Can Financial Innovation Solve Household Reluctance to Take Risk?

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ABSTRACT

Using a large administrative panel of Swedish households, we document the fast and broad adoption of retail structured products, an innovative class of contracts offering non-linear exposures to equity markets. Households investing in structured products differ from traditional stock market participants on key characteristics and significantly increase their equity exposures over the sample period. The introduction of retail structured products thereby raises both the likelihood and the extent of stock market participation, especially for households with lower wealth and IQ and of older age. The design of purchased products varies strongly with household characteristics, suggesting the importance of heterogeneity in preferences and financial circumstances. A simple portfolio choice model shows that household loss aversion best explains the demand for structured products and the empirical facts we observe. Our results illustrate how financial innovation can mitigate investor behavioral biases.

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The low share of household wealth invested in stocks and mutual funds is a major challenge of household finance in developed economies (Campbell, 2006). This phenomenon illustrates the reluctance of households to participate in risky asset markets, which has large economic and welfare effects. Households with low exposures to compensated risk forfeit an important source of income over their lives (Mankiw and Zeldes, 1991; Haliassos and Bertaut, 1995), which reinforces wealth inequality (Bach, Calvet, and Sodini, 2017). Furthermore, as household savings are mainly directed toward safe assets, raising external capital might be costlier for firms. Traditional explanations for the low household exposure to risky assets rely on a high risk aversion combined with fixed participation costs, risky human capital, beliefs and behavioral biases such as loss aversion (Gomes, 2005). The issue of low stock market participation is more pronounced for certain sub-groups of the population: households with low-to-median financial wealth (Calvet, Campbell, and Sodini, 2007), low-to-median IQ (Grinblatt, Keloharju, and Linnainmaa, 2011), or loss-averse preferences.

This paper investigates whether financial innovation can foster participation in risky asset markets, and if so, through which mechanism. Are households better off when innovative products are offered? To address these questions, we study the introduction of retail structured products in Sweden and its impact on household portfolio allocation.

By offering a pre-packaged risk profile compatible with household preferences, retail structured products may increase household willingness to participate in risky asset markets. Retail structured products marketed in Sweden typically offer downside protection, and hence allow households to gain exposure to a risky asset market while capping the maximum loss. [1] Buying downside protection, for instance by buying put options or implementing portfolio insurance, is often difficult or costly to do for households, especially for long investment horizons. While Célérier and Vallée (2017) describe how banks use the design of these products to cater to yield-seeking investors, this study takes a different view and explores the potential benefits of retail structured products.

We focus on the allocation of household wealth to four asset classes: cash, equity mutual funds, stocks, and structured products. Investments in the latter three classes are viewed as risky assets. We consider retail structured products as risky, despite the capital protection they often offer, because they allow the investor to earn a fraction of the risk premium. The risky share is the weight of risky assets in the portfolio of cash and risky assets. We refine this measurement of the risky share by adjusting the holdings of structured product by their price elasticity to their underlying risky assets, and label it exposure to risky assets. We do not study corporate bonds are they represent a negligible fraction of household portfolios.

We exploit Swedish micro data with granular information on both household characteristics and financial holdings (see Calvet et al. (2007)) that we merge with a dataset with detailed information on all structured products sold in Europe since market inception (see Célérier and Vallée (2017)). The combined panel dataset is unique on many dimensions. First, the dataset offers a comprehensive coverage of the first five years of the development of the retail market for structured products for the whole population of Sweden.[2] Second, the dataset allows us to investigate how a rich set of household characteristics, such as wealth, IQ or age, relate to participation in this new asset class. Third, we can observe the whole portfolio composition of households and how the introduction of these innovative products impact household holdings in both safe and risky assets. Last, the data allow us to explore the link between household characteristics and the design of these products. More broadly, our research setting offers a unique opportunity to study how the introduction and the development of a financial innovation can impact retail investors portfolio decisions, while also shedding light on what drives the success of an innovation in household finance.

Our main results are the following. First, we document that the adoption of retail structured products is fast and broad, with 11% of all Swedish households buying at least one of these products within five years of the introduction. For these participating households, retail structured products represent more than 15% of their financial wealth. This speed of development contrasts with the slow adoption of other innovative financial products offering equity exposure, such as exchange traded funds (ETFs).

Second, households participating in structured products differ from owners of traditional risky assets, equity funds and stocks along the following dimensions: IQ and age. The probability of participating in retail structured products is a hump-shaped function of IQ, while the probability of owning stocks and equity funds monotonically increases with IQ. The probability of participating in retail structured products increases with age, while age reduces the probability of owning equity funds and stocks. These relationships suggest that structured products attract specific groups of households that are less likely to invest in traditional risky assets.

Third, among participants, the share of financial wealth invested in structured products is decreasing with wealth and increasing with age. Poor and old households traditionally have a low risky share, as the share of stocks and funds in financial wealth exhibit the reverse relationships: they are both increasing in wealth and decreasing in age. On the other hand, the share of wealth held in cash relates to wealth and age similarly than for structured products.

Fourth, participation in retail structured products is associated with an increase in households' risky share. Over the five years following the introduction of structured products, the risky share increases twice as much for households that participate in these products than for households that do not. Retail structured products, therefore, mostly complement other risky assets. Investment in structured products might, however, be correlated with a higher demand for risky assets over that period that our large set of controls does not capture. We address this endogeneity issue by using household exposure to banks offering structured products to instrument the supply of structured products. This IV analysis confirms the positive impact of structured product supply on the risky share of households. The increase in the risky share is especially pronounced for households with low financial wealth, and of older age. Households use cash to fund 63% of investments in structured products: when a household invests 1% percent of their financial wealth in retail structured products, it therefore increases its risky share by 0.63%. When adjusting for the price-elasticity of structured products, the gain in exposure to risky assets remains consequent: when investing 1% of their financial wealth in structured products while selling 0.27% of a traditional risky asset, a household increases its exposure to risky assets by 0.36%.

Finally, the relationship between household characteristics and product design suggests that less sophisticated households predominantly look for protection and simplicity, while sophisticated households look for more exotic products in terms of exposure and design, possibly for diversification purposes. Mature households with lower financial wealth and lower IQ are more likely to invest in products offering full capital protection, while households with higher financial wealth and higher IQ invest more in complex products or in products offering exposures to emerging markets.

We develop a portfolio-choice model to investigate the theoretical mechanisms explaining our empirical results on the impact of structured product introduction on household portfolio allocation. In this model, the investor can invest in three distinct assets: a risk-free bond, a stock market index and a structured product offering a guaranteed return and a participation in the performance of a stock market index. We find that loss aversion or misperception about the expected returns of structured products are the most likely mechanism to explain the data. By contrast, the strong demand for structured products cannot be explained by a constant relative risk aversion (CRRA) utility alone, while habit formation can only generate a moderate appetite for guaranteed products.

This study contributes to the strand of the household finance literature documenting the low stock market participation and low risky shares of households (Campbell, 2006; Calvet et al., 2007). While several papers explore possible explanations for low risk-taking (Attanasio and Vissing-Jørgensen, 2003; Guiso and Jappelli, 2005; Guiso, Sapienza, and Zingales, 2008; Haliassos and Bertaut, 1995; Hong, Kubik, and Stein, 2004; Barberis, Huang, and Thaler, 2006; Kuhnen and Miu, 2015), our work focuses on possible solutions that can alleviate it. In this respect, our study relates to papers that explore solutions to the frictions households face in their financial decisions, such as financial advisors (Gennaioli, Shleifer, and Vishny, 2015), default options (Madrian and Shea, 2001), or innovative banking products (Cole, Iverson, and Tufano, 2016).

Our work also contributes to the literature on the cost and benefits of financial innovation. Several studies have underlined potential adverse effects of financial innovation, such as speculation (Simsek, 2013) or rent extraction (Biais, Rochet, and Woolley, 2015; Biais and Landier, 2015), particularly from unsophisticated agents (Carlin, 2009). The present paper illustrates how innovative financial products may also benefit unsophisticated market players. Our paper provides evidence that innovative security design can mitigate investor behavioral biases, and not merely exploit them (Célérier and Vallée, 2017), thereby having a positive impact on investor welfare. This mechanism differs from and complements the more traditional role of financial innovation to improve risk-sharing and complete markets. While recent work has focused on the dark side of retail structured products (Arnold, Schuette, and Wagner, 2016; Henderson and Pearson, 2011; Hens and Rieger, 2014), the present study offers a more nuanced view of these markets.

The paper is organized as follows. Section I presents the household and asset data. Section II documents the adoption of retail structured products in Sweden, explores the relationship between household characteristics and the probability of owning these products, and documents its impact on the extensive margin of risky asset market participation. In Section III, we relate household characteristics with the extent to which they invest in these products, and study their impact on households' risky share. In Section IV, we explore how product design varies with household characteristics. In Section V, we develop a theoretical framework of portfolio allocation for an investor that can access products paying a risk premium while offering a capital protection, and interpret our empirical results in light of the model predictions. Section VI concludes. An Internet Appendix provides additional empirical results.

I. Background and Data

The study relies on combining two main datasets: one comprising detailed information on structured products issuance in Sweden and other European countries, the other one covering comprehensive information on individual portfolios at the asset level and household characteristics for the whole Swedish population. Both datasets are merged through the unique International Security Identification Number (ISIN) of each financial asset.

A. The Development of Retail Structured Products

Retail structured products include any investment products marketed to retail investors and possessing a payoff function that varies automatically and non-linearly with the performance of an underlying financial asset.[3] Typically designed with embedded options, these products leave no room for discretionary investment decisions during the life of the investment. These products are based mainly on equity indices and individual stocks but may also offer exposure to commodities, fixed income, or alternative indices.

For illustration purpose, we provide below an example of a Swedish best-seller named *Spax Pension 284d* sold by Swedbank in 2004 (ISIN: SE0001242983). It has a maturity of 8 years and its payoff is defined as follows:

> *This is a growth product linked to the performance of the OMX 30 index. At maturity the product offers a minimum capital return of 100% plus 105% of the rise in the index over the investment period. The performance is calculated as the average of each monthly performance reading. The product is issued at par.*

The retail market for structured products emerged in Europe at the beginning of the 2000s and has subsequently experienced steady growth. In 2012, with 770 billion euros of assets under management, the retail market for structured products stood at 3% of all European financial savings, one-eighth of the mutual fund assets under management in Europe, and double the assets under management of the hedge fund industry. The European market is the largest market in the world, with more than half of the global volume. The US and Asian markets, however, have been growing fast: retail structured product assets under management exceeded 400 billion US dollars in 2015 in the US.

In Europe, retail structured products are available to any household and are under the same regulatory framework as stocks or mutual funds during our sample period. Specific rules to regulate the distribution of these products are rare: while Italy in 2009, France in 2010, and Belgium in 2011 tightened the conditions under which certain categories of structured products could be sold to retail investors, Norway was the only country that placed a ban on selling structured products to retail investors and did so in 2008.

The Swedish market for structured products is an ideal laboratory for our research question because most of the products offer a capital protection, and the overall level of product complexity is moderate. Potentially exploitative behaviors by banks, such as cater to reaching-for-yield investors by shrouding risk, are therefore less of a concern in this market, as opposed to France, Germany or Italy for example (Célérier and Vallée, 2017).

B. Data

B.1. Structured Products

The first dataset, which is developed in Célérier and Vallée (2017), contains detailed information on all the retail structured products that have been sold in Europe since 2002. A comprehensive pay-off description, information on distributors, and volume sold are available at the issuance level. The database also includes measures of complexity for each product, obtained through a text analysis of the pay-off description.[4]

Our sample includes 1,939 structured products that have been issued in Sweden over the 2002 to 2007 period, for a total volume of 9.4 billion dollars. Table IA.2 of the Internet Appendix reports summary statistics on the main characteristics of these products.

In Sweden, the large majority of products offer equity exposure (87% of the products). In terms of payoff formula, products offering a capital guaranteed, and therefore presenting a limited downside, are overwhelmingly dominant. Hence, 98% of the products issued over the period offer capital protection, by offering a minimum payoff of at least 100% of face value at maturity. The majority of these products, however, are issued at a price that is higher than face value, resulting in an actual level of capital protection of 94% on average. The capital protection is typically associated with a participation in the rise of the underlying asset (call feature for 88% of the issuances), coupled with an Asian option (both features for 52

Figure IA.1 of the Internet Appendix plots the histogram of capital protection (Panel A), and the participation rate in the growth of the underlying as a function of the minimum return for the sample of products indexed to a European index (Panel B). The figure illustrates a "waterbed" effect between the two dimensions. Banks offer a lower capital protection when they offer a higher participation rate in the rise of the underlying asset, thereby tailoring the risk-return profile of the product. This relationship is consistent with the asset pricing model developed in Section V.

Finally, almost all products have a structured bond format (98% of issuances), and therefore bear credit risk. This format can be pensionable through Individual Pension Savings (IPS) status eligibility, and the average term is 3.5 years.

B.2. Household Portfolios and Characteristics

The second dataset, described in Calvet et al. (2007), consists in panel data of financial wealth and income covering all Swedish households over the period 2000 to 2007. This data provides us with the detailed breakdown of financial wealth between cash, equity mutual funds, stocks and structured products.[5] This panel has been used to study household portfolio diversification (Calvet et al., 2007), rebalancing behavior (Calvet, Campbell, and Sodini, 2009), financial risk-taking (Calvet and Sodini, 2014) and value investing (Betermier, Calvet, and Sodini, 2017). The data are available because the Swedish government levied a wealth tax over the 2000 to 2007 period. To collect this tax, the government assembles records of financial assets. The records are available at the individual security level and are based on statements from financial institutions that are verified by taxpayers. In addition, the data contains a high diversity of individual socio-demographic and financial characteristics, in addition to a number of proxies for sophistication, such as IQ and educational attainment and subject.

The merge of the two datasets is done using the unique ISIN identifiers of financial assets. Household portfolio data are disaggregated at the security level, with the corresponding ISIN of each security, including retail structured products. The dataset resulting from merging the two previous sources represents an ideal setting to investigate how the development of structured products affected household investment decisions, as the overlap of the datasets occurs during the launch and subsequent high growth period of the retail market for structured products.

Table I presents demographic and financial characteristics for the different sample used in our empirical analysis. The IQ data, resulting from military tests, is only available for men who were born between XX and YY. We therefore present separately the characteristics of the sample where this information is available.[6]

II. Financial Innovation and Risky Asset Markets Participation

A. *Adoption of Retail Structured Products*

Despite the usual reluctance of households to invest in equity funds and stocks, the retail market for structured products developed within a few years in Sweden. At the end of 2007, 11% of Swedish households participated in this new asset class and invested a significant fraction of their financial wealth in these products.

