Can Financial Innovation Solve Household Reluctance to Take Risk?

LAURENT CALVET, CLAIRE CÉLERIER, PAOLO SODINI, and BORIS VALLEE*

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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. We first estimate the expected returns and markup of such products, and find them to be comparable to equity mutual funds. Households investing in retail structured products significantly increase the risky share of their financial wealth over the sample period, especially for households with an initially low risky share, lower wealth and IQ, higher reluctance to take financial risk, and of older age. The relationships between household characteristics and the share of financial wealth invested is similar for structured products and cash, but differs strongly for equity mutual funds and stocks. A simple portfolio choice model shows that risk aversion and misperception over the design cannot explain the demand for structured products and the empirical facts we observe, while loss aversion can. Our results illustrate how security design can mitigate household reluctance to take financial risk.

JEL classification: I22, G1, D18, D12.

*Calvet: Department of Finance, EDHEC Business School, 393 Promenade des Anglais, 06202 Nice Cedex 3, France, and CEPR, laurent.calvet@edhec.edu. Célerier: Rotman School of Management, University of Toronto, 105 St. George Street, Toronto ON M5S 3E6, Canada, claire.celerier@rotman.utoronto.ca. Sodini: Department of Finance, Stockholm School of Economics, Sveavägen 65, Box 6501, SE-113 83 Stockholm, Sweden, Paolo.Sodini@hhs.se. Vallée: Finance Department, Harvard Business School, Baker Library 245, Boston, MA 02163, U.S.A, bvallee@hbs.edu. We received helpful comments from Daniel Dorn, Andra Ghent, Valentin Haddad, Vincent Van Kervel, Lars Norden, Daniel Schmidt, the discussants, as well as suggestions from John Y. Campbell, Shawn Cole, Andrei Shleifer, Erik Stafford and seminar participants at Babson College, Columbia University, Erasmus University, Harvard University, Tilburg University, the Toulouse School of Economics, Universidad Católica de Chile, the University of Alberta, the University of Maastricht, the University of Toronto, the University of Washington, the Brazilian Finance Society, the IFSID Montreal conference, the 2017 RIEF Junior Finance conference, the 2016 AFFI-Eurofidai Conference, the 2017 meeting of the European Finance Association, the 2017 NBER Behavioral Finance meeting, and the 2018 meeting of the Western Finance Association. We thank Nikolay Antonov, Huseyin Aytug, George Cristea and Botir Kobilov for excellent research assistance. The authors are grateful to IFSID for generous financial support. All errors are ours only.
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I. Introduction

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, in the form of products offering non-linear exposure to risk assets, can increase household portfolio allocation to risky asset markets. If so, through which economic mechanism? And are households better off as a result? 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. 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.

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 Célerier and Vallée (2017)).

1 A typical product offers the following cash flows: investor pays 110 initially, and gets 100 times \(1 + 80\%\) of the positive performance of an equity index over the period) four years later. See Section II for more details on structured product design.
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. Second, the dataset allows us to investigate how a rich set of household characteristics, such as wealth, IQ or age, but also reluctance to take financial wealth, 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 develop an asset pricing methodology and establish several facts about structured product design and the implied exposure they offer. We find that their expected returns of structured products sold in Sweden between 2002 and 2007 are significantly higher than the risk free rate, and that their markups are around 1.4% per year on average, which makes their cost comparable to the one of mutual funds marketed to Swedish households at that time. These results are consistent with structured products allowing households to share in the risk premium.

Second, we document that the adoption of these products is fast and broad, with 13% of all Swedish households buying at least one of these products within five years of the introduction. For the participating households, retail structured products represent more than 15% of their financial wealth. The speed of development contrasts with the slow adoption of other innovative financial products offering equity exposure, such as exchange traded funds (ETFs).

Third, participation in retail structured products is associated with an increase in household risk-taking. We focus on the allocation of household portfolio to the four asset classes that compose financial wealth: cash, equity mutual funds, stocks, and structured products, and consider the latter three classes as risky assets. We develop an innovating measure of the risky share by weighing

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2The market developed from 2002 in Sweden. Since the end of the 1990s, European financial institutions have sold more than 2 trillion euros of structured products. More recently in the US, equity-linked certificates of deposit, one category of retail structured products, are becoming increasingly popular.

