the system analysis are presented in Table VII, where portfolio composition and risk are jointly estimated. Panel A provides the results of estimating Equation (8), whilst Panel B shows the relationship between the risk metrics and the portfolio composition, Equation (9). There are four sets of estimates shown across the columns based upon the alternative risk metrics as defined above. For brevity, only the estimates of γ_k and ϕ_j are reported in Panels A and B, respectively.

Focusing initially on Panel A, each portfolio share is considered, i.e. y_k, where the receipt of financial advice is used to model the share of assets, as motivated above. Clearly, for all portfolio composition measures, there is evidence of a statistically significant association with financial advice and, with the exception of $RealEstate/TW$, the relationship is a positive one.[12] Noticeably, the estimates shown in Panel B are also very similar to those shown in Table III Panel A.

Table VII Panel B shows the estimates associated with Equation (9), where we have four alternative dependent variables, each capturing the different risk portfolio compositions: the financial variance; the complete variance; the financial component of the complete variance; and the real component of the complete variance.

In the first column of Panel B, the focus is on the financial variance. There is evidence that the shares of bonds and stocks in the financial portfolio ($Bonds/FW$ and $Stocks/FW$) have a statistically significant positive relationship with the financial variance, σ_{it}^{f2}. Specifically, the coefficients of interest, ϕ_1 and ϕ_2 in Equation (9), are both statistically significant at the 1% level and equal to 0.0012 and 0.0207, respectively. In-

[12] As noted above, given that we have controlled for outstanding loans, the inverse association between the share of real estate and financial advice may reflect the fact that financial advice in the UK is generally received in the context of mortgage debt, which will be low for those with a high proportion of equity in their housing assets.

deed, these are sizable effects given that the mean of the dependent variable is 0.003 with a standard deviation of 0.006.

When focusing on the complete variance, column 2 of Panel B σ_{it}^{c2}, as explained above, we consider portfolio allocations as a share of total wealth. All shares are found to have a positive and statistically significant impact on the variance of the total portfolio. The smallest coefficient is for $Bonds/TW$ with an estimate of 0.0028, whilst the largest coefficient in terms of magnitude is on $Stocks/TW$, which has a coefficient of 0.0168. In line with the previous results shown in the first column of Panel B, the estimated effects are economically significant, given that the mean of σ_{it}^{c2} equals 0.004 with a standard deviation of 0.003.

As the complete portfolio includes two distinct types of assets, financial and non-financial, we can split the complete variance into its financial and real components, σ_{it}^{fc} and σ_{it}^{nc}, respectively. The final two columns of Table VII Panel B present the effects of portfolio composition as a share of total wealth on these two risk metrics. Not surprisingly, for $Bonds/TW$ and $Stocks/TW$, the estimates of ϕ_1 and ϕ_2 from Equation (9) are larger in terms of magnitude for the financial component. Moreover, an increase in the share of stock holdings is positively associated with the variance of the financial component, but has an inverse relationship with the real component. This result is in accordance with expectations, since the financial (real) component captures the portion of the complete variance originating from the (non-)financial assets.

A stronger association between $RealEstate/TW$ and the real component is revealed in comparison to the financial component, i.e. the estimate of ϕ_3, with respective coefficients of 0.0057 and 0.0023. Turning to $Business/TW$, no statistically significant effect is found on the financial component, whilst the estimate of ϕ_4 on the real component is 0.0024. Although the coefficients appear small in absolute terms, their financial significance is non negligible; in fact, the corresponding means (standard deviations) of the financial and real components of the complete variance are 0.003 and 0.001 (0.003 and 0.001), respectively.

To summarise, by jointly modelling the composition of the portfolio and risk metrics,

and allowing financial advice to have a direct impact on portfolio allocation whilst indirectly influencing risk, there is clear evidence that portfolio shares are positively associated with greater risk (with the exception of $Stocks/TW$ and the real component).[13]

6. Conclusion

Our findings have shown that financial advice plays an important role in shaping the composition of UK household financial portfolios. Specifically, our results, which are based on a nationally representative survey of the population, suggest that financial advice is associated with a reallocation of wealth away from real estate and towards bonds and stocks. The inverse association found between the share of real estate and financial advice may reflect the fact that financial advice in the UK is often received in the context of mortgage debt. In addition, we exploit the detailed information in the WAS on numerous facets of the financial advice received, which is typically not available in large scale sample surveys.

Exploring the various reasons why households seek financial advice, we find that "advice for investments" consistently has the largest effect, with this type of advice primarily affecting the share of the portfolio held in stocks (positively) and the share held in real estate (negatively). With respect to the type of financial advisor, we find that having a consultation with a stockbroker has a particularly large effect on the share of stocks held in the portfolio. In addition, even free financial advice has a positive effect on the shares of bonds and stocks held in the portfolio compared to not receiving financial advice.