The top half of Figure 1 shows the evolution of the share of households participating in structured products and in other stock market products over the 2002 to 2007 period.[7] Household participation in traditional stock market products, while high in Sweden compared to other countries, is slightly declining over the sample period. Conversely, the share of household investing in structured products significantly increases from 2000 to 2007, reaching 11% in 2007. Retail structured products, therefore, play an increasing role in households' access to stock markets over the period.

INSERT FIGURE 1

B. *Characteristics of Structured Product Participants*

We turn to exploring the characteristics of households that invest in retail structured products. In Table I, we compare financial and demographic characteristics of households investing in structured products with the characteristics of the whole Swedish population, and of households investing in equity funds and stocks.

INSERT TABLE I

These unconditional summary statistics points at structured products participants being wealthier than the overall population and fund and stock participants, but also significantly older, and less invested in risky assets than equity fund and stock participants.

To further explore the determinants of structured product participation, we implement logit regressions to estimate the probability that a household invests in structured products at least once during the 2002 to 2007 period. We focus on the three main characteristics that identify households with lower participation in risky asset markets: financial wealth, IQ and age.

We run the following specification for participating in retail structured products, in equity funds, and in stocks:

$$\text{logit}(p_h) = \log\left(\frac{p_h}{1-p_h}\right) = \alpha + \beta\, x_h,$$

where p_h is the probability that the household participate at least once in a given type of investment over the 2002-2007 period, and x_h is a vector of household characteristics in 2007. Figure 2 displays the predicted probability of participation for each financial wealth decile, IQ level, and age category. Each regression includes financial wealth, IQ, and age fixed effects in this non-parametric specification as explanatory variables as well as controls for the number of children in the household, household size, a urban dummy and a household head gender dummy.

INSERT FIGURE 2

The likelihood to participate increases with financial wealth for all three asset classes. However, there are notable differences between retail structured products, and equity fund and stocks, on the two other dimensions. The likelihood of participating in retail structured products is a hump-shaped function of IQ, while it is a monotonically increasing function for equity funds and stock markets. The different pattern is even more pronounced for age: while likelihood of participating in retail structured products increases with age (except at the end of life), the opposite is true for equity funds and stocks. We also implement the same analysis on years of education, and find results consistent with the ones for IQ that we include in the Internet Appendix.

These differences point to retail structured products appealing differently than equity funds and stocks to specific sub-groups of the population: these products appear in relative higher demand from mature households, but in lower demand from households with the highest IQs.

C. Impact on Household Risky Asset Markets Participation

We define new participants to risky asset markets as households that were not participating in equity funds or stocks during the four years before 2002 and that start investing in equity funds, stocks or structured products during the 2003-2007 period.

Figure 3 shows the evolution of new participants, and their breakdown between new participants who start investing in equity funds or stocks, and new participants who start investing in structured products. We observe that the share of new participants through structured products substantially increases over time. While new participants through structured products only represent 3.6% of new participants through traditional products in 2002, this proportion reaches 17% in 2007.

INSERT FIGURE 3

We then reproduce the logit regressions from Figure 2, while restricting our sample to households that hold neither equity funds nor stocks in 2002, before the development of the structured product market.

We thus explore whether certain demographics are more likely to start investing in stock markets through structured retail products, rather than through stocks or equity funds. We do not observe meaningful differences in that regard. Results are displayed in Figure B.4 of the Internet Appendix.

III. Financial Innovation and Portfolio Allocation

While participating in risky asset markets is a necessary condition for earning the risk premium, this benefit might be small if only a small amount of household wealth is directed towards risky assets. In this section, we therefore study how portfolio allocation varies with household characteristics, and whether the introduction of structured products affects the relationships between household characteristics and their risky share of financial wealth.

A. *Share of Financial Wealth Invested in Structured Products*

The bottom half of Figure 1 displays the evolution of the composition of the financial wealth of households that participate in retail structured products as of end 2007. The figure shows how these households build up a significant share of their wealth invested in retail structured product in a matter of five years: from 0% in 2002 to more than 15% in 2007. This increases contrasts with how they reduce over the same period their share of wealth held in cash, as well as the share invested in stocks and equity fund.

We then explore whether household characteristics relate to the extent to which households invest in structured products, as well as in other financial assets: cash, equity funds, and stocks. For this purpose, we run cross-sectional OLS regressions on the share of financial wealth invested in a given financial asset as of end of 2007. We use the following specification on the sample restricted to structured product participants:

$$\omega_{j,h} = \alpha_j + \beta_j \, x_h + \varepsilon_{h,j},$$

where $\omega_{j,h}$ is the share of financial wealth invested in asset class j. As previously, the vector of characteristics, x_h, consists of financial wealth, IQ and age, as well as the number of children, household size, a urban dummy and a household head gender dummy. Figure 4 plots regression coefficients on fixed effects for each financial wealth decile, IQ level, and age category. We also report the regression coefficient in Table II for assessing the economic magnitudes.

There are three key take-aways from this analysis. First, household with lower financial wealth invest a larger share of their wealth in retail structured products. Second, older households invest a larger share of their wealth in retail structured products than younger households. Last, these relationships are the opposite for traditional equity products, but are similar for cash. These results suggest a complementarity between structured products, and equity funds and stocks. The relationship between IQ and the share invested in structured product appear unclear, while it is strongly positive for equity funds and stocks.

INSERT FIGURE 4 AND TABLE II

B. *Effect on the Risky Share of Households' Financial Wealth*

We now explore whether investing in structured products is associated with an increase in the risky share of households' financial wealth. While we include structured products in the risky share - as they allow earning a fraction of the risk premium - we adjust the portfolio weight of structured product by the price-elasticity to their underlying risky asset. The exposure to the risk premium these products offer is not as large as for traditional risky assets, as the downside protection comes at a cost of a lower upside.

To compute the price-elasticity of these products to their underlying risky asset, we calibrate the asset-pricing model that we describe on the theoretical framework section on the security design we observe the most in the data. The median Swedish structured products has typically a maturity of 4 years, a capital guarantee of 94% and the final performance is the average of the yearly performance during the life of the product. This exercise yields an estimate in the [0.6-0.7] range for the structured product return elasticity to the underlying performance.

We restrict our sample to households participating in equity funds or stocks in 2002 and compare the change between 2002 and 2007 in their risky share, expressed in percentage points of financial wealth, for households that have invested in structured products during that period versus households that have not. We also interact the indicator variable for participating in structured products with financial wealth decile, IQ levels, and age categories to identify heterogeneity in this change along our key characteristics. The exact specification is

$$\Delta\, w_h = \alpha + \beta \times Ind(Participation)_h \times\, x_h + Controls + \varepsilon_h.$$

where $\Delta\, w_h \,=\, w_{h,07} - w_{h,02}$ is the change in the risky share between 2002 and 2007, and x_h is either financial wealth decile, IQ levels, or age categories. Figure 5 displays the OLS regression coefficients. This figure illustrates how structured product participants have increased significantly more their risky share, and how this increase is more pronounced for households with lower financial wealth, and for older households.

INSERT FIGURE 5

Table III displays the regression coefficients with linear specifications for the explanatory variables. The increase in stock market exposure would be half as large as the coefficient of the *StructuredParticipant* dummy suggests if we adjust for the elasticity of the final return to the underlying asset performance using our estimation for the median Swedish product.

TABLE III

C. Controlling for Endogenous Selection into Structured Product Investment: Instrumental Variable Analysis

Because investment in structured products is an endogenous decision which might correlate with a willingness to increase household risky share independently of the introduction of structured products, our analysis requires an exogenous variation in the supply of retail structured products For this purpose, we exploit the fact some Swedish banks did not market structured products to their client base during our sample period, and that these banks are un-evenly distributed geographically, which generates geographic variation in the supply intensity of retail structured products.

We collect the list of bank branches in each parish and build a proxy for the household exposure to retail structured product supply by calculating the ratio of branches in their parish that market retail structured product during our study period.

This strategy alleviates concerns that households might have several banking relationships, or could shop around. It relies on the assumption that shopping banking services is a local market. which is supported by the existing literature (Beck, Demirguc-Kunt, and Peria, 2007).

A natural concern is that household from parishes with few or no banks distributing retail structured products differ fundamentally from the other parishes, which could result in a different trend in the evolution of their portfolio allocation. This concern is mitigated by the richness and the size of our dataset, which allows us to control for a comprehensive set of household characteristics, as well as their evolution, in non-parametric specifications.

Figure 6 illustrates the geographic distribution of supply intensity.

INSERT FIGURE 6

Table IV shows the result of this analysis. Column 1 displays the coefficients of the first stage, and shows that a higher share of branches offering structured products in a given parish significantly increases the probability to invest in structured products for the households of this parish, even when controlling for household characteristics. Column 2 presents the coefficients from the second stage, which regresses change in the risky share on participation in retail structured products, where participation in retail structured product is instrumented. The positive and significant coefficient on the indicator variable for participating in retail structured products confirms our initial result. The larger magnitude of the coefficient suggests that the endogeneity issue is biasing our results downwards, which suggests that households participating in structured products would have actually reduced their risky share in the absence of these products.

D. *Portfolio Rebalancing*

To rationalize this increase in their risky share, we study how households that invest in structured products fund these purchases, and more specifically whether they do so with cash or by selling stock market instruments they own. We can measure this substitution between financial assets thanks to the panel structure of our data.

We estimate the rate of substitution between structured products and cash at a yearly frequency. We run the following OLS regression in a panel model:

$$CashShare_{h,t} = \alpha_h + \delta_t + \beta \times SPshare_{h,t} \times x_h + \varepsilon_{h,t},$$

where $CashShare_{h,t}$ is the share of financial wealth held as cash by household h in year t, $SPshare_{h,t}$ is the share of financial wealth invested in **structured products** indexed to equity by household h in year t, and x_h is either the decile of financial wealth, the level of IQ, or the age category. α_h is a household fixed effect and δ_t is a year fixed effect.

Table V reports the regression coefficients. The coefficient on $SPshare_{h,t} \times x_h$ shows how structured products purchase are predominantly funded with cash, with an average substitution rate of 62%. Substitution with cash appears to be even higher for household with lower financial wealth, lower IQ, and younger households, which is consistent with the larger increase in stock market exposure for these sub-groups of the population.

INSERT TABLE V

When we adjust for the return elasticity to the underlying asset performance, the average increase in exposure to risky assets resulting from household investing 1% of their financial wealth in structured products is therefore around 0.36

IV. Product Design and Household Characteristics

As a final step of our empirical analysis, we investigate whether and how the design of retail structured products varies with household characteristics. We explore three dimensions of product design: (i) capital guarantee, (ii) complexity, and (iii) exposure to stock markets of emerging economies. The capital guarantee dummy is equal to unity if the structured product offers full capital guarantee (after fees). Product complexity is measured by the number of payoff features, as in Célérier and Vallée (2017).

We run logit and OLS regressions using each of these three design characteristics as the dependent variable, and financial wealth deciles, IQ levels, and age categories as explanatory variables. Figure 7 plots the coefficients of these regressions. We observe that product design significantly varies along the key household characteristics.

Household with lower financial wealth, lower IQ and older are more likely to invest in products offering full protection.

Households with higher financial wealth and higher IQ invest in more complex products.

Households with higher financial wealth, and younger households, are more likely to invest in products offering an exposure to emerging markets.

INSERT FIGURE 7

This mapping between household characteristics and product design reinforces the case for a heterogeneity in preferences among the population. This calls for a theoretical framework to identify the preferences consistent with our empirical facts.

V. Theoretical Framework

This section investigates the theoretical mechanisms that can explain the impact on household portfolios of the introduction of structured products we observe in our data. We develop a portfolio-choice model with three assets: a risk-free bond, a stock-market index, and a structured product based on the index. The return on the structured product is a call option on the rate of return of the index. We also extend the framework to accommodate Asian options, as they are the most frequent design we observe in the data. This call option is characterized by (i) a guaranteed rate of return and (ii) a percentage of the index performance, called *participation rate* in the industry. A Black and Scholes-type no-arbitrage condition first determines the relationship between the guaranteed return and the participation rate of the structured product. We then compute the portfolio choice of an investor with CRRA, habit formation, or loss aversion preferences.[8] We finally calculate the increase in utility brought by the access to the structured product, and determine the increase in the risk-free rate that would provide the same utility gain for the agent.

A. ***Financial Assets: Description and Pricing***

We consider a two-period, incomplete-market economy with three traded assets. The risk-free bond has net arithmetic return $R_f \geq 0$ and logarithmic return $r_f = \ln(1 + R_f) \geq 0$, which is known ar date t and is paid off at date $t + 1$. The risky asset (equity index) has arithmetic net return $R_{m,t+1}$, and logarithmic return $r_{m,t+1} = \ln(1+R_{m,t+1})$. The capital guaranteed product has arithmetic net return $R_{g,t+1}$ and logarithmic return $r_{g,t+1} = \ln(1 + R_{g,t+1})$.

The assets are assumed to satisfy the following properties. Under the physical measure $\mathbb{P}$, the equity index $R_{m,t+1}$ is lognormal and satisfies

$$\ln(1 + R_{m,t+1}) \sim \mathcal{N}(\mu + r_f, \sigma^2). \tag{1}$$

We also assume that under the risk-adjusted measure $\mathbb{Q}$, the market return is lognormally distributed:

$$\ln(1 + R_{m,t+1}) \sim \mathcal{N}(r_f - \sigma^2/2, \sigma^2), \tag{2}$$

so that $\mathbb{E}^{\mathbb{Q}}(1 + R_{m,t+1}) = e^{r_f} = 1 + R_f$.

The return on the guaranteed product is contingent on the realization of the stock return:

$$R_{g,t+1} = \max(p\, R_{m,t+1}; g),$$

where $g \geq -1$ is the guaranteed rate of return and $p \geq 0$ is a constant (called participation rate in the industry). The return on the guaranteed product is bounded below by g. Therefore $g < R_f$ in the absence of arbitrage.

To price the structured products, we proceed as follows. Since the return on the guaranteed product satisfies $R_{g,t+1} = g + \max(p\, R_{m,t+1} - g; 0)$, the mean return $\mathbb{E}^Q(R_{g,t+1})$ is given by a Black-Scholes type formula.