3We do not study corporate bonds as they represent a negligible fraction of household portfolios.
the holdings in these assets by their exposure to the risk premium, i.e. the ratio of excess expected return of the investment over the market risk premium, when calculating their risky share. Over the five years following the introduction of structured products, we find that the risky share increases twice as much for households that participate in these products than for households that do not. The effect is larger for households in the lowest quartile of risky share in 2002: participating in structured products lead to an additional 10 percentage point increase in their risky share, which amounts to less than 4% in 2002. Guaranteed products, therefore, mostly complement rather than substitute for other risky assets.

We implement an instrumental variable analysis to mitigate potential sources of endogeneity when studying the effect of investing in structured products. Investment in structured products over our sample period might be correlated with a higher demand for risky assets over that period that our large set of controls does not capture. We therefore use household proximity to banks offering structured products to instrument the supply of structured products. This instrumental variable 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, a low IQ, of older age, and with a higher reluctance to take financial risk. 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 exposure of structured products to equity markets, the gain in household exposure to risky assets remains substantial. When investing 1% of their financial wealth in structured products while selling 0.37% of a traditional risky asset, a household increases its exposure to risky assets by 0.3%.

Fourth, among participants, the share of financial wealth invested in structured products is decreasing with wealth and IQ and increasing with age and reluctance to take financial risk, exactly as the share of financial wealth invested in cash. The share of stocks and funds in financial wealth exhibit the reverse relationships: they are both increasing in wealth and IQ, and decreasing in age and reluctance to take financial risk. This mapping between household characteristics and product design suggests an heterogeneity in preferences across households.

Finally, we develop a portfolio-choice model to investigate the theoretical mechanisms possibly
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 about the design 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 or misperception.

This study contributes to the strand of the household finance literature documenting the limited 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 suggests that innovative security design can mitigate investor behavioral biases, and not merely exploit them (Célerier 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 (Ross 1976; Calvet, Gonzalez-Eiras, and Sodini 2004). 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 II provides background on retail structured products and presents the asset pricing results. Section III documents the adoption of retail structured
products in Sweden and studies the impact of these products on household risky shares. In Section IV we explore the relationship between household characteristics and both the likelihood and extent of structured product investments. 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.

II. The Swedish Market for Structured Products

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. 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 purposes, we provide below an example of a Swedish best-seller named Spax Pension 284d sold by Swedbank in 2004 (ISIN: SE0001242983):

The product has a maturity of 8 years and a fee of 1.5% is charged at issuance. The product return is linked to the performance of the OMX 30 index, as follows: at maturity the product offers a minimum capital return of 100% plus 105% of the positive performance of the index over the investment period. The performance of the index is calculated as the average of the index return since inception over the last 13 months, and does not include dividends.

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 assets under management of European mutual funds, and twice the

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Exchange traded funds, which have payoffs that are a linear function of a given underlying financial index, are not retail structured products.
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 the conditions under which certain categories of structured products could be sold to retail investors were tightened by Italy in 2009, France in 2010, and Belgium in 2011, 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 (98%), and the overall level of product complexity is moderate. Potentially exploitative behaviors by banks, such as catering to reaching-for-yield investors by shrouding risk, are therefore less of a concern in Sweden than in markets such as France, Germany, or Italy (Célier and Vallée, 2017).

B. Characteristics and Design of Structured Products

The dataset compiled by Célier and Vallée (2017) contains detailed information on all retail structured products sold in Europe since 2002. Comprehensive information on the pay-off structure, distributors, and volume are available at the issuance level. The database also includes all the features embedded in each product, obtained through a text analysis of the pay-off description.5

Our sample includes 1,510 equity-linked structured products issued in Sweden over the 2002 to 2007 period, for a total volume of 8 billion dollars.6 Table II reports summary statistics on the main characteristics of these products.

In terms of design, products offering a capital guarantee, and therefore presenting a limited downside, are overwhelmingly dominant. Hence, 98% of the products issued over the period offer

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5 See Célier and Vallée (2017) for the precise methodology.
6 In Sweden, the large majority of products offer equity exposure (87% of the products)
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, as an initial fee is added to calculate the issuance price. This feature leads to an actual level of capital protection below 100%, or 91.3% on average in the sample.