Finally, we explore the relationship between portfolio shares and risk, whilst accounting for the effects of financial advice. For financial wealth, we find a positive association between the shares of stocks and bonds in the portfolio and the risk of the portfolio, after

[13] In an alternative specification, we have estimated the joint model using the type of financial advice. The results of estimating the first part of the system, i.e. portfolio shares Equation (8), not reported here for brevity, are identical to those shown in Table III Panel B. Moreover, the point estimates of portfolio shares in the risk metric outcomes, i.e. Equation (9), where the type of financial advice has an indirect effect on risk are unchanged from those reported in Table VII Panel B.

controlling for the influence of financial advice in portfolio composition. In the case of the complete variance measure of portfolio risk, all measures of portfolio composition are positively associated with risk. Hence, financial advice influences the shares of stocks, bonds, real estate and business assets held, which in turn influence the risk composition of the household portfolio.

From a policy perspective, in the UK, there have been changes to the financial regulatory body with the establishment of the Financial Conduct Authority (FCA) in 2013 with the overall aim to 'make markets work well – for individuals, for business, large and small, and for the economy as a whole'. The regulation of financial promotions to ensure that the consumers do not receive misleading information falls under this remit. Indeed, the UK Money and Pensions Service (formerly the Money Advice Service, established with cross government part support), which provides 'free and impartial advice on money and financial decisions to people', covers areas such as whether individuals need a financial advisor. Furthermore, the Financial Advice Market Review (FAMR) was launched in 2015 by the FCA and HM Treasury to develop affordable and accessible financial advice and guidance for customers and a further review was launched in 2019 to explore the impact of the FAMR on improving the outcomes of customers from financial advice and guidance.

Such actions by policymakers are a clear signal that the role of financial advice in the UK is under a certain degree of scrutiny and that there is a commitment to considering ways to improve the working of the market for financial advice from the consumer's perspective. Hence, our findings shed further light on the effects of financial advice on UK household finances, which we hope will stimulate further academic interest in this highly policy-relevant area.

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Table I: Summary statistics

Panel A: Dependent variables

	Mean	Std Dev	Min	Max	Mean if ADVICE=1	Mean if ADVICE=0
Bonds/TW	0.2191	0.167	0	1	0.2289	0.2172
Stocks/TW	0.2167	0.170	0	1	0.2646	0.2075
Real Estate/TW	0.3825	0.304	0	1	0.3945	0.3802
Business/TW	0.0118	0.076	0	1	0.0184	0.0105
Bonds/FW	0.1627	0.254	0	1	0.1848	0.1585
Stocks/FW	0.1405	0.259	0	1	0.2972	0.1103
Number of households (N)		18,384			3,610	16,222
Observations (NT)		25,594			4,136	21,461

Panel B: Financial advice variables

	Mean	Std Dev	Min	Max
Any financial advice received	0.1615	0.368	0	1
Number of times financial advice received	0.2896	1.022	0	50
Financial advice for investments	0.0667	0.249	0	1
Financial advice for savings	0.0182	0.134	0	1
Financial advice for pensions	0.0253	0.157	0	1
Financial advice for debts	0.0228	0.149	0	1
Financial advice for other reasons	0.0286	0.167	0	1
For those who received financial advice				
No consultation	0.0926	0.290	0	1
Consultation with building society	0.2326	0.475	0	1
Consultation with financial advisor	0.5106	0.500	0	1
Consultation with stockbroker	0.0348	0.183	0	1
Consultation with other	0.1294	0.336	0	1
No products recommended	0.3426	0.475	0	1
No products purchased	0.1018	0.302	0	1
One product purchased	0.2764	0.447	0	1
Selection of products purchased	0.1920	0.394	0	1
Did not buy product	0.0965	0.295	0	1
Free advice	0.2009	0.401	0	1
One-off-fee	0.1356	0.342	0	1
Commission	0.2094	0.410	0	1
Fee and commission	0.0730	0.260	0	1
Ongoing charge	0.1054	0.307	0	1
Other type of payment	0.0776	0.268	0	1
Households (N)		18,384		
Observations (NT)		25,594		

Notes: *Bonds* include fixed term investment bonds, national savings products, UK bonds or gilts, overseas bonds or gilts, insurance products, and other investments. *Stocks* include investment Individual Savings Accounts (ISAs), unit investment trusts, employee shares, employee options, UK shares, overseas shares, and other stock investments. *Real estate* includes the main residence, other houses, buy to let houses, UK and overseas lands, other properties, and collectables, minus the value of mortgages on primary and other residences as well as equity release. *Business* includes main and other business wealth net of debt. *Financial Wealth (FW)* includes deposits (current and savings accounts, and cash ISAs), bonds minus loans (outstanding credit card and store card balances, outstanding mail order accounts, hire purchase agreements, formal loans excluding loans from a student loan company, and students loans from a student loan company), and stocks. *Total Wealth (TW)* includes deposits, bonds minus loans, stocks, real estate, business wealth and the total value of the household's pension. All the variables in panel B are dummies, with the exception of the number of times financial advice was received.