Proposition 1 (Expected return on the structured product). *The mean return on the structured product under the risk-adjusted measure is given by*

$$\mathbb{E}^{\mathbb{Q}}(R_{g,t+1}) = g + pe^{r_f} N(d_1) - (p+g)N(d_2),$$

where

$$d_1 = \frac{1}{\sigma}\left[\ln\left(\frac{p}{p+g}\right) + r_f + \frac{\sigma^2}{2}\right]$$

and $d_2 = d_1 - \sigma$. Furthermore, the mean return $\mathbb{E}^Q(R_{g,t+1})$ strictly increases with the participation rate p and the guaranteed return g.

Under the risk-adjusted measure $\mathbb{Q}$, the mean return on the structured product is equal to the risk-free rate: $\mathbb{E}^Q(R_{g,t+1}) = R_f = e^{r_f} - 1$.

Proposition 2 (Pricing of structured products). *The participation rate p and the guaranteed rate g satisfy the equation*

$$g + pe^{r_f} N(d_1) - (p+g)N(d_2) = e^{r_f} - 1. \tag{3}$$

For every guaranteed rate $g \in [-1; R_f]$, there exists a unique participation rate $p(g, r_f, \sigma) \in [0; 1]$ such that condition (7) holds. The no-arbitrage participation rate $p(g, r_f, \sigma)$ decreases with the guaranteed rate g, declining from unity if $g = -1$ (no guarantee) to zero if $g = R_f$ (full guarantee). Furthermore, the participation rate increases with volatility σ and increases with the interest rate r_f.

If $g = 0$, then d_1 and d_2 do not depend on p, and the participation rate is available in closed form:

$$p = \frac{e^{r_f} - 1}{e^{r_f} N(d_1) - N(d_2)}.$$

B. ***Portfolio Choice and Corresponding Utility***

The agent is endowed with initial wealth W_t that she can invest in the riskless asset, the stock, and the guaranteed product. Let α_t denote the portfolio weight of the stock and β_t the portfolio weight of the structured product. The agent chooses the values of α_t and β_t that maximize the expected value of its utility. We compute the portfolio choice α_t and β_t of an investor with CRRA, habit formation, and loss aversion preferences, as well as the increase in interest rate that would correspond to the same gain in utility.

B.1. CRRA Investor

We consider an agent with CRRA utility $\mathbb{E}_t \left[u(C_{t+1}) \right]$, where

$$u(C) = \frac{C^{1-\gamma}}{1-\gamma}.$$

The agent chooses the values of α_t and β_t that maximize

$$\mathbb{E} \left\{ u \left[W_t(1 + R_f + \alpha_t \, R^e_{m,t+1} + \beta_t \, R^e_{g,t+1}) \right] \right\} = W_t^{1-\gamma} v(\alpha_t, \beta_t),$$

where

$$v(\alpha_t, \beta_t) = \frac{1}{1-\gamma} \mathbb{E} \left[(1 + R_f + \alpha_t R^e_{m,t+1} + \beta_t R^e_{g,t+1})^{1-\gamma} \right]$$

denotes the expected utility from one unit of initial wealth.

When the investor can only invest in the bond and the stock, the optimal share invested in the stock is given by Merton's formula:

$$\alpha_t = \frac{\mu + \sigma^2/2}{\gamma \sigma^2},$$

as we verify in the Appendix.

When the investor can invest in all three assets, the optimal solution can be computed numerically. For a given $z = \ln(1 + R_{m,t})$, the net arithmetic return on the portfolio is

$$R_p(z;\alpha,\beta) = (1-\alpha-\beta)R_f + \alpha(e^z - 1) + \beta \max[p(e^z-1); g].$$

We infer from (1) that the objective function is

$$v(\alpha_t,\beta_t) = \frac{1}{1-\gamma}\int_{-\infty}^{+\infty} [1 + R_p(z;\alpha,\beta)]^{1-\gamma} \ \phi(z;\mu + r_f, \sigma^2) \ du,$$

where $\phi(\ \cdot\ ; m, \sigma^2)$ denotes the p.d.f. of a Gaussian with mean m and variance σ^2.

In a second step, we compute the increase in interest rate that would correspond to the same gain in utility.

A pure bond portfolio achieves the utility level $W_t^{1-\gamma} v(\alpha_t, \beta_t)$ if and only if

$$1 + R_f^* = [(1-\gamma)\ v(\alpha_t,\beta_t)]^{1/(1-\gamma)}\,.$$

If the investment period contains n years, the gross yearly interest rate is

$$(1 + R_f^*)^{1/n} - (1 + R_f)^{1/n}$$

in annual units.

B.2. Habit Formation

We now consider an agent with habit formation with utility

$$u(C) = \frac{(C - X)^{1-\gamma}}{1-\gamma}.$$

Let $\xi = X/W$ denote the habit to wealth ratio. The objective function is

$$v(\alpha,\beta) = \frac{1}{1-\gamma}\int_{-\infty}^{+\infty} [1 + R_p(z;\alpha,\beta) - \xi]^{\ 1-\gamma} \phi(z;\mu + r_f,\sigma^2)\ dz.$$

A strategy is admissible if $C - X \geq 0$ for all realizations of the stock return. That is

$$[1 + (1 - \alpha_t - \beta_t)R_f + \alpha_t(e^z - 1) + \beta_t \max[p(e^z - 1); g] \geq \xi$$

for all $z \in \mathbb{R}$, which holds if and only if $1 + (1 - \alpha_t - \beta_t)R_f - \alpha_t + \beta_t \max(-p; g) \geq \xi$. Therefore, a portfolio is admissible if and only if

$$(1 + R_f)\alpha_t + [R_f - \max(-p; g)]\, \beta_t \leq 1 + R_f - \xi.$$

We compute the increase in interest rate that would lead to the same utility gain as follows. A pure bond portfolio achieves the utility level $W_t^{1-\gamma} v(\alpha_t, \beta_t)$ if and only if $(1 + R_f^* - \xi)^{1-\gamma}/(1 - \gamma) = v(\alpha_t, \beta_t)$, or equivalently

$$1 + R_f^* = [(1 - \gamma)v(\alpha_t, \beta_t)]^{1/(1-\gamma)} + \xi.$$

If the investment period contains n years, the welfare gain is quantified by the difference $(1 + R_f^*)^{1/n} - (1 + R_f)^{1/n}$.

B.3. Loss Aversion

We now consider an agent with loss aversion. The expected utility becomes

$$u(W; W_R) = \begin{cases} (W - W_R)^{1-\gamma}/(1-\gamma) & \text{if} \quad W \geq W_R, \\ -\lambda(W_R - W)^{1-\gamma}/(1-\gamma) & \text{if} \quad W < W_R. \end{cases}$$

Let $\omega_R = W_R/W_t$ denote the ratio of the reference point to initial wealth.

The objective function is $W_t^{1-\gamma} v(\alpha_t, \beta_t)$, where

$$v(\alpha_t, \beta_t) = \frac{1}{1-\gamma} \int_{-\infty}^{+\infty} u\left[1 + R_p(z; \alpha, \beta); \omega_R\right]\ \phi(z; \mu + r_f, \sigma^2)\ dz.$$

A pure bond portfolio achieves the utility level $W_t^{1-\gamma} v(\alpha_t, \beta_t)$ if and only if $(1+R_f^* - \omega_R)^{1-\gamma}/(1-\gamma) = v(\alpha_t, \beta_t)$, or equivalently

$$1 + R_f^* = [(1 - \gamma)v(\alpha_t, \beta_t)]^{1/(1-\gamma)} + \omega_R.$$

If the investment period contains n years, the welfare gain is quantified by the difference $(1 + R_f^*)^{1/n} - (1 + R_f)^{1/n}$.

B.4. Misperception on the Fraction of Risk Premium the Investor Receives

We finally consider misperception on the actual payoff obtained through a structured product as potential mechanism underlying our empirical results. We assume that for a given guaranteed rate g, investors believe that the percentage of the index performance p they will receive is higher than it really is, and we study the portfolio allocation impact of such a belief. The rationale for considering such a variation is that retail structured products design frequently relies on payoff designs that translate into a higher percentage of the index performance the investor receives than a vanilla call option would provide. Asian options, for instance, mechanically reduce the index performance during bullish periods. If household do not distinguish between vanilla call options and Asian options, they misperceive p.

C. *Asian Option: Pricing and Underlying Exposure*

We also extend our framework to accommodate structured product built with Asian options, and work under the assumption that households adequately perceive these products.

C.1. Design

The return on the guaranteed product is assumed to be:

$$R_{g,T} = \max(p\ R_T^*; g), \tag{4}$$

where R_T^* is a benchmark return, $p \geq 0$ is a constant (called participation rate in the industry), and $g \geq -1$ is the guaranteed rate of return. As previously, $g < R_f$ in the absence of arbitrage. The guaranteed product is issued at date $t = 0$.

The benchmark return is

$$1 + R_T^* = \frac{S_{t_1} + S_{t_2} + ... + S_{t_n}}{nS_{t_0}},$$

where S_{t_0} is the initial reference level of an index or asset at t_0 and $t_1, ..., t_n$ are prespecified reading dates. The dates are chosen so that

$$0 \leq t_0 < t_1 < ... < t_n \leq T.$$

The date t_0 is often chosen to be a few days after issuance.

C.2. Issue Price

Consistent with Turnbull and Wakeman (1991), we assume that under the risk-adjusted measure Q, the conditional distribution of the benchmark return $1 + R_T^*$ at date $t = 0$ is approximately lognormal with mean M_1 and second moment M_2. The variance of the log benchmark return, $\ln(1 + R_T^*)$, is then

$$w^2 = \ln\left(\frac{M_2}{M_1^2}\right),$$

as the properties of the lognormal distribution imply.

We assume that under the risk-adjusted measure Q, the underlying index follows a geometric Brownian motion:

$$\frac{dS_t}{S_t} = (r_f - q)dt + \sigma dZ_t,$$

where r_f is the continuous-time interest rate, q is the continous-time dividend yield, and σ denotes volatility. In the Appendix, we verify that the first and second moments of the benchmark return, $M_1 = E_0^Q(1 + R_T^*)$ and $M_2 = E_0^Q\left[(1 + R_T^*)^2\right]$, satisfy

$$M_1 = \frac{1}{n}\sum_{i=1}^{n} e^{(r_f - q)(t_i - t_0)}, \tag{5}$$

$$M_2 = \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} e^{[2(r_f - q) + \sigma^2][\min(t_i, t_j) - t_0] + (r_f - q)|t_j - t_i|},$$

which can be easily computed for a structured contract.

Since the net return on the guaranteed product between issuance and maturity (4) satisfies

$$R_{g,T} = g + \max[p(1 + R_T^*) - p - g; 0],$$

the mean return $E^Q(R_{g,T})$ is given by a Black-Scholes type formula.

Proposition 3 (Expected return on the structured product). *The mean return on the structured product under the risk-adjusted measure is given by*

$$E^Q(R_{g,T}) = g + pM_1N(d_1) - (p+g)N(d_2),$$

where

$$d_1 = \frac{1}{w}\left[\ln\left(\frac{p}{p+g}\right) + \ln(M_1) + \frac{w^2}{2}\right] \tag{6}$$

and $d_2 = d_1 - w$. *Furthermore, the mean return* $E^Q(R_{g,T})$ *strictly increases with the participation rate* p *and the guaranteed return* g.

Under the risk-adjusted measure Q, the mean return on the structured product is equal to the risk-free rate: $E^Q(R_{g,T}) = e^{r_f T} - 1$.

Proposition 4 (Pricing of structured products). *The participation rate* p *and the guaranteed rate* g *satisfy the equation*

$$g + pM_1N(d_1) - (p+g)N(d_2) = e^{r_f T} - 1. \tag{7}$$

[*For every guaranteed rate* $g \in [-1; R_f]$, *there exists a unique participation rate* $p(g, r_f, \sigma) \in [0; 1]$ *such that condition (7) holds. The no-arbitrage participation rate* $p(g, r_f, \sigma)$ *decreases with the guaranteed rate* g, *declining from unity if* $g = -1$ *(no guarantee) to zero if* $g = R_f$ *(full guarantee). Furthermore, the participation rate increases with volatility* σ *and increases with the interest rate* r_f.]

C.3. Price of Outstanding Contract and Underlying Exposure

We now consider the value of the contract after it is originated. For every $i \in \{0, ..., n-1\}$ and $u \in [t_i, t_{i+1})$, we define

$$
\begin{aligned}
M_{1,u} &= \frac{1}{n-i} \sum_{j=i+1}^{n} e^{(r_f - q)(t_j - u)}, \\
M_{2,u} &= \frac{1}{(n-i)^2} \sum_{j=i+1}^{n} \sum_{k=i+1}^{n} e^{[2(r_f-q)+\sigma^2][\min(t_j,t_k)-u]+(r_f-q)|t_j-t_k|}, \\
w_u^2 &= \ln\left(\frac{M_{2,u}}{M_{1,u}^2}\right), \\
d_{1,u} &= \frac{1}{w_u}\left[\ln\left(\frac{p}{p+g}\right) + \ln(M_{1,u}) + \frac{w_u^2}{2}\right], \\
d_{2,u} &= d_{1,u} - w_u.
\end{aligned}
$$

We show in the Appendix the following property.

Proposition 6 (Price of Outstanding Contract). *The price C_u of the contract at date u, $t_i \leq u < t_{i+1}$, is given by*

$$
e^{-r_f(T-u)}\left[1 + g + p\frac{n-i}{n}\frac{S_u}{S_{t_0}} M_{1,u} N(d_{1,u}) + p\left(\frac{S_{t_1} + ... + S_{t_i}}{nS_{t_0}} - K\right) N(d_{2,u})\right],
$$

where $K = 1 + g/p$.

We infer that

$$
\begin{aligned}
\Delta_u &= \frac{\partial C_u}{\partial S_u} = \frac{pe^{-r_f(T-u)}}{S_{t_0}} \frac{n-i}{n} M_{1,u} N(d_{1,u}) && (8) \\
&= \frac{pe^{-r_f(T-u)}}{nS_{t_0}} \left[\sum_{j=i+1}^{n} e^{(r_f-q)(t_j-u)}\right] N(d_{1,u}). && (9)
\end{aligned}
$$

The equivalent of the risky share is the elasticity:

$$
w_u = \frac{S_u}{C_u}\frac{\partial C_u}{\partial S_u} = \frac{S_u}{C_u}\Delta_u,
$$

where S_u is the stock (index) price at date u, C_u is the value of the contract corresponding to a \$1 initial investment, and Δ_u is given by (8). The equivalent of the risky share, w_u, is therefore

$$\frac{p(S_u/S_{t_0})\left[n^{-1}\sum_{j=i+1}^{n}e^{(r_f-q)(t_j-u)}\right]N(d_{1,u})}{1+g+p(S_u/S_{t_0})\left[n^{-1}\sum_{j=i+1}^{n}e^{(r_f-q)(t_j-u)}\right]N(d_{1,u})+\left(p\frac{S_{t_1}+\ldots+S_{t_i}}{nS_{t_0}}-p-g\right)N(d_{2,u})}$$

We now consider the special case $u=t_0=0$. The elasticity of the contract at date $t=0$ reduces to:

$$w_0 = pe^{-r_fT}M_1N(d_1).$$

where M_1 and d_1 are defined in equations (5) and (6).