In more than half of the issuances, representing 60% of the volume, the capital protection is associated with a participation in the rise of the underlying asset coupled with an Asian option. We label such a payoff structure as the representative design in the market.

More formally, the representative contract is defined by:

1. an initial fee $\text{init}$ charged when the product is originated at date 0,
2. a maturity date $T$,
3. an underlying asset or index, $S_t$,
4. a benchmark return $R_T^*$ based on the underlying,
5. a participation rate $p$,
6. a guaranteed rate of return $g$.

The benchmark return is the average performance of the underlying measured at prespecified dates $t_1 < \cdots < t_n$:

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

(1)

where $S_{t_0}$ is the initial reference level of an index or asset at $t_0$, typically a few days after issuance. In the empirical section, we refer to $t_n - t_1$ as the length of the Asian option.

The gross return on the structured product between issuance and maturity is

$$1 + R_{g,T} = \frac{1 + \max(pR_T^*; g)}{1 + \text{init}}.$$  

(2)

The initial fee is deducted from the initial investment at the initial date. For example if $\text{init} = 0.1$, a $110$ investment in the guaranteed product is worth $100[1 + \max(pR_T^*; g)]$ at maturity.\(^7\)

\(^7\)This format can be pensionable through Individual Pension Savings (IPS) status eligibility, and the average term is 3.5 years.

\(^8\)Almost all products have a structured bond format (98% of issuances), and therefore bear credit risk. Credit spread are close to zero in the period we study, and no Swedish banks defaulted during the financial crisis, so this issue plays no role in the analysis.
C. Pricing of Structured Products

In order to investigate the risk and return properties of the representative contract, we develop a pricing model based on the absence of arbitrage. We assume that under the risk-adjusted measure $Q$, the underlying follows a geometric Brownian motion:

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

(3)

where $r_f$ is the continuous-time interest rate, $q$ is the continuous-time dividend yield, and $\sigma$ denotes volatility.

Let $E^Q_0$ denotes the expectation operator conditional on the information available at date 0. Under the risk-adjusted measure $Q$, the mean return on the structured product is equal to the risk-free rate, $E^Q_0(1 + R_{g,T}^* T) = e^{r_f T}$, which by equation [2] implies the following pricing result.

**Proposition 1 (Fair pricing of structured product).** The fair initial fee is given by:

$$\text{init} = e^{-r_f T} \left[ 1 + g + p M^Q_1 N(d_1) - (p + g) N(d_2) \right] - 1,$$

(4)

where $M^Q_1$ and $M^Q_2$ denote the first two moments under $Q$ of the benchmark return:

$$M^Q_1 = E^Q_0 (1 + R^*_T) = \frac{1}{n} \sum_{i=1}^{n} e^{(r_f - q)(t_i - t_0)},$$

(5)

$$M^Q_2 = E^Q_0 [(1 + R^*_T)^2] = \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} e^{2(r_f - q) + \sigma^2 \ln \left[ \min(t_i, t_j) - t_0 \right] + \sigma \sqrt{\ln \left[ \min(t_i, t_j) - t_0 \right] + \sigma \sqrt{\ln \left[ \min(t_i, t_j) - t_0 \right] + \sigma \sqrt{\ln \left[ \min(t_i, t_j) - t_0 \right]}}},$$

(6)

$(w^Q)^2$ denotes the variance of the log benchmark return:

$$(w^Q)^2 = \text{Var}^Q \left[ \ln (1 + R^*_T) \right] = \ln \left[ M^Q_2 (M^Q_1)^2 \right],$$

(7)

and $d_1$ and $d_2$ are Black-Scholes normalized ratios:

$$d_1 = \frac{1}{w^Q} \left[ \ln \left( \frac{p}{p + g} \right) + \ln(M^Q_1) + \frac{(w^Q)^2}{2} \right],$$

(8)

and $d_2 = d_1 - w^Q$. Furthermore, the fair initial fee [4] increases with the participation rate $p$ and
the guaranteed return \( g \).

The expected return of the representative contract under the physical measure \( \mathbb{P} \) is easily derived when the underlying follows

\[
\frac{dS_t}{S_t} = (\mu - q)dt + \sigma \, dZ_t
\]

under \( \mathbb{P} \).