Table II: Correlation of the dependent variables with financial advice and risk tolerance

	Financial Advice	Low Risk Tolerance	Mid Risk Tolerance	High Risk Tolerance
Bonds/TW	0.0257***	0.0275***	-0.0259***	-0.0084
Stocks/TW	0.1234***	0.0058	-0.0207***	0.0175**
Real Estate/TW	0.0173***	0.0430***	-0.0465***	-0.0055
Business/TW	0.0383***	-0.0181**	0.0118*	0.0123**
Bonds/FW	0.0381***	0.0419***	-0.0428***	-0.0085
Stocks/FW	0.2656***	-0.0560***	0.0151**	0.0648***
Observations			25,594	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table III: Portfolio shares and financial advice

Panel A: Whether financial advice received

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice	0.018***	0.035***	-0.038***	0.005**	0.040***	0.109***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.006)	(0.006)
Mid Risk Tolerance	-0.011**	-0.004	0.006	0.000	-0.022***	0.031***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.005)	(0.004)
High Risk Tolerance	-0.010**	0.003	0.018***	0.001	-0.006	0.050***
	(0.005)	(0.005)	(0.006)	(0.002)	(0.006)	(0.006)
R-squared	0.152	0.153	0.550	0.099	0.195	0.179
Observations	25,594	25,594	25,594	25,594	25,594	25,594

Panel B: Type of financial advice

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Advice for Investments	0.039***	0.074***	-0.083***	0.000	0.081***	0.235***
	(0.005)	(0.005)	(0.007)	(0.002)	(0.009)	(0.010)
Advice for Savings	0.017**	0.020**	-0.048***	0.005	0.021*	0.033**
	(0.008)	(0.009)	(0.013)	(0.005)	(0.012)	(0.014)
Advice for Pensions	0.016**	0.025***	-0.032***	0.006	0.020*	0.081***
	(0.007)	(0.007)	(0.010)	(0.006)	(0.012)	(0.014)
Advice for Debt	0.001	0.003	0.013	-0.004	0.008	-0.001
	(0.009)	(0.008)	(0.014)	(0.005)	(0.012)	(0.009)
Advice for Other Reasons	0.006	0.020**	-0.018	0.021***	0.034***	0.089***
	(0.009)	(0.008)	(0.011)	(0.006)	(0.013)	(0.012)
R-squared	0.153	0.154	0.552	0.101	0.197	0.199
Observations	25,594	25,594	25,594	25,594	25,594	25,594

Panel C: Number of times financial advice received

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
# Fin. Advice Received	0.086***	0.224***	-0.231***	0.028**	0.192***	0.668***
	(0.018)	(0.021)	(0.027)	(0.013)	(0.029)	(0.040)
# Fin. Advice Received Sq.	-0.036***	-0.061***	0.077***	-0.006	-0.064***	-0.153***
	(0.010)	(0.011)	(0.016)	(0.004)	(0.015)	(0.034)
R-squared	0.152	0.153	0.551	0.099	0.194	0.188
Observations	25,594	25,594	25,594	25,594	25,594	25,594

Notes: OLS regression models with standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Other controls include: gender; age; highest educational attainment; whether in very good health; whether any children; number of adults in household; whether single; labour market status; whether the home is owned; the natural logarithm of labour income, benefit income and financial wealth; and the historical return and standard deviation of stock market returns.

Table IV: Portfolio shares, financial advice and heterogeneity

Panel A: Financial advice and risk tolerance

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
No Financial Advice×Mid Risk Tolerance	-0.010**	-0.005	0.005	0.001	-0.014***	0.038***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.005)	(0.004)
No Financial Advice×High Risk Tolerance	-0.008	0.003	0.018***	-0.001	-0.003	0.052***
	(0.005)	(0.005)	(0.006)	(0.002)	(0.006)	(0.006)
Financial Advice×Low Risk Tolerance	0.019***	0.031***	-0.037***	0.004	0.043***	0.104***
	(0.004)	(0.004)	(0.006)	(0.003)	(0.006)	(0.006)
Financial Advice×Mid Risk Tolerance	0.011	0.046***	-0.036***	0.000	0.007	0.158***
	(0.008)	(0.009)	(0.010)	(0.003)	(0.012)	(0.014)
Financial Advice×High Risk Tolerance	-0.004	0.035***	-0.023	0.016*	0.032**	0.162***
	(0.010)	(0.010)	(0.016)	(0.008)	(0.015)	(0.018)
R-squared	0.152	0.154	0.550	0.099	0.197	0.187

Panel B: Financial advice and education

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
No Financial Advice×Some Qual.	0.058***	0.062***	-0.045***	-0.001	0.067***	0.043***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.004)	(0.003)
No Financial Advice×Degree Qual.	0.084***	0.099***	0.090***	-0.004*	0.093***	0.096***
	(0.005)	(0.004)	(0.006)	(0.002)	(0.006)	(0.005)
Financial Advice×No Qual.	0.051***	0.042***	-0.048***	0.009	0.103***	0094***
	(0.012)	(0.010)	(0.013)	(0.006)	(0.019)	(0.017)
Financial Advice×Some Qual.	0.021***	0.036***	-0.041***	0.006*	0.047***	0.109***
	(0.005)	(0.005)	(0.007)	(0.003)	(0.008)	(0.008)
Financial Advice×Degree Qual.	0.007	0.031***	-0.032***	0.002	0.016**	0.113***
	(0.005)	(0.006)	(0.009)	(0.003)	(0.008)	(0.009)
R-squared	0.152	0.153	0.550	0.099	0.196	0.179

Notes: OLS regression models with standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Observations: 25,594. For other information and controls see notes to Table III.