D. ***Model Estimation***

D.1. Assumptions

We use an investment period of 4 years, and a guaranteed return of -6% for the structured product, which corresponds to the average in our sample for these parameters. We use yearly risk free rate of 2%, market premium of 4% and a volatility of 20%. These inputs translate into a p, the percentage of index performance the investor receives through the structured product, of 51.27%.

In Sweden, average financial wealth is about \$45,000 and average human capital is about \$760,000 (see Calvet and Sodini, Appendix to Twin Picks, 2014). The ratio HC_t/W_t is therefore about 16.9.

We use the investment universe with only the riskless asset as our initial benchmark. For each of the framework specification, we then sequentially introduce the stock index and the structured product, and study the change in portfolio allocation, in utility levels, and the interest rate increase that would lead to the same increase in utility. We also include quantiles of net portfolio returns.

D.2. Results

Portfolio Allocation

We present a summary of the model allocation outputs and welfare gains in Table VI.

INSERT TABLE VI

They are several key take-aways from this exercise. First, we observe that CRRA and habit formation utilities are unlikely to explain our data, as they generate negligible appetite for the guaranteed product. Second, loss aversion, and misperception on the fraction of the index performance the investor will receive, generate significant appetite for the guaranteed product. Third, the risky share expands significantly under both these specifications, which is consistent with the data. Fourth, the introduction of risk-less human capital reduces the appetite for the guaranteed product to zero, and makes the stock index significantly more appealing.

Under the loss-aversion mechanism, structured product would mitigate this behavioral bias and thereby foster households to participate more often and in a larger extent to risky asset markets.

On the other hand, the misperception mechanism suggests a possible interaction between behavioral and rational motivation. To generate appetite for risk management, banks may need to partly obfuscate its cost.

Asian Option Price Elasticity to Underlying Index

We estimate the price-elasticity of structured product relying on Asian options at issuance by using the same market parameters as previously. This exercise yields an estimate in the [0.6-0.7] range. The natural next step of the analysis will be to calculate the portfolio allocation associated with the introduction of an Asian-option structured product.

VI. Conclusion

This study provides empirical evidence suggesting that innovative financial products can help alleviate the low participation of households in risky asset markets. We use a large administrative dataset to characterize the demand for structured products, an innovative class of retail financial products with option-like features.

The micro-evidence in this paper suggests that the introduction of retail structured products increases significantly stock market participation and the risky share of specific subgroups of the population, in particular households with lower financial wealth, with low to median IQ, and older. Both empirical and theoretical evidence is most consistent with these innovative products being successful at alleviating loss aversion among households.

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Appendix A. Proofs

Proof of Proposition 1. The average return on the structured product is

$$\begin{aligned} \mathbb{E}^{\mathbb{Q}}[R_{g,t+1}] &= g + p\,\mathbb{E}^{\mathbb{Q}}[\max(R_{m,t+1} - g/p, 0)] \\ &= g + p\,\mathbb{E}^{\mathbb{Q}}\left\{\max\left[e^{\ln(1+R_{m,t+1})} - 1 - \frac{g}{p}; 0\right]\right\}. \end{aligned}$$

We infer from (2) that

$$\begin{aligned} \mathbb{E}^{\mathbb{Q}}[R_{g,t+1}] &= g + \frac{p}{\sqrt{2\pi\sigma^2}} \int_{\ln(1+g/p)}^{+\infty} \left(e^u - 1 - \frac{g}{p}\right) \exp\left[-\frac{(u - r_f + \sigma^2/2)^2}{2\sigma^2}\right] du \\ &= g + p\,I_1 - (p+g)\,I_2, \end{aligned}$$

where

$$\begin{aligned} I_1 &= \frac{1}{\sqrt{2\pi\sigma^2}} \int_{\ln(1+g/p)}^{+\infty} \exp\left[u - \frac{(u - r_f + \sigma^2/2)^2}{2\sigma^2}\right] du, \\ I_2 &= \frac{1}{\sqrt{2\pi\sigma^2}} \int_{\ln(1+g/p)}^{+\infty} \exp\left[-\frac{(u - r_f + \sigma^2/2)^2}{2\sigma^2}\right] du. \end{aligned}$$

Since

$$u - \frac{(u - r_f + \sigma^2/2)^2}{2\sigma^2} = r_f - \frac{(u - r_f - \sigma^2/2)^2}{2\sigma^2},$$

we consider the change of variables $v = (u - r_f - \sigma^2/2)/\sigma$ and obtain

$$I_1 = \frac{1}{\sqrt{2\pi}} \int_{[\ln(1+g/p) - r_f - \sigma^2/2]/\sigma}^{+\infty} \exp\left(r_f - \frac{v^2}{2}\right) dv = e^{r_f} N(d_1).$$

Similarly, the change of variables $v = (u - r_f + \sigma^2/2)/\sigma$ implies that

$$I_2 = \frac{1}{\sqrt{2\pi}} \int_{[\ln(1+g/p) - r_f + \sigma^2/2]/\sigma}^{+\infty} \exp\left(-\frac{v^2}{2}\right) dv = N(d_2).$$

In order to derive the monotonicity of

$$\varphi(g,p) = g + pe^{r_f} N(d_1) - (p+g) N(d_2),$$

we begin by deriving a few preliminary results. We note that

$$\begin{aligned}\frac{\partial d_1}{\partial g} &= \frac{\partial d_2}{\partial g} = -\frac{1}{\sigma(p+g)},\\ \frac{\partial d_1}{\partial p} &= \frac{\partial d_2}{\partial p} = \frac{g}{\sigma p(p+g)},\end{aligned}$$

We also note that

$$N'(d_2) = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{d_2^2}{2}\right) = \frac{1}{\sqrt{2\pi}}\exp\left[-\frac{(d_1-\sigma)^2}{2}\right]$$

and therefore

$$N'(d_2) = N'(d_1)\exp\left(d_1\sigma - \frac{\sigma^2}{2}\right).$$

Since

$$\exp\left(d_1\sigma - \frac{\sigma^2}{2}\right) = \exp\left[\ln\left(\frac{p}{p+g}\right) + r_f + \frac{\sigma^2}{2} - \frac{\sigma^2}{2}\right],$$

we obtain that

$$\exp\left(d_1\sigma - \frac{\sigma^2}{2}\right) = \frac{p}{p+g}e^{r_f}.$$

Hence

$$(p+g)N'(d_2) = pe^{r_f}N'(d_1).$$

The monotonicity of $\varphi(g,p)$ with respect to g follows from the fact that $\varphi(g,p) = \mathbb{E}^{\mathbb{Q}}\max[pR_{m,t+1}, g]$. It also results from the analytical expression (), since

$$\frac{\partial\varphi}{\partial g}(g,p) = 1 + \left(pe^{r_f}N'(d_1)\frac{\partial d_1}{\partial g} - (p+g)N'(d_2)\frac{\partial d_2}{\partial g}\right) - N(d_2).$$

The term in parentheses can be rewritten as

$$\begin{aligned}& pe^{r_f}N'(d_1)\frac{\partial d_1}{\partial g} - (p+g)N'(d_2)\frac{\partial d_2}{\partial g}\\ =& \left[pe^{r_f} - (p+g)\exp\left(d_1\sigma - \frac{\sigma^2}{2}\right)\right]N'(d_1)\frac{\partial d_2}{\partial g}\\ =& \ 0.\end{aligned}$$

Hence

$$\frac{\partial\varphi}{\partial g}(g,p) = N(-d_2) > 0.$$

The function $\varphi(g,p)$ strictly increases with the guaranteed rate g.

Similarly, we verify that

$$\varphi(g,p) = g + pe^{r_f}N(d_1) - (p+g)N(d_2).$$

Hence

$$
\begin{aligned}
\frac{\partial \varphi}{\partial p}(g,p) &= e^{r_f}N(d_1) - N(d_2) + pe^{r_f}N'(d_1)\frac{\partial d_1}{\partial p} - (p+g)N'(d_2)\frac{\partial d_2}{\partial p} \\
&= e^{r_f}N(d_1) - N(d_2) + \frac{\partial d_1}{\partial p}\left[pe^{r_f}N'(d_1) - (p+g)N'(d_2)\right]
\end{aligned}
$$

and therefore

$$\frac{\partial \varphi}{\partial p}(g,p) = e^{r_f}N(d_1) - N(d_2).$$

Since $d_1 > d_2$ and $r_f > 0$, we conclude that

$$\frac{\partial \varphi}{\partial p}(g,p) = e^{r_f}N(d_1) - N(d_2) > 0.$$

The function $\varphi(g,p)$ strictly increases with the participation rate p.

Proof of Proposition 2. Let $\psi = g + pe^{r_f}N(d_1) - (p+g)N(d_2) - e^{r_f} + 1$. We have

$$
\begin{aligned}
\frac{\partial \psi}{\partial r_f} &= pe^{r_f}N(d_1) - e^{r_f} + pe^{r_f}N'(d_1)\frac{\partial d_1}{\partial r_f} - (p+g)N'(d_2)\frac{\partial d_1}{\partial r_f} \\
&= e^{r_f}\left[pN(d_1) - 1\right] < 0.
\end{aligned}
$$

By the Implicit Function Theorem, the participation rate p increases with the interest rate.

Similarly,

$$
\begin{aligned}
\frac{\partial \psi}{\partial \sigma} &= pe^{r_f}N'(d_1)\frac{\partial d_1}{\partial \sigma} - (p+g)N'(d_2)\left(\frac{\partial d_1}{\partial \sigma} - 1\right) \\
&= (p+g)N'(d_2).
\end{aligned}
$$

We note that $p+g = p(g, r_f, \sigma)+g$ increases in g. Since $p+g = 0$ if $g = -1$. we know that $p+g \geq 0$. By the Implicit Function Theorem, the participation rate p decreases with volatility.

Two-Asset Portfolio Choice. As Campbell and Viceira (2001) show, the excess log return on the portfolio, $r_{p,t+1} = \log(1 + R_{p,t+1})$, satisfies[9]

$$r_{p,t+1} - r_f \approx \alpha_t(r_{t+1} - r_f) + \frac{1}{2}\alpha_t(1-\alpha_t)\sigma^2.$$

Since $r_{p,t+1}$ is approximately normal, then

$$\mathbb{E}_t[e^{(1-\gamma)r_{p,t+1}}] = \exp\left[(1-\gamma)\mathbb{E}_t(r_{p,t+1}) + \frac{(1-\gamma)^2}{2}Var_t(r_{p,t+1})\right].$$

The investor therefore maximizes

$$\log(R_p^{CE}) = \mathbb{E}_t(r_{p,t+1}) + \frac{1-\gamma}{2} Var_t(r_{p,t+1}).$$

The objective function, $\log(R_p^{CE})$, is then

$$\begin{aligned} & r_f + \alpha_t(\mathbb{E}_t r_{t+1} - r_f) + \frac{1}{2}\alpha_t(1-\alpha_t)\sigma^2 + \frac{1-\gamma}{2}\alpha_t^2\sigma^2 \\ = \quad & r_f + \alpha_t\left(\mu + \frac{\sigma^2}{2}\right) - \frac{\gamma}{2}\alpha_t^2\sigma^2. \end{aligned}$$

We conclude that the objective function is optimal if

$$\alpha_t = \frac{\mu + \frac{\sigma^2}{2}}{\gamma\sigma^2}.$$

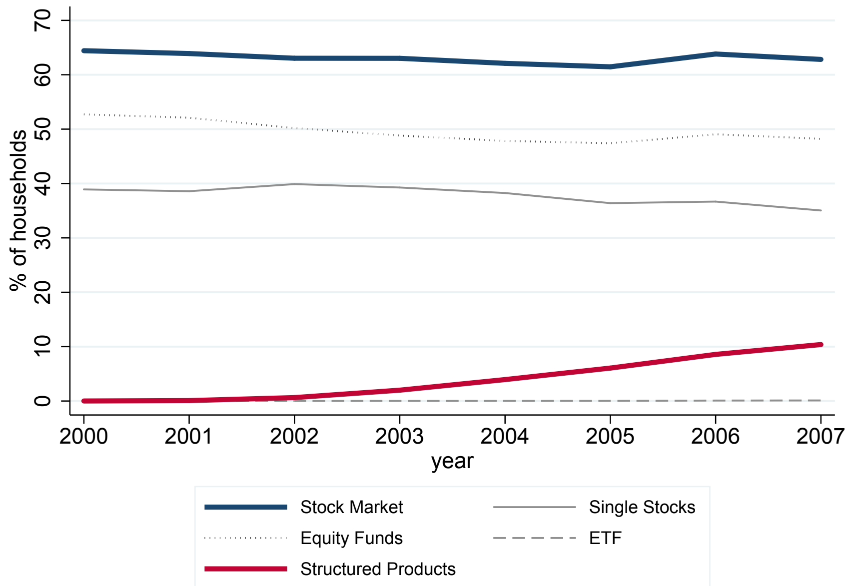
The certainty equivalent is

$$\log(R_p^{CE}) = r_f + \frac{1}{2\gamma\sigma^2}\left(\mu + \frac{\sigma^2}{2}\right)^2.$$

The utility is therefore

$$\frac{W_t^{1-\gamma}}{1-\gamma}\exp\left\{(1-\gamma)\left[r_f + \frac{1}{2\gamma\sigma^2}\left(\mu + \frac{\sigma^2}{2}\right)^2\right]\right\}.$$

Panel A. Fraction of Households Participating in Structured Products, Stocks, and Equity Funds



Panel B. Share of Financial Wealth Invested in Structured Products, Stocks, and Equity Funds