**Proposition 2 (Expected return of the guaranteed product under \( \mathbb{P} \)).** The expected return on the guaranteed product under the physical measure is

\[
E_P(1 + R_{g,T}) = \frac{1 + g + pM_1^P N(d_1^P) - (p + g)N(d_2^P)}{1 + \text{init}},
\]

where \( M_1^P \) and \( M_2^P \) denote the first two moments under \( \mathbb{P} \) of the benchmark return:

\[
M_1^P = E_0^P(1 + R^*_T) = \frac{1}{n} \sum_{i=1}^{n} e^{(\mu - q)(t_i - t_0)},
\]

\[
M_2^P = E_0^P[(1 + R^*_T)^2] = \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} e^{2[(\mu - q) + \sigma^2][\min(t_i, t_j) - t_0] + (\mu - q)|t_j - t_i|},
\]

\((w^P)^2\) denotes the variance of the log benchmark return:

\[
(w^P)^2 = \text{Var}_0^P[\ln(1 + R^*_T)] = \ln \left( \frac{M_2^P}{(M_1^P)^2} \right),
\]

and

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

and \( d_2^P = d_1^P - w^P \).

A subset of contracts include a cap to the return that can be earned on the initial investment net of fee. In the Appendix, we provide the fair initial fee and expected return in the presence of a cap.
D. Summary Statistics on Structured Products

D.1. Issuance and Design

Panel A of Table I provides summary statistics on the issuance of all structured products in Sweden during the 2002 to 2007 period, as well as on the sub-sample of products defined by the representative contract. The representative contract represents 55% of the retail structured products issued during our sample period in Sweden, and 60% of the corresponding volumes. Table I also shows summary statistics of the six parameters that define the contract for this sub-sample of products: the maturity $T$, the capital guarantee $g$, the initial fee $\text{init}$, the participation rate $p$, the market premium $\mu$ and volatility $\sigma$ of the underlying asset, and the length of the Asian option $t_n - t_1$.

D.2. Pricing

The sub-sample of products described by the representative contract rely on 155 different underlying assets, which are either a stock index, a basket of stock indices, or a basket of stocks. We rely on the following assumptions for each underlying asset.

- We estimate the risk premium of a given underlying asset at the monthly frequency, $\mathbb{E}(R_{m,t})$, by applying the World CAPM over the longest time-series available and a risk premium on the world market of 4%. We then convert it into our model input $\mu = \ln[1 + \mathbb{E}(R_{m,t})]/t$, where $t = 1/12$ if $\mu$ is expressed in yearly units.
- We use historical volatility as measured over the 1990 - 2007 period for $\sigma$.
- We use the latest dividend yield before the structured product issuance for $q$.
- We use the SEK Swap Rate for the product maturity as the risk free rate $r_f$ in the pricing model.

We compute the product markup as the difference between the fair initial fee that we derive from Proposition 1 and the actual initial fee we observe in our data. To obtain a yearly markup that can be easily compared to mutual fund yearly fees, we scale this markup by the product maturity in year. We then derive the excess expected return the investor earns. A product expected return is calculated as per Proposition 2. The excess expected return is obtained by annualizing this expected return and subtracting the risk-free rate (T-bill rate).
Table I reports the product markup and excess expected returns implied by the asset pricing method. There are several important take-aways. First, the cost to households/ the profitability to the banks of retail structured products represents 1.4% of the invested amount per year on average, which is comparable to the fees of mutual funds available to the same population. This finding suggests that banks have comparable financial incentives to market equity mutual funds and retail structured products.

Second, yearly excess expected returns for these products are significantly positive with an average of 4.9%. This confirms that retail structured products allow households to earn part of the risk premium.

**INSERT FIGURE 1**

In Figure 1, we report the distribution of the expected excess return in the population of structured products. We observe that about 90% of products earn a positive risk premium, which confirms that these products can benefit retail investors. In Table IA.2 of the Internet Appendix, we conduct a sensitivity analysis that shows that our results are not driven by a particular choice of parameters. Furthermore, Table IA.3 shows that the monotonic relationships between the initial fee, participation rate and guaranteed return implied by Proposition 1 hold in the cross-section of contracts.

Having empirically established that the retail structured products marketed to Swedish households allow them to share in a large fraction of the risk premium, we turn to their portfolio data to study who buys such products and to which extent.