Table V: Portfolio shares, financial advice, type of consultation and purchase of products

Panel A: Financial advice and type of consultation

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice×No Consultation	0.027***	0.061***	-0.074***	0.003	0.026	0.113***
	(0.009)	(0.010)	(0.013)	(0.006)	(0.016)	(0.018)
Financial Advice×Building Society	0.027***	0.026***	-0.029***	-0.000	0.050***	0.043***
	(0.007)	(0.007)	(0.010)	(0.003)	(0.010)	(0.010)
Financial Advice×Financial Advisor	0.020***	0.041***	-0.042***	0.001	0.045***	0.147***
	(0.005)	(0.004)	(0.007)	(0.003)	(0.008)	(0.008)
Financial Advice×Stockbroker	-0.003	0.095***	-0.074***	0.011	0.016	0.357***
	(0.012)	(0.016)	(0.027)	(0.008)	(0.018)	(0.003)
Financial Advice×Other	-0.002	0.004	-0.013	0.024***	0.020*	0.062***
	(0.009)	(0.010)	(0.014)	(0.009)	(0.012)	(0.014)
R-squared	0.152	0.154	0.551	0.101	0.195	0.189

Panel B: Financial advice and whether products purchased

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice×No Consultation	0.025***	0.057***	-0.070***	0.007	0.030*	0.098***
	(0.010)	(0.010)	(0.013)	(0.007)	(0.017)	(0.018)
Financial Advice×Consultation No Products Recommended	0.013**	0.031***	-0.030***	0.006	0.033***	0.114***
	(0.006)	(0.006)	(0.008)	(0.004)	(0.008)	(0.009)
Financial Advice×Consultation No Products Purchased	0.014	0.020**	-0.021	0.012	0.031**	0.055***
	(0.010)	(0.010)	(0.016)	(0.008)	(0.014)	(0.014)
Financial Advice×Consultation One Product Purchased	0.020***	0.018***	-0.035***	0.004	0.044***	0.078***
	(0.006)	(0.016)	(0.006)	(0.004)	(0.011)	(0.009)
Financial Advice×Consultation Selection of Products Purchased	0.026***	0.054***	-0.057***	-0.003	0.062***	0.203***
	(0.010)	(0.007)	(0.011)	(0.003)	(0.013)	(0.014)
R-squared	0.152	0.153	0.551	0.099	0.195	0.184

Notes: OLS regression models with standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Observations: 25,594. For other information and controls see notes to Table III.

Table VI: Portfolio shares, financial advice and how the consultation was paid for

Panel A: Financial advice and how consultation was paid for

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice×No Consultation	0.028***	0.063***	-0.074***	0.004	0.030*	0.109***
	(0.009)	(0.010)	(0.012)	(0.006)	(0.016)	(0.017)
Financial Advice×Did Not Buy Product	-0.006	-0.001	0.021	0.02	0.030*	0.024*
	(0.007)	(0.011)	(0.016)	(0.009)	(0.015)	(0.013)
Financial Advice×Free Advice	0.025***	0.022***	-0.020**	0.004	0.037***	0.031***
	(0.007)	(0.007)	(0.010)	(0.004)	(0.010)	(0.009)
Financial Advice×One-Off-Fee	0.010	0.019**	-0.029**	0.007	0.043***	0.110***
	(0.008)	(0.008)	(0.014)	(0.005)	(0.014)	(0.016)
Financial Advice×Commission	0.024***	0.045***	-0.043***	-0.000	0.054***	0.166***
	(0.008)	(0.007)	(0.010)	(0.003)	(0.013)	(0.013)
Financial Advice×Fee and Commission	0.017	0.057***	-0.068***	0.014	0.044**	0.244***
	(0.011)	(0.012)	(0.017)	(0.012)	(0.018)	(0.022)
Financial Advice×Ongoing Charge	0.005	0.063***	-0.083***	0.021**	0.025*	0.244***
	(0.008)	(0.010)	(0.013)	(0.009)	(0.013)	(0.020)
Financial Advice×Other	0.041***	0.047***	-0.074***	-0.003	0.056***	0.102***
	(0.010)	(0.010)	(0.014)	(0.003)	(0.016)	(0.018)
R-squared	0.153	0.155	0.552	0.100	0.195	0.193

Notes: OLS regression models with standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Observations: 25,594. For other information and controls see notes to Table III.