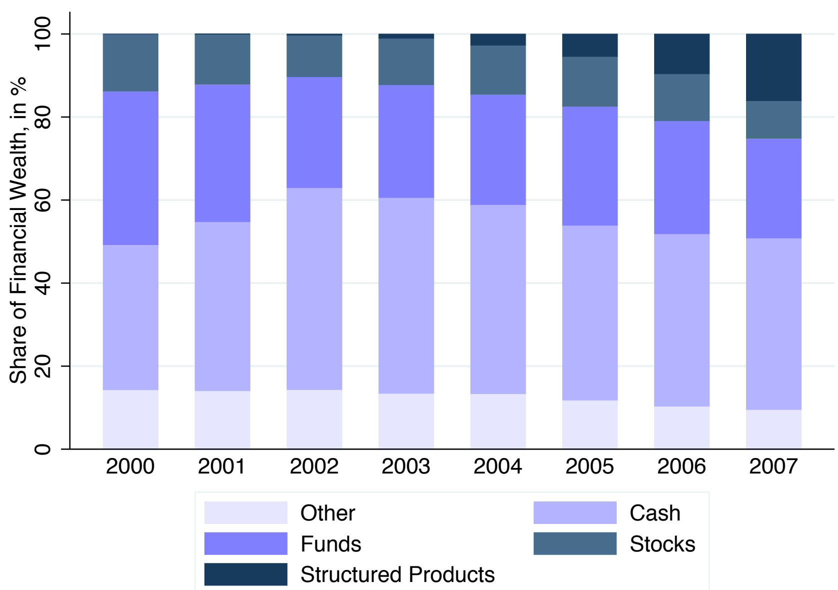
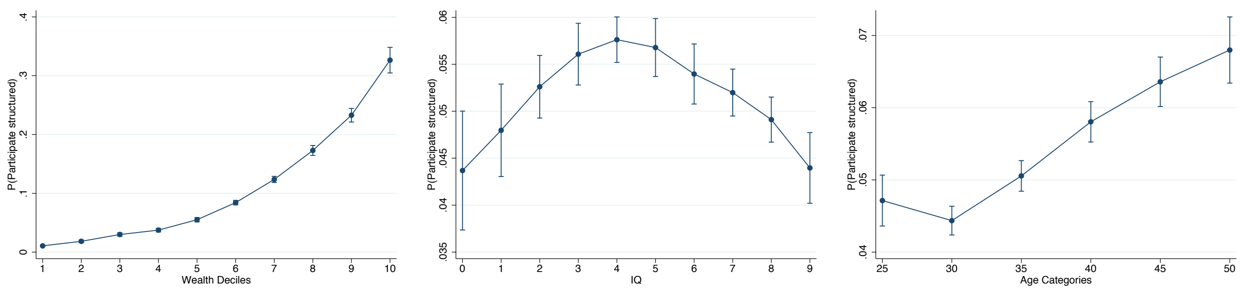
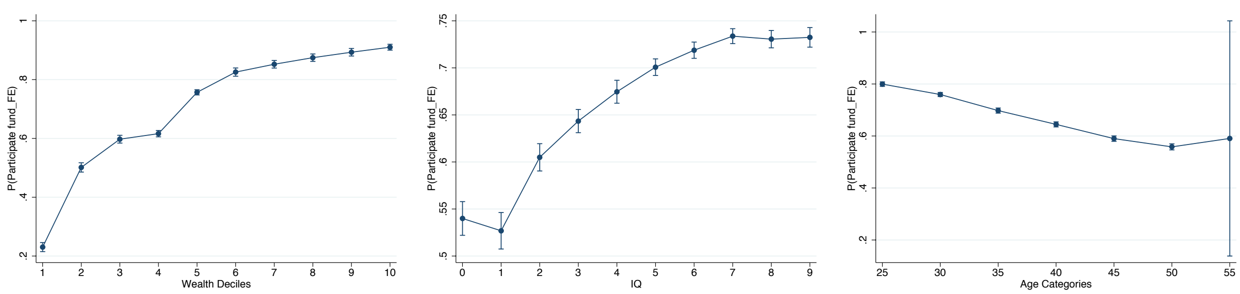


Figure 1. Adoption of Structured Products in Sweden (2000-2007)
Panel A shows the evolution of the share of Swedish households investing in equity markets through either stocks, funds or structured products (blue line), in equity funds (dot line), in stocks (grey line), in structured products (red line) and in ETFs (dashed line). Swedish banks started distributing retail structured products in 2000, the beginning of our sample period. Panel B displays the evolution of the composition of the financial wealth of households that participate in retail structured products as of end 2007.

Panel A. Structured Products



Panel B. Equity Funds



Panel C. Stocks

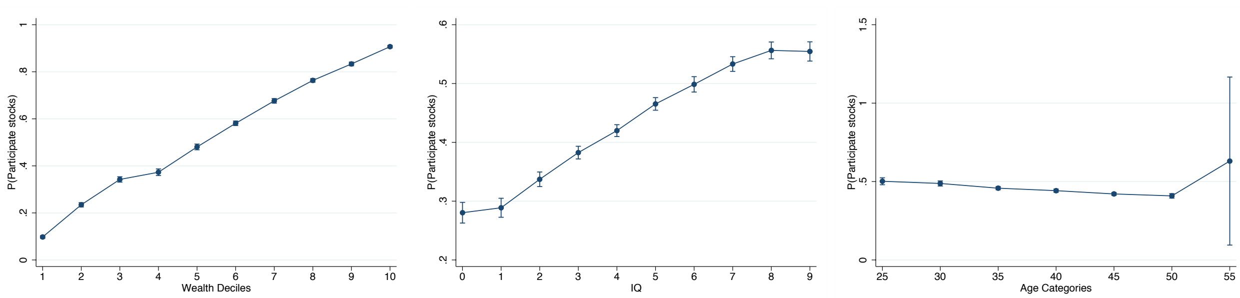


Figure 2. Likelihood of Participation in Structured Products, Equity Funds and Stocks
This figure shows predicted probabilities estimated from logit regressions, where the dependent variable is an indicator variable for investing in a given investment products at least one year during the 2002-2007 period. All regressions include the same explanatory variables: financial wealth deciles, IQ score levels (from 0 to 9), age categories, the number of adults in the household, the number of children in the households, and indicator variable for living in a urban area, and the gender of the household. All explanatory variables are defined in 2002.

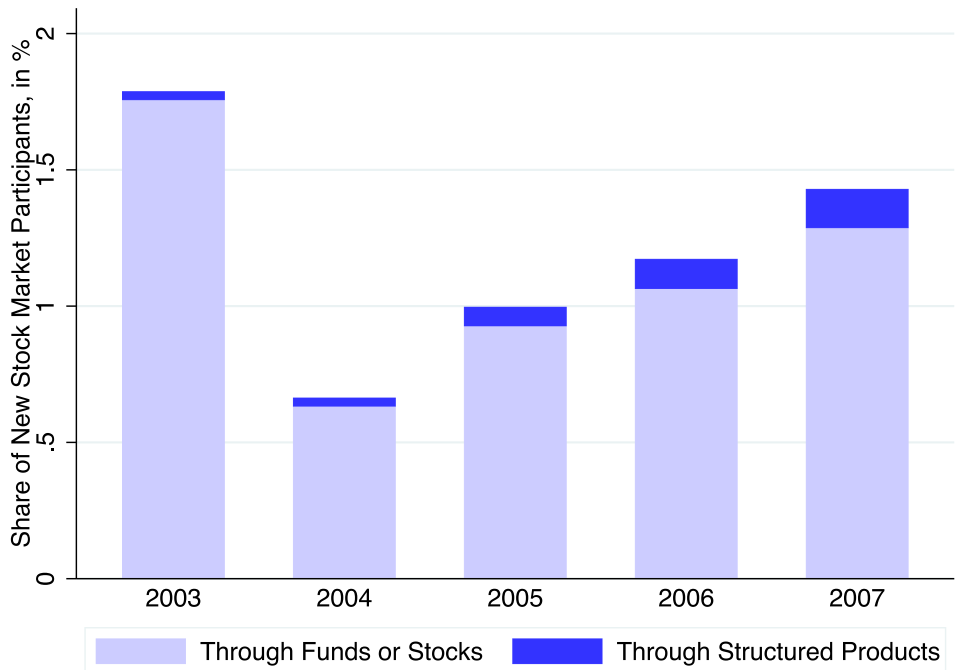


Figure 3. Evolution of the share of new participants through equity funds and stocks, and through structured products.

This figure shows the evolution of the share of households that start participating in risky asset markets. These new participants are broken down between the one that start participating through equity funds and stocks, and the ones that do so through structured products. New participants are defined as households that were not participating in equity funds, stocks or structured products during in the four precedent years.

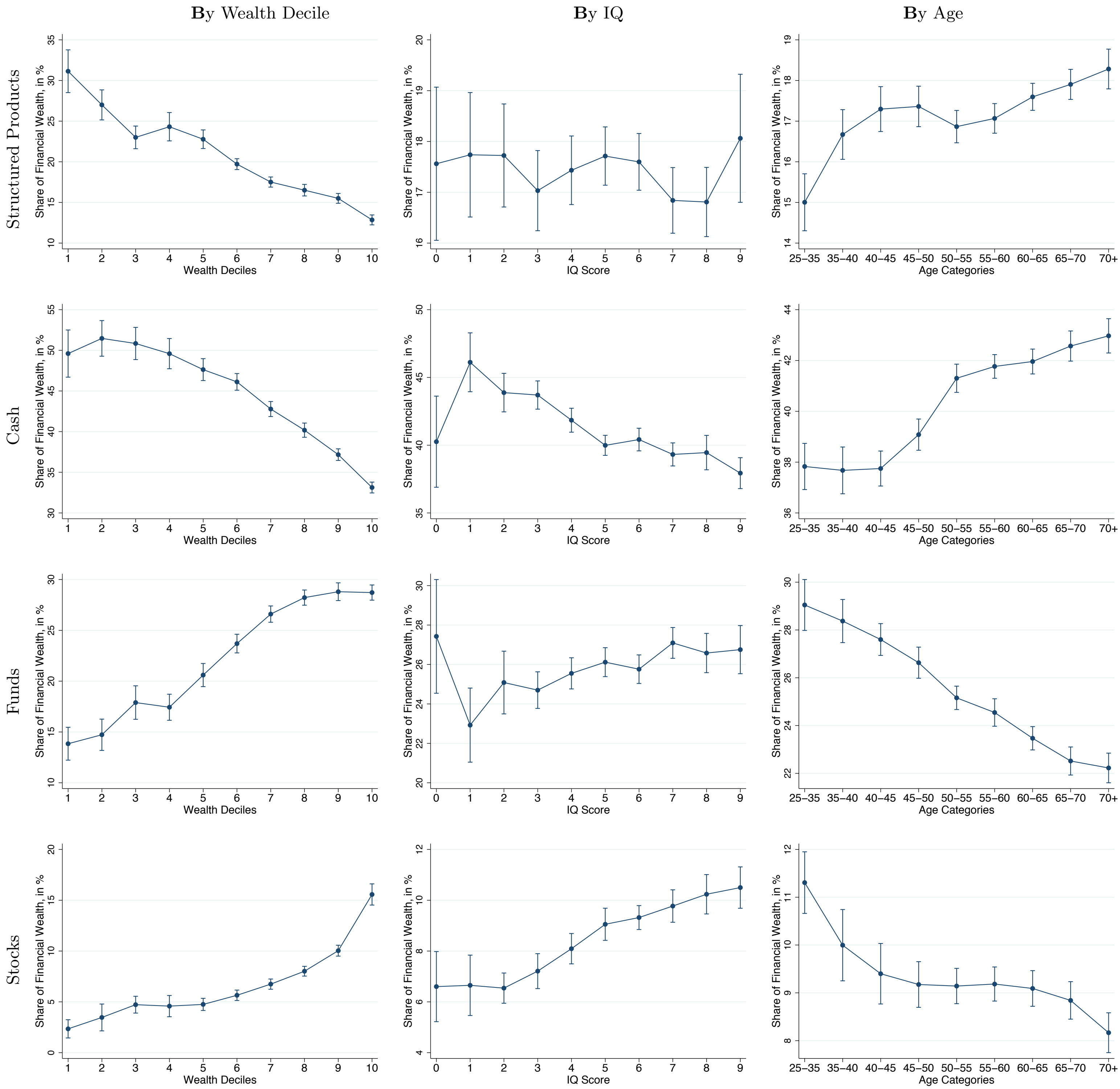


Figure 4. Portfolio Composition: Share of Financial Wealth Invested in Structured Products, Equity Funds, Stocks and Cash

This figure displays regression coefficients from OLS regressions, where the dependent variable is the share of financial wealth invested in a given investment products as of end of 2007. All regressions include the same explanatory variables: financial wealth deciles, IQ score levels (from 0 to 9), age categories, the number of adults in the household, the number of children in the households, and indicator variable for living in a urban area, and the gender of the household head. The sample is restricted to structured product participants.

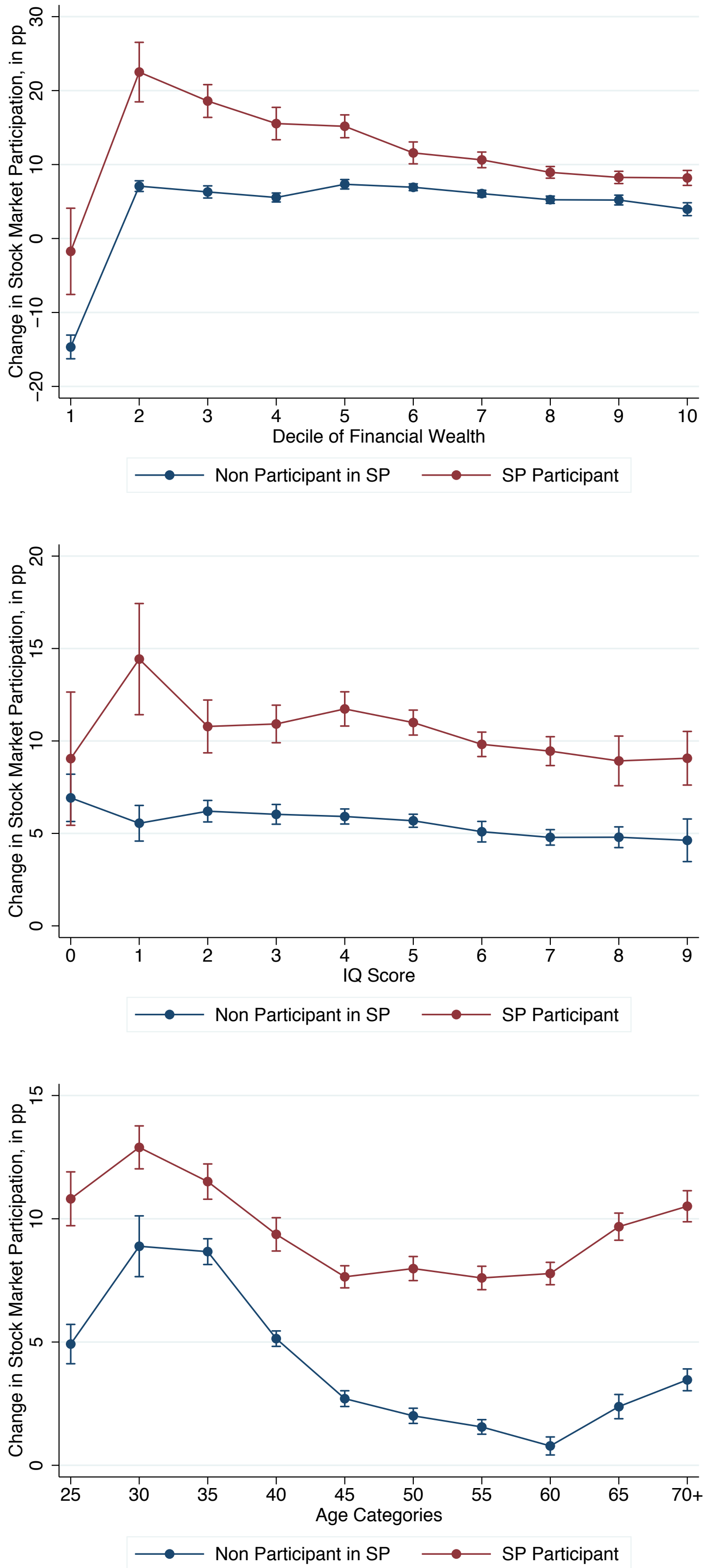


Figure 5. Change in the risky share over the 2002-2007 period for participants in equity funds, stocks or structured products.