**III. Do Structured Products Increase Household Risk-Taking?**

**A. Measuring Household Risky Share**

Household risk-taking is a function of the share of their financial wealth invested in equity products and the share of the risk premium they obtain through each equity product.

For guaranteed products, the fraction of the equity premium earned by the household in expec-

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9 The average equity mutual fund fee is 1.80% in Sweden over the 2000 to 2007 period.
tation is the fraction of the excess expected return over the market risk premium:

\[ \eta_g = \frac{\mathbb{E}(R_{g,T} - e^{r_f T})}{\mathbb{E}(R_{m,T} - e^{r_f T})}. \]

This definition coincides with the risky share in the case of a portfolio of the stock and the riskless asset. It can also be applied to mutual funds, where the expected fund return is net of fees.

We compute \( \eta \) for each equity product, i.e. both funds and structured products, and assume \( \eta = 1 \) for stocks. For funds, the excess expected return is the difference between the market premium and the fund fees. We collect fund fees for each fund in our database. For structured product, we compute the excess expected return as described in Proposition 2. We find that \( \eta \) amounts to 60% for structured products versus 70% for equity funds on average. We measure an household risky share as follows:

\[ w_h = \sum_{i=1}^{3} \eta_i \times \frac{EquityProduct_{h,i}}{FinancialWealth_h}, \]

where \( i \) describes the three equity asset classes: structured products, equity mutual funds, and stocks.

### B. Household Risk-Taking: Data and Summary Statistics

We investigate household holdings by merging the structured product database with the Swedish Income and Wealth Registry. This second dataset, described in Calvet et al. (2007), is a panel of financial wealth and income covering all Swedish households over the 2000 to 2007 period. It provides the detailed breakdown of financial wealth between cash, equity mutual funds, stocks and structured products.\(^{[10]}\) This panel has been used to study household portfolio diversification (Calvet et al. 2007), rebalancing (Calvet, Campbell, and Sodini 2009a), investor sophistication (Calvet, Campbell, and Sodini 2009b), financial risk-taking (Calvet and Sodini 2014) and value and growth 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

\(^{[10]}\)Bonds and bond mutual funds, which we can also observe, are infrequent.
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.

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.

Finally, we merge our data with a survey conducted on the population of twins in Sweden that collects information on preferences and behavioral biases. We extract from this survey a measure of household reluctance to take risk for a sub-sample of 11,000 households. Participants answer the following question: “Are you a person who is willing to take financial risks or trying to avoid financial risks?” one a 1 to 10 scale.\footnote{While the survey also includes several questions related to behavioral biases, there is unfortunately very little heterogeneity in participants’ answers.}

\begin{table}[h]
\centering
\caption{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 born after 1945.\footnote{Our analysis being conducted at the household level, we use the man's IQ as a proxy of the average IQ in the household.}}
\label{table:sample}
\end{table}

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.

Figure\ref{fig:structured_products} illustrates the massive adoption of structured products in Sweden over the 2002 to 2007 period. The market is still dynamic in the recent period: 3.2 billion euros of retail structured products have been issued in 2015 in Sweden, which makes it comparable to 2007.\footnote{SRP 2015 annual report} Panel A of Figure\ref{fig:structured_products} shows the evolution of the share of households participating in structured products and in
other stock market products over the 2002 to 2007 period. 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.

C. Impact of Structured Products on Financial Risk-Taking

We now explore whether investing in structured products is associated with an increase in the risky share of household financial wealth. This analysis requires one important adjustment when comparing the risky share of households before and after the introduction of retail structured products. 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 products, as previously described.

We focus on the subsample of households participating in equity funds or stocks in 2002 and compare the change in the risky share between 2002 and 2007 for households that have invested in structured products during that period versus households that have not. The risky share is expressed in percentage points of financial wealth. The exact specification is:

\[ w_{h,2007} - w_{h,2002} = \alpha + \beta 1_{SP,h} + \lambda' x_h + \varepsilon_h, \]

where \( w_{h,t} \) denotes the risky share of household \( h \) in year \( t \), \( x_h \) is a vector of household characteristics, and \( \varepsilon_h \) is the measurement error. The vector \( x_h \) includes the number of children, household size, an urban dummy, a gender dummy, the change in income over the period, the change in financial wealth, as well as wealth and income decile and IQ or years of education fixed effects.