Table VII: Portfolio risk composition: A system approach

Panel A: Portfolio composition

eq.8.1	Bonds/FW	Bonds/TW	Bonds/TW	Bonds/TW
eq.8.2	Stocks/FW	Stocks/TW	Stocks/TW	Stock/TW
eq.8.3		Real Estate/TW	Real Estate/TW	Real Estate/TW
eq.8.4		Business/TW	Business/TW	Business/TW
Financial Advice eq.8.1	0.0401***			
	(0.006)			
Financial Advice eq.8.2	0.1095***			
	(0.006)			
Financial Advice eq.8.1		0.0182***	0.0182***	0.0184***
		(0.004)	(0.004)	(0.004)
Financial Advice eq.8.2		0.0347***	0.0346***	0.0351***
		(0.003)	(0.003)	(0.003)
Financial Advice eq.8.3		-0.0382***	-0.0381***	-0.0387***
		(0.005)	(0.005)	(0.005)
Financial Advice eq.8.4		0.0047**	0.0047**	0.0047**
		(0.002)	(0.002)	(0.002)

Panel B: Portfolio risk

eq.9	Financial variance σ_{it}^{f2}	Complete variance σ_{it}^{c2}	Fin. component σ_{it}^{fc}	Non-fin. component σ_{it}^{nc}
Bonds/FW	0.0012***			
	(0.002)			
Stocks/FW	0.0207***			
	(0.001)			
Bonds/TW		0.0028***	0.0026***	0.0004***
		(0.000)	(0.000)	(0.000)
Stocks/TW		0.0168***	0.0171***	-0.0005***
		(0.000)	(0.000)	(0.000)
Real Estate/TW		0.0080***	0.0023***	0.0057***
		(0.000)	(0.000)	(0.000)
Business/TW		0.0035***	0.0011	0.0024***
		(0.000)	(0.001)	(0.000)
Wald test $H_0 : \beta_k = .. = \gamma_k = .. = \phi_k = 0$	35,213.69	122,741.35	96,840.60	265,859.16
p-value	0.000	0.000	0.000	0.000
Observations	25,594	25,594	25,594	25,594

Notes: Standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Controls include: gender; age; highest educational attainment; whether in very good health; whether any children; number of adults in household; whether single; labour market status; whether the home is owned; the natural logarithm of labour income, benefit income and financial wealth; and the historical return and standard deviation of stock market returns.