This figure shows the change in the risky share, in p.p. of financial wealth, over the 2002-2007 period for 2007 structured product participants versus equity fund or stock participants (that do not participate in structured products), broken down by wealth decile, IQ levels and age categories. The risky share includes equity funds, stocks and retail structured products. The sample includes all households that participate in equity funds or stocks in 2002.

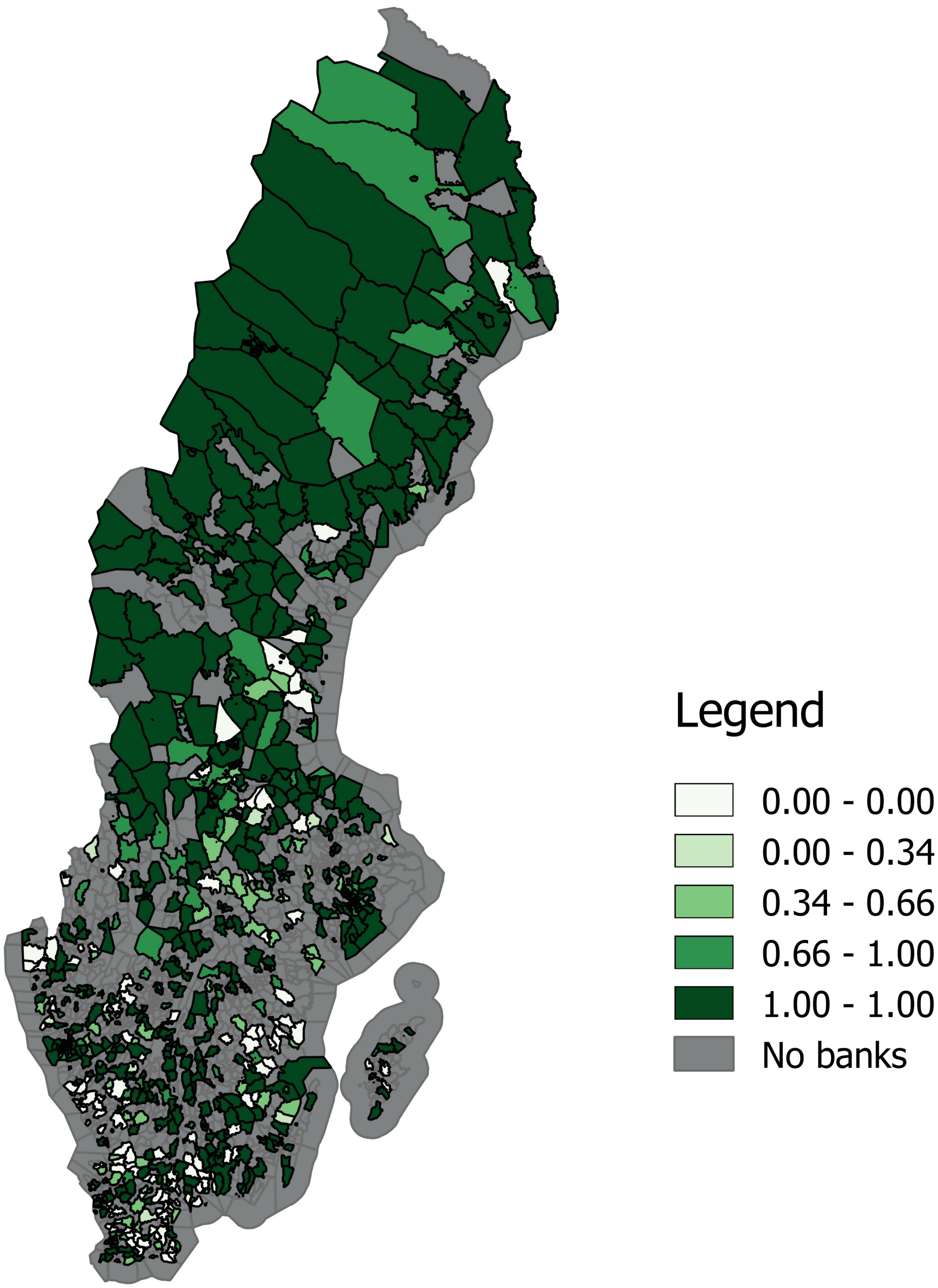


Figure 6. Within Parish Share of Bank Branches Offering Structured Products over the 2002-2007 Period

This figure displays within in Swedish parish the share of branches offering structured products over the 2002-2007 period. We use this measure to instrument household likelihood to participate in structured products.

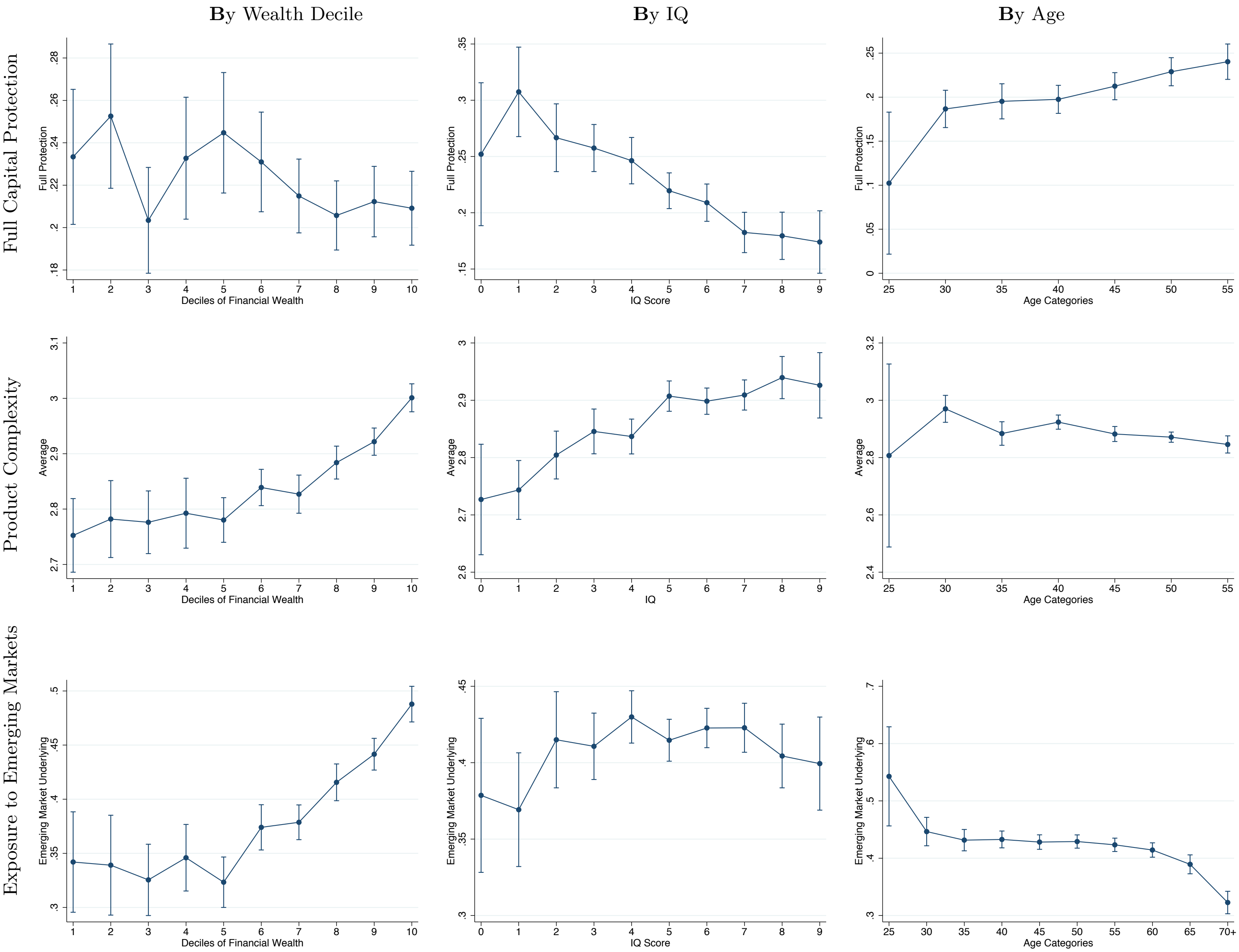


Figure 7. Product Design and Investor Characteristics.

This figure displays coefficients from logit and OLS regressions where the dependent variable is an indicator variable for the household being invested in a structured product with 100% capital guarantee, the household level average complexity of structured products, as measured by the number of payoff features as in Celerier and Vallee (2017), and an indicator variable for the household to be invested in a structured product with an underlying asset from an emerging economy. The sample is restricted to structured product participants.

Table I. Structured Product Participants: Summary Statistics

Sample	All		Structured Participants		Fund Participants		Stock Participants		IQ Sample	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Financial characteristics ($):										
Yearly income	33,340	25,447	47,557	37,690	39,997	32,521	45,219	36,201	37,163	29,517
Total wealth	183,020	93,390	350,008	231,024	250,329	151,223	336,906	209,729	174,669	95,695
Financial wealth	53,504	13,841	136,991	73,760	78,840	27,550	115,393	44,570	38,462	10,501
Total liability	46,971	17,440	48,074	15,586	57,621	26,256	63,844	27,028	65,829	36,421
Total wealth invested in: (in $)										
Structured Products	18,231	0	158,100	75,000	28,708	0	37,294	0	11,823	0
Residential real estate	106,947	58,987	167,481	117,693	139,689	94,531	172,328	121,138	113,100	68,736
Investment real estate	22,569	0	45,535	0	31,800	0	49,185	0	23,107	0
Share of financial wealth invested in (in %)										
Stock Markets	21.2%	7.1%	29.5%	25.6%	35.0%	30.9%	37.9%	34.5%	23.1%	10.3%
Structured Products	1.9%	0.0%	16.1%	11.0%	2.6%	0.0%	2.7%	0.0%	1.4%	0.0%
Funds	17.0%	2.4%	24.0%	20.0%	30.7%	25.7%	22.2%	15.3%	17.8%	4.1%
Equity Funds	12.4%	0.0%	16.4%	10.8%	22.4%	15.5%	17.1%	9.1%	14.1%	0.8%
Bonds	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%	0.0%
Derivatives	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Capital Insurance	4.1%	0.0%	6.4%	0.0%	4.8%	0.0%	5.2%	0.0%	4.1%	0.0%
Stocks	6.2%	0.0%	9.0%	1.7%	7.9%	0.0%	17.9%	8.5%	6.5%	0.0%
Cash	69.4%	79.4%	41.3%	38.5%	52.3%	51.5%	49.7%	47.5%	69.4%	78.7%
Share of Participants in: (in %)										
Stock Markets	62%		90%		97%		100%		65%	
Funds	55%		86%		100%		77%		58%	
Equity Funds	48%		77%		86%		70%		52%	
ETF Funds	0%		0%		0%		0%		0%	
Stocks	34%		62%		48%		100%		35%	
Structured Products	12%		100%		18%		21%		8%	
Demographics										
Age	54	54	58	60	53	53	56	57	42	43
Number of adults	1.9	1.0	2.0	2.0	2.1	2.0	2.1	2.0	2.1	1.0
Number of Dep. Children	0.5	0.0	0.5	0.0	0.6	0.0	0.5	0.0	0.7	0.0
Years of Schooling	11.9	11.0	12.1	12.0	12.2	12.0	12.3	12.0	12.1	12.0
Unemployed, in %	6%	0%	4%	0%	5%	0%	4%	0%	7%	0%
# of Observations	2,954,152		340,660		1,633,733		1,017,775		855,894	

The table reports summary statistics of the main financial and demographic characteristics of Swedish households at the end of 2007. We convert all financial variables into real prices and U.S. dollars using the average exchange rate in 2000.