Column (1) of Table III displays the regression coefficients for the total sample. The coefficient of the variable \( 1_{SP,h} \) suggests that structured product participants increase their risky share by an additional 3.5 pp over the 2002 to 2007 period compared to nonparticipants. This increase represents more than 15% of their initial risky share, and is twice as large as the average increase.

\(^{14}\)A household is viewed as a participant in a given financial product if it possesses a strictly positive amount of investment in that type of financial products in a given year.
in the whole population.

Figure 4 shows that the effect of participating in structured products is higher on households with ex-ante low risky share/a large share of cash in their financial wealth. We split the sample into quintiles cash share in 2002 and interact indicators for each of these categories with the indicator variable for participating in structured products. The dependent variable is the growth rate in risky share, measured using Davis and Haltiwanger (1992) growth measure:

\[
\frac{2 \ast (w_{h,2007} - w_{h,2002})}{w_{h,2007} + w_{h,2002}}
\]

Table III confirms this result: participating in structured products is associated with an additional active increase in risky share of 10 percentage points for household in the lowest quartile of risky share who initially have less than 4% of risky share. To obtain this result, we split the sample in quartiles of risky share in 2002. Households with a risky share of 3.8% ex ante experienced a growth in their risky share 10 pp higher when they participated in structured products. The coefficient of the dummy variable \( I_{SP,h} \) is decreasing as household ex-ante risky share increases.

Finally, we 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. 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.

Columns (6) to (9) in Table III displays the regression coefficients with linear specifications for the explanatory variables.
D. Controlling for Endogenous Selection: Restricted Control Group and Instrumental Variable Analysis

Household decision to invest in structured products might correlate with their willingness to increase their risky share, independently of the introduction of structured products. In this case, our OLS estimate would be upward biased.

We address this endogeneity issue by restricting the control group to active fund buyers. Hence, the sample includes only households that have decided to increase their risky share. Table IA.6 displays the results. The coefficient of the variable $I_{SP,h}$ suggests that structured product participants increase their risky share by an additional 2.6 pp over the 2002 to 2007 period compared to active fund buyers that have not participated in structured products. The effect is only 25% percent lower compared to the main model. In this specification, we assume that structured products have an effect on the risky share for participants but does not affect the decision to participate.

Alternatively, the OLS estimate would be downward bias if households that participate in structured products are different from households that do not participate in some dimensions that are not perfectly observable and that would induce a lower change in the risky share in the absence of structured products compared to the control group. For example, participants in structured products might be strongly loss averse.

We exploit an exogenous variation in the supply of retail structured products in an instrumental variable analysis to address this concern. Some Swedish banks did not market structured products to their client base during our sample period, and these banks are unevenly 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).

Figure 7 illustrates the geographic distribution of supply intensity. The instrument varies substantially across Sweden, both within and across regions. The figure suggests that the instrument...
exhibits sufficient heterogeneity to be a plausible instrument. 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.

Table IV reports the results of the instrumental variable 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 downward, which suggests that households participating in
structured products would have actually reduced their risky share in the absence of these products.

E. Controlling for Passive Variation in the Risky Share

We now verify that the results of the previous sections are not mechanically driven by passive
variation in the risky share induced by changes in asset prices. We focus on changes induced by
active household behaviour, adjusting for any passive changes in the risky share if the household
does not trade over the period.

To adjust for the passive change in the risky share, we define the active change in the risky
share between \( t - n \) and \( t \) by:

\[ A_{h,t} = w_{h,t} - w_{h,t}^p, \]

where \( w_{h,t} \) is the observed risky share in year \( t \) and \( w_{h,t}^p \) is the passive risky share after an inactivity
period of \( n \) years. More precisely, \( w_{h,t}^P \) is the risky share at the end of year \( t \) if the household does not trade between years \( t - n \) and \( t \), and is calculated by applying to each asset of the household portfolio the realized returns of this asset between \( t - n \) and \( t \).

In Table A.5 of the internet appendix, we estimate the specification:

\[
A_{h,t} = \alpha + \beta SP_{h} + \lambda'x_h + \epsilon_h
\]

The effect of structured product participation on household risky share is almost unchanged when passive variations are taken into account. Thus, our main results are not driven by mechanical variation in portfolio weights caused by time variation in asset prices.