A. Appendix: Summary statistics and additional results

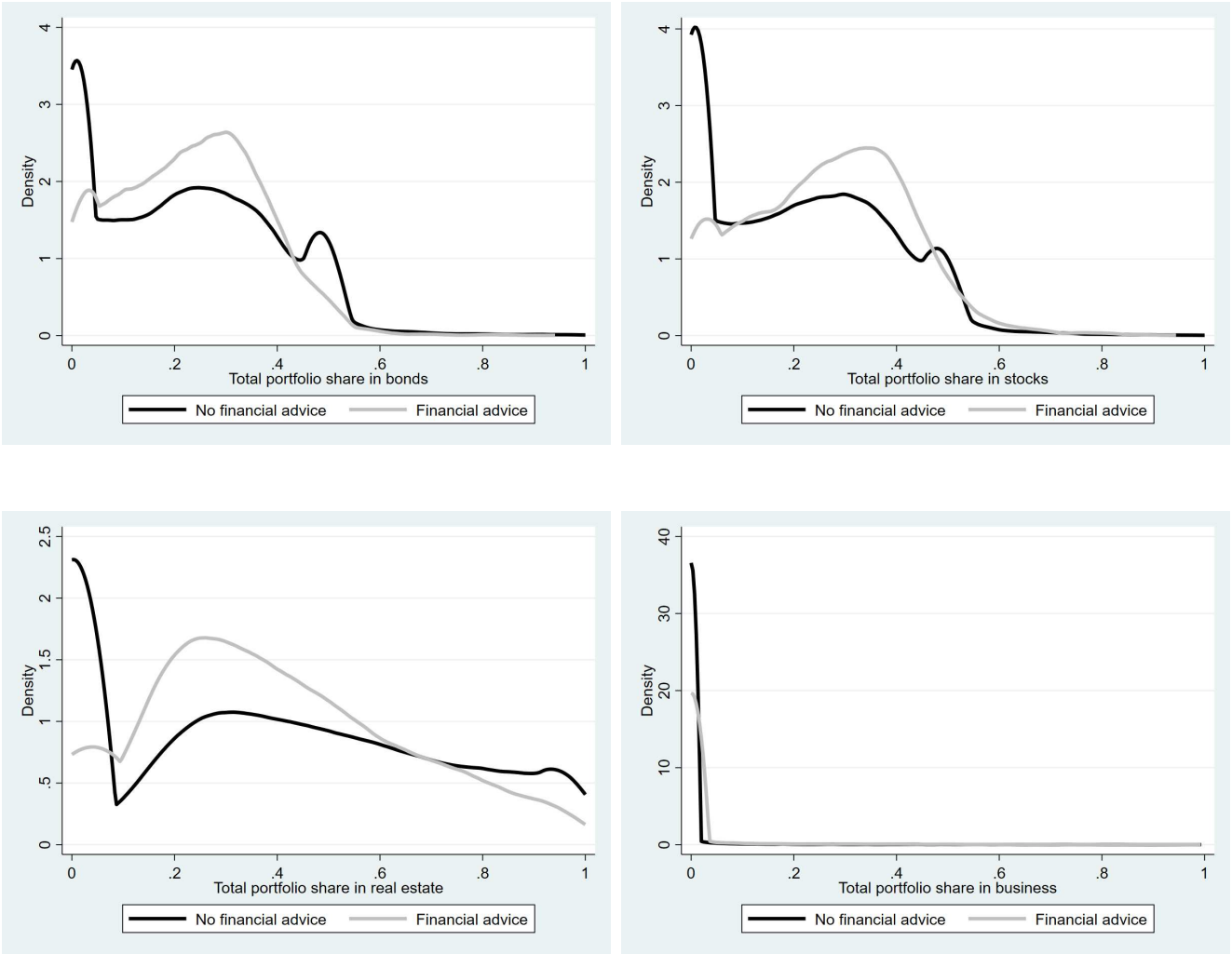

Figure A.1: Kernel density plots of portfolio composition by the receipt of financial advice

Notes: For a description of the portfolio shares see notes to Table III.

Table A.I: Summary statistics for covariates

	Mean	Std Dev	Min	Max	Mean if ADVICE=1	Mean if ADVICE=0
High risk tolerance	0.0936	0.291	0	1	0.0991	0.0925
Mid risk tolerance	0.1623	0.369	0	1	0.1574	0.1632
Male	0.6103	0.488	0	1	0.6439	0.6038
Single	0.4875	0.498	0	1	0.5348	0.4784
Whether children in household	0.1512	0.358	0	1	0.1243	0.1564
Number of adults in household	1.7663	0.766	0	5	1.7570	1.7680
Whether in very good health	0.2676	0.443	0	1	0.3161	0.2583
Some qualifications below degree	0.5082	0.499	0	1	0.4698	0.5157
Degree level qualifications	0.2791	0.449	0	1	0.4475	0.2467
Employee	0.4102	0.492	0	1	0.4212	0.4080
Self employed	0.0592	0.236	0	1	0.0926	0.0527
Natural logarithm of labour income	4.2512	5.144	0	14.62	4.8345	4.1488
Natural logarithm of non-labour income	7.3251	4.013	0	11.73	6.7387	7.4381
Natural logarithm of wealth	8.9279	5.999	0	19.33	10.8999	8.5478
Whether home owner	0.7531	0.431	0	1	0.9028	0.7238
Aged 25-29	0.0179	0.133	0	1	0.0150	0.0185
Aged 30-34	0.0301	0.171	0	1	0.0273	0.0307
Aged 35-39	0.0392	0.194	0	1	0.0348	0.0401
Aged 40-44	0.0583	0.234	0	1	0.0476	0.0604
Aged 45-54	0.0732	0.260	0	1	0.0583	0.0761
Aged 55-59	0.0814	0.273	0	1	0.0791	0.0848
Aged 60-64	0.1080	0.310	0	1	0.1417	0.1015
Aged 65-69	0.1389	0.346	0	1	0.1867	0.1297
Aged 70-74	0.1207	0.326	0	1	0.1240	0.1201
Aged 75-79	0.1017	0.302	0	1	0.0953	0.1030
Aged 80+	0.1344	0.341	0	1	0.0950	0.1421
Cohort history return	0.0559	0.085	-0.06	0.22	0.0532	0.0564
Cohort history standard deviation	0.5765	0.470	0.14	1.91	0.6494	0.5625
Households (N)		18,384			3,610	16,222
Observations (NT)		25,594			4,136	21,461