Table II. Portfolio Allocation across Household Characteristics

	Share of Financial Wealth Invested in:			
	Structured Products	Stocks	Funds	Cash
	(1)	(2)	(3)	(4)
Financial Wealth (Log)	-0.036***	0.044***	0.014***	-0.041***
	(0.001)	(0.001)	(0.001)	(0.001)
IQ score	-0.001	0.004***	0.005***	-0.007***
	(0.000)	(0.000)	(0.001)	(0.001)
Age (years)	0.000	-0.001***	-0.001***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls				
Province FE	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Observations	80,315	80,315	80,315	80,315
R^2				

This table displays OLS regression coefficients. The dependent variable is the share of financial wealth invested in structured products (column 1), stocks (column 2), equity mutual funds (column 3), and cash (column 4) as of 2007. The sample is restricted to structured product participants as of 2007. Standard errors are clustered at the kommun level. Individual controls include a urban area dummy, a household head gender dummy, the size of the household and the number of children. T-statistics are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table III. 2002-2007 Change in Risky Share and Participation in Structured Products

	Change in Stock Market Exposure, in p.p.			
	(1)	(2)	(3)	(4)
Structured Product Participant	4.187***	41.101***	5.188***	9.003***
	(0.197)	(2.539)	(0.549)	(1.436)
Structured Product Participant × Financial Wealth (log)		-2.967***		
		(0.203)		
Structured Product Participant × IQ Score			-0.186*	
			(0.101)	
Structured Product Participant × Age				-0.114***
				(0.032)
Controls				
Province FE	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Observations	317,422	317,422	317,422	317,422
R^2	0.0470	0.0489	0.0470	0.0471

This table displays OLS regression coefficients. The dependent variable is the absolute change in the risky share from 2002 to 2007, in p.p. of financial wealth. The risky share includes equity funds, stocks and retail structured products. *Structured Product Participant* is a dummy variable equal to one if the household invested at least once in structured products over the 2002-2007 period. The sample is restricted to household participating in stock markets in 2002. The coefficient in column 1 means that the increase in stock market exposure over the 2002-2007 period was 4.2 percentage points higher for households who participated in structured products than for the ones that did not. Standard errors are clustered at the kommun level. T-statistics are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table IV. 2002-2007 Change in Risky Share and Participation in Structured Products: Instrumental Variable Analysis

	First Stage Structured Product Participant	IV Change in Stock Market Exposure, in p.p.
	(1)	(2)
Supply Intensity	0.128***	
	(0.022)	
Structured Product Participant		17.928***
		(0.917)
Controls		
Individual Controls	Yes	Yes
Observations	735,859	735,859

This table displays the results of our IV analysis. In the first stage, the dependent variable, *Structured Product Participant*, is a dummy variable equal to one if the household invested at least once in structured products over the 2002-2007 period. The independent variable is a measure of structured product supply at the parish level, i.e. the share of branches in a given parish that offers structured product. In the second stage, the dependent variable is the absolute change in the risky share from 2002 to 2007, in p.p. of financial wealth. The risky share includes equity funds, stocks and retail structured products. The sample is restricted to household participating in stock markets in 2002. Control variables include years of schooling, wealth decile and age category fixed effects, as well as a urban dummy, number of children, household size and household head gender dummy. The coefficient in column 2 means that the increase in stock market exposure over the 2002-2007 period was 18 percentage points higher for households who participated in structured products than for the ones that did not. Standard errors are clustered at the parish level. T-statistics are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table V. Substitution Effects and Household Characteristics

	Share of Financial Wealth Invested in Cash, in %			
	(1)	(2)	(3)	(4)
Structured Product Share of Financial Wealth	-0.620***	-2.115***	-0.738***	-1.147***
	(0.002)	(0.022)	(0.012)	(0.010)
Structured Product Share of Financial Wealth × Financial Wealth (log)		0.117***		
		(0.002)		
Structured Product Share of Financial Wealth × IQ Score			0.012***	
			(0.002)	
Structured Product Share of Financial Wealth × Age				0.010***
				(0.000)
Controls				
Household FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	16,547,797	16,547,797	5,252,612	16,547,797
R^2	0.0470	0.0489	0.0470	0.0471

This table displays OLS panel regression coefficients with household and year fixed effects. The dependent variable is the share of financial wealth invested in cash. Sample period is 2002-2007. Standard errors are clustered at the household level. T-statistics are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table VI. Model Outputs

	NO HUMAN CAPITAL				HUMAN CAPITAL (HC = 16.89 x initial wealth)			
	CRRA RRA g =5	Habit formation Curvature g = 2 Habit = 0.7 x initial wealth	Loss aversion Curvature g = 0.5 Kink coefficient l = 2 Ref point = initial wealth	Expanded loss aversion Low threshold = 0.8 x initial wealth Same other param.	CRRA RRA g =5	Habit formation Curvature g = 2 Habit = 0.7 x initial wealth	Loss aversion Curvature g = 0.5 Kink coefficient l = 2 Ref point = initial wealth	Expanded loss aversion Low threshold = 0.8 x initial wealth Same other param.
Riskless asset								
- Utility (per unit of total wealth)	-0.1821	-2.6148	0.5742	0.5742	-0.1821	-0.9585	2.0264	2.0264
- Portfolio return (annualized)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Riskless asset and stock								
- Share of stock	0.2943	0.2674	0.1532	0.1532	1.0000	1.0000	1.0000	1.0000
- Utility (per unit of total wealth)	-0.1585	-2.3908	0.6627	0.6627	-0.1728	-0.9445	2.0423	2.0423
- Corresponding interest rate increase (annualized)	0.89%	0.83%	0.64%	0.64%	0.33%	0.36%	0.38%	0.38%
- Quantiles of net portfolio return (annualized))								
P1	-2.30%	-1.88%	-0.17%	-0.17%	-15.87%	-15.87%	-15.87%	-15.87%
P2.5	-1.68%	-1.32%	0.14%	0.14%	-12.73%	-12.73%	-12.73%	-12.73%
P5	-1.08%	-0.79%	0.43%	0.43%	-9.94%	-9.94%	-9.94%	-9.94%
P10	-0.31%	-0.09%	0.82%	0.82%	-6.61%	-6.61%	-6.61%	-6.61%
P25	1.21%	1.28%	1.59%	1.59%	-0.76%	-0.76%	-0.76%	-0.76%
P50	3.28%	3.16%	2.67%	2.67%	6.16%	6.16%	6.16%	6.16%
P75	5.81%	5.48%	4.04%	4.04%	13.57%	13.57%	13.57%	13.57%
P90	8.54%	7.99%	5.56%	5.56%	20.68%	20.68%	20.68%	20.68%
P95	10.40%	9.71%	6.62%	6.62%	25.14%	25.14%	25.14%	25.14%
P97.5	12.16%	11.34%	7.65%	7.65%	29.15%	29.15%	29.15%	29.15%
P99	14.39%	13.41%	8.97%	8.97%	33.97%	33.97%	33.97%	33.97%
Riskless asset, stock, and guaranteed product								
- Share of stock	0.2943	0.2674	0.0290	0.0290	1.0000	1.0000	1.0000	1.0000
- Share of guaranteed product	0.0000	0.0000	0.4137	0.4137	0.0000	0.0000	0.0000	0.0000
- Utility (per unit of total wealth)	-0.1585	-2.3908	0.6787	0.6787	-0.1728	-0.9445	2.0423	2.0423
- Corresponding interest rate increase (annualized)	0.89%	0.83%	0.76%	0.76%	0.33%	0.36%	0.38%	0.38%
- Quantiles of net portfolio return (annualized)								
P1	-2.30%	-1.88%	0.17%	0.17%	-15.87%	-15.87%	-15.87%	-15.87%
P2.5	-1.68%	-1.32%	0.22%	0.22%	-12.73%	-12.73%	-12.73%	-12.73%
P5	-1.08%	-0.79%	0.28%	0.28%	-9.94%	-9.94%	-9.94%	-9.94%
P10	-0.31%	-0.09%	0.35%	0.35%	-6.61%	-6.61%	-6.61%	-6.61%
P25	1.21%	1.28%	0.95%	0.95%	-0.76%	-0.76%	-0.76%	-0.76%
P50	3.28%	3.16%	2.69%	2.69%	6.16%	6.16%	6.16%	6.16%
P75	5.81%	5.48%	4.84%	4.84%	13.57%	13.57%	13.57%	13.57%
P90	8.54%	7.99%	7.18%	7.18%	20.68%	20.68%	20.68%	20.68%
P95	10.40%	9.71%	8.79%	8.79%	25.14%	25.14%	25.14%	25.14%
P97.5	12.16%	11.34%	10.32%	10.32%	29.15%	29.15%	29.15%	29.15%
P99	14.39%	13.41%	12.26%	12.26%	33.97%	33.97%	33.97%	33.97%
Riskless asset, stock, and guaranteed product	SUBJECTIVE PARTICIPATION RATE = 1							
- Share of stock	0.0000	0.2674	0.0290	0.0290	0.0000	1.0000	1.0000	1.0000
- Share of guaranteed product	0.6811	0.0000	0.4137	0.4137	1.0000	0.0000	0.0000	0.0000
- Utility (per unit of total wealth)	-0.1364	-2.3908	0.6787	0.6787	-0.1712	-0.9445	2.0423	2.0423
- Corresponding interest rate increase (annualized)	1.86%	0.83%	0.76%	0.76%	0.40%	0.36%	0.38%	0.38%
- Quantiles of net portfolio return (annualized)								
P1	-0.37%	-1.88%	0.17%	0.17%	-1.54%	-15.87%	-15.87%	-15.87%
P2.5	-0.37%	-1.32%	0.22%	0.22%	-1.54%	-12.73%	-12.73%	-12.73%
P5	-0.37%	-0.79%	0.28%	0.28%	-1.54%	-9.94%	-9.94%	-9.94%
P10	-0.37%	-0.09%	0.35%	0.35%	-1.54%	-6.61%	-6.61%	-6.61%
P25	0.39%	1.28%	0.95%	0.95%	-0.39%	-0.76%	-0.76%	-0.76%
P50	2.92%	3.16%	2.69%	2.69%	3.34%	6.16%	6.16%	6.16%
P75	5.98%	5.48%	4.84%	4.84%	7.69%	13.57%	13.57%	13.57%
P90	9.22%	7.99%	7.18%	7.18%	12.17%	20.68%	20.68%	20.68%
P95	11.41%	9.71%	8.79%	8.79%	15.10%	25.14%	25.14%	25.14%
P97.5	13.46%	11.34%	10.32%	10.32%	17.82%	29.15%	29.15%	29.15%
P99	16.04%	13.41%	12.26%	12.26%	21.16%	33.97%	33.97%	33.97%

Internet Appendix

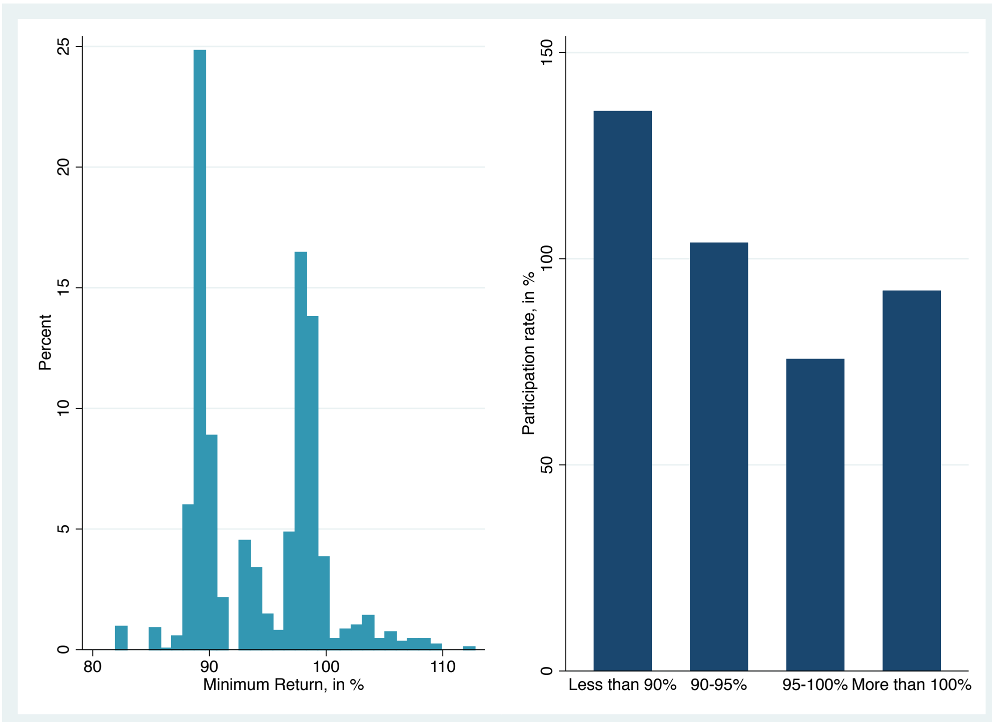


Figure IA.1. Minimum Return and Participation Rate in the Underlying Asset Performance

The left hand side of the figure displays the distribution of minimum return for the product of our sample. Minimum return corresponds the minimum fraction of the initial investment amount that the household gets at maturity. The right hand side of the figure plots the participation rate in the underlying asset performance over the minimum return.

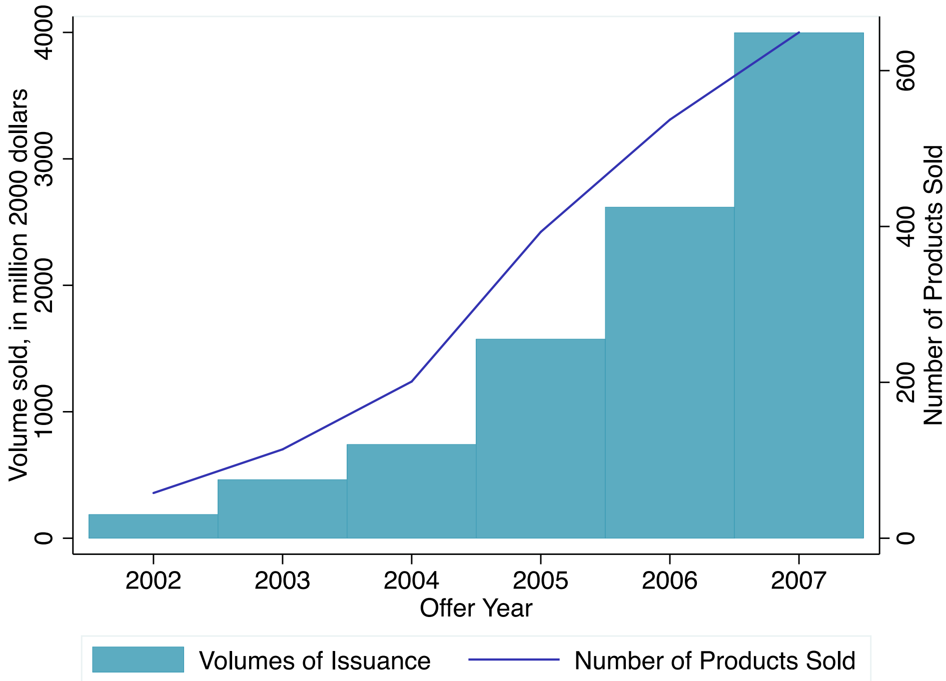


Figure IA.2. Volume and Number of Products Sold per Year

This figure shows volume issuance in millions of 2000 USD of retail structured products over the 2002-2007 period in the Swedish market.