F. How Does Innovation Change Household Portfolio Allocations?

In Table V, we now 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 estimate the rate of substitution between structured products and cash at the yearly frequency by running the panel regression:

\[
\text{CashShare}_{h,t} = \alpha_h + \delta_t + \beta SP\text{share}_{h,t} x_h + \epsilon_{h,t},
\]

where \( \text{CashShare}_{h,t} \) is the share of financial wealth held as cash by household \( h \) in year \( t \), \( SP\text{share}_{h,t} \) is the share of financial wealth invested in equity-linked structured products, \( x_h \) denotes characteristics, \( \alpha_h \) is a household fixed effect and \( \delta_t \) is a year fixed effect. \( x_h \) is either the decile of financial wealth, the level of IQ, or the age category. The coefficient on the interacted term, \( SP\text{share}_{h,t} \times x_h \), 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.

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 0.3%. As structured product participants invest on average 15% of their financial wealth in these products, this translates into an increase in the exposure to risky assets of around 5% of their financial wealth.

G. Does Financial Innovation Drive Risky Asset Market 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 to 2007 period.

Figure 6 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 more than 22% in 2007.

Finally, column (3) in Table IV indicates that households are more likely to start participating in stock markets when they live in parishes where the supply of retail structured products is high.

IV. Who Buys Structured Products and To Which Extent?

We now zoom in on the characteristics of investors in structured products. We investigate the drivers of participation in guaranteed products (extensive margin) as well as the share of wealth invested in these products (intensive margin). We run a similar analysis for cash, stocks, and equity mutual funds. The relationships between guaranteed product investments and household characteristics are strikingly similar to the relationships between cash holdings and household characteristics, while sharply different results hold for equity mutual funds and stocks.
A. Characteristics of Structured Product Participants

We study the characteristics of households that invest in retail structured products. In Table VI, 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.

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:

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

where \(p_h\) is the probability that the household holds structured products at least once over the 2002 to 2007 period, and \(x_h\) is a vector of household characteristics in 2007. We estimate similar logit regressions for participation in stocks and equity mutual funds. 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, an urban dummy and a household head gender dummy.

Figure 8 displays the predicted probability of participation for each financial wealth decile, IQ level, and age category. 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.

B. Who Invests the Most in Structured Products?

The bottom half of Figure 3 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 funds.

In Table VI, we 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 at the 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, an urban dummy, and a household head gender dummy. Figure 9 plots regression coefficients on fixed effects for each financial wealth decile, IQ level, and age category.

There are three key takeaways. 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 products is nonmonotonic, while it is strongly positive for equity funds and stocks.

C. Product Design and Household Characteristics

In Figure IA.6, we finally investigate whether and how the design of retail structured products varies with household characteristics. We explore the four main parameters of the representative design: (i) participation rate $p$, (ii) initial fee $\text{init}$, (iii) length of the Asian option $t_n - t_1$, and (iv) capital guarantee $g$, as well as our measures of expected return and markup. We run OLS regressions using each of these four parameters as the dependent variable, and financial wealth deciles, IQ levels, and age categories as explanatory variables.

Figure IA.6 plots the regression coefficients. We observe, first, that the level of the guarantee increases when age and reluctance to take risk increase, and decreases when financial wealth and IQ decrease. There is, however, no significant patterns for the level of markup and the Asian Option. Second, households with lower financial wealth, lower IQ, of older age and more reluctant to take financial risk are more likely to invest in products offering lower participation rate, a lower initial fee, and a lower expected returns, which corresponds to a lower level of risk.

This mapping between household characteristics and product design suggests some heterogeneity in preferences among the population. In addition, this result does not support a predatory view of the market, where one design parameter, such as the initial fee, is shrouded for the low sophistication households.
V. Theoretical Framework for Portfolio Choice

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. Structured product distribution of returns is derived from the methodology in Section II. We compute the portfolio choice of an investor with CRRA, habit formation, or loss aversion preferences.\(^{15}\) 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. Portfolio Choice and Corresponding Utility

We consider an agent endowed with initial wealth \(W_0\) at date 0 and consuming \(C_T\) at date \(T\). The agent has expected utility

\[ E_0[u(C_T)]. \]