Table A.II: Full results for Table III panel A

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice	0.018***	0.035***	-0.038***	0.005**	0.040***	0.109***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.006)	(0.006)
Mid Risk Tolerance	-0.011**	-0.004	0.006	0.000	-0.022***	0.031***
	(0.004)	(0.004)	(0.004)	(0.001)	(0.005)	(0.004)
High Risk Tolerance	-0.010**	0.003	0.018***	0.001	-0.006	0.050***
	(0.005)	(0.005)	(0.006)	(0.002)	(0.006)	(0.050)
Male	0.006*	0.016***	-0.015***	0.003**	-0.006	0.013***
	(0.003)	(0.003)	(0.004)	(0.001)	(0.004)	(0.003)
Single	0.037***	0.030***	-0.042***	0.000	0.022***	0.013***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.005)	(0.005)
Whether children in household	-0.001	-0.006	0.007	0.006**	0.013*	0.001
	(0.006)	(0.005)	(0.007)	(0.003)	(0.007)	(0.005)
Number of adults in household	-0.001	0.000	-0.000	0.005***	0.011***	0.003
	(0.003)	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)
Whether in very good health	0.016***	0.018***	-0.017***	-0.003*	0.016***	0.011***
	(0.003)	(0.003)	(0.004)	(0.002)	(0.005)	(0.004)
Some qualifications	0.057***	0.062***	-0.045***	-0.001	0.064***	0.044***
	(0.004)	(0.003)	(0.004)	(0.001)	(0.005)	(0.003)
Degree qualifications	0.080***	0.097***	-0.087***	-0.005	0.085***	0.098***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.006)	(0.005)
Employee	0.028***	0.034***	0.004	-0.002	-0.012	-0.020***
	(0.006)	(0.006)	(0.007)	(0.003)	(0.008)	(0.006)
Self employed	-0.059***	-0.057***	0.067***	0.096***	-0.016	0.004
	(0.007)	(0.007)	(0.010)	(0.008)	(0.010)	(0.009)
Natural log of labour income	0.001	0.002***	0.000	0.001**	0.001*	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Natural log of non-labour income	-0.004***	-0.005***	0.002***	-0.001**	-0.003***	-0.002***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Natural log of wealth	-0.006***	-0.002***	-0.002***	0.000**	-0.019***	0.007***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Whether home owner	-0.084***	-0.058***	0.542***	-0.004**	0.086***	0.039***
	(0.004)	(0.004)	(0.005)	(0.002)	(0.005)	(0.004)
Aged 25-29	0.033*	0.049***	0.047***	0.011*	0.026	-0.033***
	(0.019)	(0.015)	(0.016)	(0.007)	(0.017)	(0.011)
Aged 30-34	0.057***	0.092***	0.048***	0.014***	0.018	-0.035***
	(0.017)	(0.013)	(0.015)	(0.005)	(0.015)	(0.010)
Aged 35-39	0.091***	0.116***	0.032**	0.007**	0.039**	-0.022**
	(0.017)	(0.012)	(0.014)	(0.003)	(0.017)	(0.010)
Aged 40-44	0.105***	0.139***	0.022	0.001	(0.033**	-0.019**
	(0.016)	(0.013)	(0.014)	(0.003)	(0.005)	(0.010)
Aged 45-54	0.133***	0.165***	-0.003	0.007***	0.075***	0.010
	(0.017)	(0.013)	(0.014)	(0.003)	(0.016)	(0.010)
Aged 55-59	0.146***	0.185***	-0.055***	0.007*	0.082***	0.020*
	(0.017)	(0.013)	(0.015)	(0.004)	(0.017)	(0.011)
Aged 60-64	0.191***	0.207***	-0.061***	0.009**	0.112***	0.020*
	(0.017)	(0.013)	(0.014)	(0.004)	(0.016)	(0.011)
Aged 65-69	0.213***	0.252***	-0.0547***	0.007**	0.132***	0.026***
	(0.016)	(0.012)	(0.013)	(0.004)	(0.015)	(0.010)
Aged 70-74	0.191***	0.241***	-0.011	0.008***	0.120***	0.034***
	(0.016)	(0.012)	(0.013)	(0.003)	(0.015)	(0.010)
Aged 75-79	0.176***	0.226***	0.029**	0.009***	0.135***	0.032***
	(0.016)	(0.012)	(0.013)	(0.003)	(0.015)	(0.010)
Aged 80+	0.144***	0.195***	0.076***	0.011***	0.127***	0.015
	(0.003)	(0.012)	(0.013)	(0.003)	(0.015)	(0.010)
Cohort history return	-0.016	-0.009	-0.001	0.013	-0.052	0.005
	(0.030)	(0.029)	(0.037)	(0.013)	(0.039)	(0.032)
Cohort history std. dev.	-0.005	-0.003	-0.002	0.000	-0.013**	-0.002
	(0.004)	(0.004)	(0.006)	(0.002)	(0.006)	(0.005)
Intercept	0.116***	-0.002	0.074***	-0.010***	0.105***	-0.056***
	(0.016)	(0.012)	(0.013)	(0.003)	(0.015)	(0.009)
R-squared	0.152	0.153	0.550	0.099	0.195	0.179
Observations	25,594	25,594	25,594	25,594	25,594	25,594

Notes: OLS regression models with standard errors clustered by head of household in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Observations: 25,594. For other information and controls see notes to Table III.

Table A.III: Portfolio shares and financial advice: Fixed effects and reverse causality

Panel A: Whether financial advice received - fixed effects

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice	-0.002	0.009***	-0.011***	0.002	0.001	0.034***
	(0.003)	(0.003)	(0.004)	(0.002)	(0.007)	(0.006)
Mid Risk Tolerance	0.004	0.003	-0.001	-0.001	-0.011*	0.008
	(0.003)	(0.004)	(0.004)	(0.002)	(0.006)	(0.006)
High Risk Tolerance	0.003	0.002	0.003	-0.003	0.003	0.018***
	(0.006)	(0.004)	(0.005)	(0.002)	(0.008)	(0.007)
R-squared	0.063	0.087	0.434	0.039	0.039	0.148
F-stat p-value H_0: α_i=0	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000