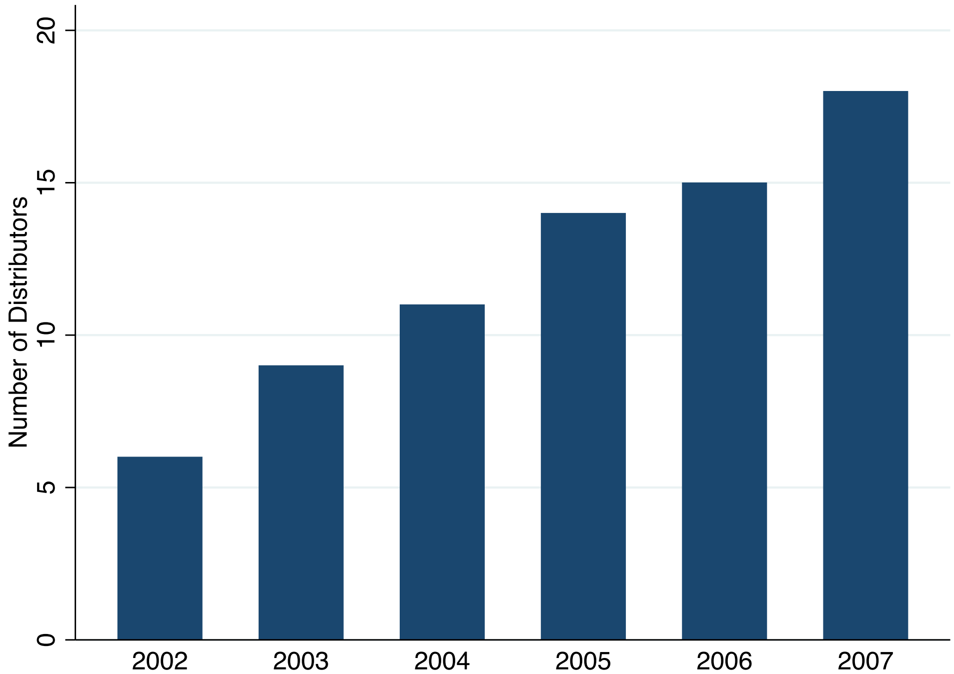


Figure IA.3. Number of Distributors per Year

This figure shows the evolution of the number of structured product distributors over the 2002-2007 period.

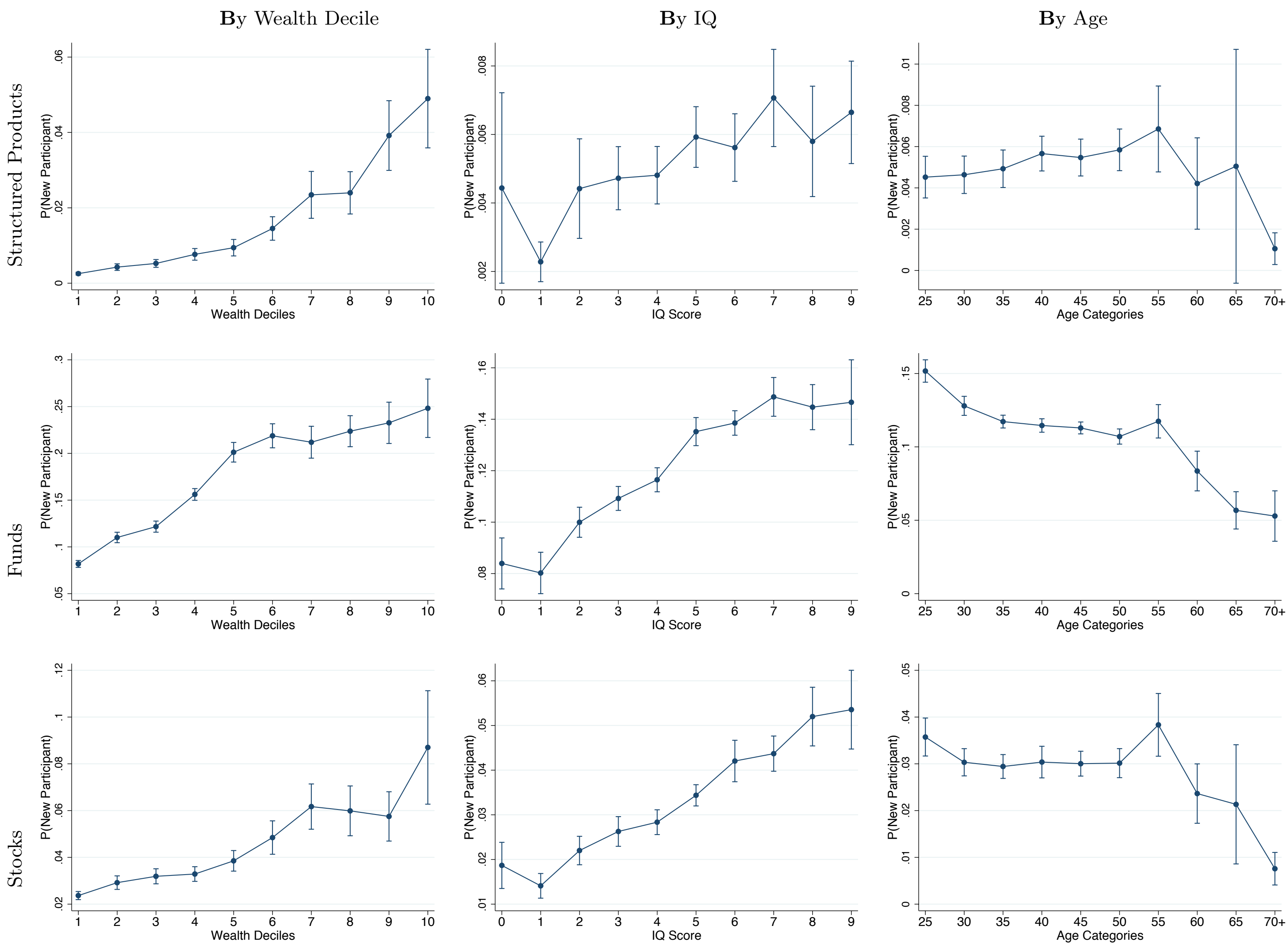


Figure IA.4. Likelihood of Participation in Structured Products, Equity Funds and Stocks for Households Not Participating to Risky Asset Markets as of 2000-2001.

This figure shows predicted probabilities estimated from logit regressions, where the dependent variable is an indicator variable for investing in a given investment products at least one year during the 2002-2007 period, and the sample is restricted to households that were not invested in risky assets in 2000 and 2001. All regressions include the same explanatory variables: financial wealth deciles, IQ score levels (from 0 to 9), age categories, the number of adults in the household, the number of children in the households, and indicator variable for living in a urban area, and the gender of the household. All explanatory variables are defined in 2002.

Table IA.1. Market Share (in volumes) of the Structured Product Distributors

	Market Share	Cumulated Market Share	Entry Date
	(1)	**(2)**	**(3)**
Swedbank	30.5%	30.5%	April 2002
Handelsbanken	20.7%	51.1%	May 2002
Nordea	14.7%	65.9%	September 2002
SEB	14.6%	80.5%	April 2003
Hq bank	5.4%	85.9%	March 2003
Acta	4.4%	90.4%	January 2002
Erik Penser	2.7%	93%	January 2004
Danske Bank	2.6%	95.7%	March 2002
Avanza	1.6%	97.3%	October 2004
Kaupthing Bank	1.1%	98.3%	November 2005
Garantum	0.7%	99%	
E-trade	0.4	99.5%	
Ohman	0.2	99.7%	
Others	0.3%	100%	

This table reports the market share of each distributor, in volumes of product sold, over our sample period.

Table IA.2. Product Characteristics - Summary Statistics

	2002-2003 **(1)**	**2004-2005** **(2)**	**2006-2007** **(3)**	**Full Sample** **(4)**
Number of Products Sold				
	172	594	1,173	1,939
Underlying				
Stock Market Exposure (in %)	**92**	**90**	**84**	**87** *(88%)*
Single Index or Share	36	41	46	44
Europe	*17.4*	*31.1*	*27.2*	*27.5*
Non Europe	*18.2*	*10.3*	*19.4*	*16.5*
Index Basket	44	37	28	32
Share Basket	9	11	8	9
Hedge Funds	5	1	2	2
Other Exposure (in %)	**8**	**10**	**16**	**13** *(12%)*
Commodities	0	3	11	8
FX Rate	0	3	4	4
Credit	8	2	0	1
Interest Rate	0.3	0.3	0.3	0.3
Number of Underlying Assets	**3.3**	**3.8**	**3.4**	**3.5**
Product Design				
Capital Protected (in %)	99	99	97	98
Issue Price (in %)	103.8	104.7	105.5	105.11
Minimum Return (in %)	96.5	94.7	93.7	94.3
Average Maturity (in years)	4.1	3.8	3.3	3.5
Payoff Formula (in %)				
Call + Averaging or Asian Option	48.8	50.0	53.4	52.4
Call	2.3	10.9	8.6	8.9
Digital + Cliquet	5.3	7.6	4.9	5.7
Call + Best of Option + Averaging	0.6	5.7	5.6	5.2
Call + Best of Option + Cliquet	2.3	5.7	5	5
Volume (in million 2000 dollars)				
Mean	3.8	3.9	5.6	4.9
10th percentile	0.5	0.4	0.5	0.5
90th percentile	7.6	10.0	14.2	12.6

This table reports summary statistics for characteristics of all the retail structured products that have been sold in Sweden over the 2002-2007 period. The sample covers 1,939 products. Computations of the average minimum return are only based on the sample of capital protected products (1,768 products).

Table IA.3. Characteristics of Structured Product Participants

	=1 if participating in				
	Structured Products **(1)**	Stock Market **(2)**	Single Stocks **(3)**	Equity Fund **(4)**	ETF **(5)**
Age	0.010***	-0.008***	-0.000	-0.017***	-0.022***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.006)
Log(years of schooling)	0.057	0.829***	0.595***	0.711***	0.978***
	(0.046)	(0.044)	(0.040)	(0.037)	(0.280)
Gender Income Weight	-0.534***	-0.014	0.620***	-0.311***	1.003***
	(0.021)	(0.018)	(0.022)	(0.023)	(0.193)
Risky Share	0.839***	26.078***	2.849***	4.600***	1.281***
	(0.030)	(1.190)	(0.066)	(0.137)	(0.257)
Urban Area Dummy	-0.033	-0.043	0.097**	-0.090	0.368**
	(0.029)	(0.058)	(0.038)	(0.061)	(0.162)
Log(Disposable Income)	0.316***	0.552***	0.465***	0.448***	0.145
	(0.038)	(0.041)	(0.027)	(0.025)	(0.160)
Log(Financial Wealth)	0.502***	0.430***	0.571***	0.342***	0.660***
	(0.014)	(0.015)	(0.008)	(0.008)	(0.061)
Log(RealEstate)	0.018***	0.049***	0.042***	0.032***	0.023*
	(0.003)	(0.001)	(0.001)	(0.001)	(0.013)
Log(Leverage)	-0.397***	0.100***	0.127***	0.048***	0.110
	(0.047)	(0.017)	(0.011)	(0.012)	(0.142)
Controls					
Province FE	Yes	Yes	Yes	Yes	Yes
Observations	189,508	189,508	189,508	189,508	181,690
R^2	0.163	0.485	0.288	0.292	0.148

This table reports logit regression coefficients where the dependent variable is a dummy equal to one if the household is invested in a given asset class (structured product, basic structured product: with domestic underlying assets and simple payoff formulas, stocks and equity mutual funds) during the 2003-2007 period. Explanatory variables are as per 2002. *Trust* is measured through the following question in the 2002 Swedish Election Study: "In your opinion, to what extent can people in general be trusted?" The answer is a score from 0 to 10. We use the mean of this score at the province level as a index of trust. *Banker* is an indicator variable equal to one if the head of the household works in a bank. The analysis is conducted over the whole representative sample. Standard errors are clustered at the parish level.

Table IA.4. Retail Structured Products: Who are the New Participants through Structured Products?

	=1 if the new participant joins with...					=1 if structured product has...		
	Structured Products	Stock Markets	Single Stocks	Equity Funds	ETF	Capital Protection	Developed Economy	Simple Payoff
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Age	-0.003	-0.014***	-0.003	-0.020***	0.185***	-0.005	-0.001	-0.002
	(0.005)	(0.001)	(0.004)	(0.002)	(0.067)	(0.008)	(0.005)	(0.006)
Log(years of schooling)	0.784***	0.741***	1.071***	0.622***	-2.171	0.403	0.675***	0.590**
	(0.223)	(0.069)	(0.137)	(0.094)	(4.635)	(0.367)	(0.228)	(0.288)
Gender Income Weight	-0.475***	-0.196***	0.359***	-0.187***	-1.305***	-0.710***	-0.526***	-0.682***
	(0.141)	(0.031)	(0.088)	(0.052)	(0.349)	(0.182)	(0.155)	(0.189)
Urban Area Dummy	-0.146	-0.019	0.023	-0.063	17.541***	-0.160	-0.126	-0.331*
	(0.105)	(0.039)	(0.069)	(0.050)	(1.569)	(0.276)	(0.114)	(0.189)
Log(Disposable Income)	0.572***	0.620***	0.565***	0.778***	-0.191	0.444**	0.479***	0.487***
	(0.124)	(0.060)	(0.111)	(0.078)	(0.253)	(0.186)	(0.138)	(0.136)
Log(Financial Wealth)	0.357***	0.225***	0.145***	-0.037*	0.305	0.444***	0.404***	0.382***
	(0.055)	(0.018)	(0.035)	(0.022)	(0.245)	(0.084)	(0.059)	(0.074)
Log(RealEstate)	0.028***	0.029***	0.033***	0.030***	0.113	0.025**	0.030***	0.021**
	(0.009)	(0.002)	(0.005)	(0.003)	(0.085)	(0.012)	(0.010)	(0.010)
Log(Leverage)	-0.453***	-0.002	-0.011	0.065***	1.579***	-0.280*	-0.423***	-0.412***
	(0.095)	(0.018)	(0.035)	(0.023)	(0.071)	(0.168)	(0.117)	(0.120)
Controls								
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50,355	50,355	50,355	50,355	12,733	50,024	50,355	50,024
R^2	0.058	0.052	0.038	0.051	0.373	0.059	0.060	0.058

This table reports logit regression coefficients where the dependent variable is a dummy equal to one if the household gains exposure through stock markets during the 2003-2007 period through a specific instrument (structured product, basic structured product: with domestic underlying assets and simple payoff formulas, stocks and equity mutual funds). Explanatory variables are as per 2002. The analysis is restricted to household that are not participating in stock markets in 2002 and the 4 year before. Standard errors are clustered at the parish level.