Panel B: Type of financial advice - fixed effects

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Advice for Investments	0.001	0.017***	-0.017***	0.006***	-0.004	0.070***
	(0.005)	(0.005)	(0.005)	(0.002)	(0.010)	(0.008)
Advice for Savings	-0.013*	0.011	-0.008	0.001	-0.030**	0.019
	(0.008)	(0.007)	(0.010)	(0.004)	(0.015)	(0.014)
Advice for Pensions	0.010	0.009	-0.026**	0.006	0.010	-0.005
	(0.008)	(0.008)	(0.010)	(0.004)	(0.016)	(0.014)
Advice for Debt	-0.005	-0.006	0.007	-0.006	0.010	0.011
	(0.010)	(0.009)	(0.012)	(0.005)	(0.020)	(0.017)
Advice for Other Reasons	-0.006	0.001	0.001	-0.000	0.016	0.010
	(0.007)	(0.001)	(0.008)	(0.003)	(0.013)	(0.011)
R-squared	0.062	0.092	0.435	0.039	0.038	0.161
F-stat p-value H_0: α_i=0	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000

Panel C: Number of times financial advice received - fixed effects

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
# Fin. Advice Received	-0.001	0.068***	-0.068***	0.009	-0.013	0.166***
	(0.016)	(0.015)	(0.020)	(0.008)	(0.032)	(0.028)
# Fin. Advice Received Sq.	0.003	-0.020***	0.018**	0.003	0.007	-0.046***
	(0.006)	(0.006)	(0.008)	(0.003)	(0.013)	(0.011)
R-squared	0.063	0.092	0.435	0.039	0.039	0.150
F-stat p-value H_0: α_i=0	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000	p=0.000

Panel D: The role of financial advice in wave 1 (2006-2007)

	Total portfolio shares				Financial portfolio shares	
	Bonds/TW	Stocks/TW	Real Estate/TW	Business/TW	Bonds/FW	Stocks/FW
Financial Advice in wave 1	0.022***	0.025***	-0.030***	0.002	0.031***	0.060***
	(0.006)	(0.005)	(0.009)	(0.003)	(0.009)	(0.009)
R-squared	0.163	0.161	0.561	0.113	0.182	0.168
Observations	12,209	12,209	12,209	12,209	12,209	12,209

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. For others controls see notes to Table III. Observations in Panels A-C: 7,210. The results in Panel D are on based upon a subset of household heads who were present in the sample in wave 1 of WAS.

B. Appendix: Time series used for portfolio risk

In Section 5, we explore the relationship between the portfolio shares and portfolio risk, whilst accounting for the effects of financial advice. We calculate the measures of the financial variance, the complete variance, and the financial and non-financial components of the complete variance using two types of information: information on household portfolio shares and information on asset excess returns. Here, we provide details on the latter.

Our measures are based on the variances and covariances of annual excess returns, which we compute from historic time series data, using a 20-year rolling time span. That is, we consider the period 1992-2011 for Wave 4 (collected between 2012 and 2014) and the period 1994-2013 for Wave 5 (collected between 2014 and 2016).

We use the following raw time series of data: 10-year government bond yields for bonds (source: Datastream); the stock market total return index for stocks (source: Datastream); residential property prices for real estate (source: Datastream); stock market dividend yields (source: Datastream) and household gross operating surplus/deficit on production activities for business wealth (source: Office for National Statistics).

All returns are measured at a quarterly frequency, because the real estate series is not available at a higher frequency. Returns on stocks and real estate are simply taken as the ratio between the price at time t, p_t, and the price one year earlier, p_{t-1}, minus one:

$$r_t = \frac{p_t}{p_{t-1}} - 1 \tag{B.1}$$

Returns on bonds should incorporate both yields and capital gains. We thus construct returns from the series of yields, y_t, with maturity $m = 10$ using the formula also used by Aswath Damodaran:[14]

$$r_t = y_{t-1} + \left(\frac{y_{t-1}}{y_t} - 1\right)\left(1 - \frac{1}{(1+y_t)^m}\right) \tag{B.2}$$

[14] See http://www.stern.nyu.edu/~adamodar/pc/datasets/histretSP.xls.

Similarly, returns on business wealth should incorporate dividends in addition to capital gains. However, business wealth is not regularly traded outside the financial market, which makes it difficult to correctly estimate its returns. To obtain a time series consistent with the other series used in our analysis, we use the following formula from Bucciol and Miniaci (2015), which incorporates variations in prices, p_t, and earnings, e_t:

$$r_t = \left(\frac{p_t + e_t}{p_{t-1}} - 1\right) = \left(\frac{e_t}{e_{t-1}}\right)\left(\frac{1 + pe_t}{pe_{t-1}}\right) - 1 \tag{B.3}$$

Here, pe_t is the price-earnings ratio. Our series on gross operating surplus/deficit captures earnings, while the reciprocal to the stock market dividend yields captures the price-earnings ratios. The implicit assumption behind this approach is that the price-earnings ratios of privately held businesses are comparable to that of (presumably larger) firms traded on the stock market. However, we expect this assumption to have limited implications for our results since business wealth is not widespread in our sample.

After computing the series for returns on bonds, stocks, real estate and business wealth, we create excess returns by subtracting 3-month treasury security yields (source: Datastream) from our returns. Finally, we estimate variances and covariances using 80 observations on excess returns (20 years of observations at quarterly frequency).