The agent can invest her initial wealth in the riskless asset, the stock, and the guaranteed product. Let \(\alpha\) denote the portfolio weight of the stock and \(\beta\) the portfolio weight of the structured product. The budget constraint implies that \(C_T = W_0 (1 + R_{p,T})\), where

\[ 1 + R_{p,T} = (1 - \alpha - \beta) e^{r_f T} + \alpha (1 + R_{m,T}) + \beta (1 + R_{g,T}). \]

In the Appendix, we derive an approximation of the joint distribution of the log index return \(r_{m,T} = \ln(1 + R_{m,T})\) and the log benchmark return \(r^*_T = \ln(1 + R^*_T)\) based on an Edgeworth expansion. In applications, the calculation of expected utility can therefore proceed by numerical integration.\(^{16}\) The agent chooses the portfolio shares \(\alpha\) and \(\beta\) that maximize expected utility. We

\[ 15\) We also interact these utility functions with the presence of human capital in the appendix.

\[ 16\) That is, we compute

\[ E_0[u(C_T)] = \int_{\mathbb{R}^2} u \left( W_0 [1 + R_p(r_{m,T}, r^*_T; \alpha, \beta)] \right) \phi(r_{m,T}, r^*_T) \, dr_{m,T} \, dr^*_T, \]

where the portfolio return is given by

\[ R_p(\alpha, \beta, r_{m,T}, r^*_T) = (1 - \alpha - \beta) e^{r_f T} + \alpha e^{r_{m,T}} + \beta \frac{\max[p(e^{r^*_T} - 1); g]}{1 + init} - 1. \]
consider several utility specifications.

A.1. CRRA Investor

We consider
\[ u(C) = \frac{C^{1-\gamma}}{1-\gamma}. \]

The objective function can be rewritten as \( \mathbb{E}[u(C_T)] = W_0^{1-\gamma} v(\alpha, \beta) \), where

\[ v(\alpha, \beta) = \mathbb{E}[u(1 + R_{p,T})] \]

denotes the expected utility from one unit of initial wealth.

When the investor can only invest in the bond and the stock (\( \beta = 0 \)), the optimal share invested in the stock is closely approximated by Merton’s formula:

\[ \alpha = \frac{\mu - r_f}{\gamma \sigma^2}. \]

When the investor can invest in all three assets, the optimal solution can be computed numerically.

The utility gain from financial innovation can be assessed as follows. We derive the increase in interest rate that would correspond to the same gain in utility. A pure bond portfolio achieves the utility level \( W_0^{1-\gamma} v(\alpha, \beta) \) if and only if

\[ 1 + R_f^* = [(1 - \gamma) v(\alpha, \beta)]^{1/(1-\gamma)}. \]

If the investment period contains \( T \) years, the gross yearly interest rate is

\[ (1 + R_f^*)^{1/T} - (1 + R_f)^{1/T} \]

in annual units.

and \( \phi \) denotes the joint density of \( r_{m,T} \) and \( r_f^* \), derived in the Appendix.
A.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

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

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

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

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

A.3. Loss Aversion

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

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

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

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

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

We finally consider the misperception of the product design as a potential mechanism for our empirical results. We assume that investors do not understand either the Asian option, or the initial fee, and therefore believe that their return conditional on the guarantee not being exercised is $p$ times the underlying asset positive return of the product maturity. They therefore overestimate the participation rate. We study the demand for such a misperceived product. 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 $p$.

B. Model Estimation

B.1. Assumptions

We take the median parameters of the representative design:

- a maturity of 4 years,
- a capital guarantee of 100%,
• an initial fee of 11%,
• a market premium of 6% and a volatility of 20%,
• a Asian option of a length of 4 years

These inputs translate into a $p$, the percentage of index performance the investor receives through the structured product, of 117%.

We use the investment universe with only the risk-free 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.

B.2. Results

Portfolio Allocation

Figures 11 and ?? display the results.

They are several key take-aways. First, we observe that CRRA is unlikely to explain our data, as there is negligible appetite for the guaranteed product in the absence of misperception. We show in the online appendix that this is true for all level of risk aversion.

Second, the misperception of the Asian Option alone can generate some appetite only in a model without fees. In the real market conditions, the misperception of the Asian Option does not generate any appetite. Only the misperception of the initial fee does.

Third, while misperception can generate some appetite for structured products, it cannot explain the cross section of our results. The effect of structured products on the risky share is indeed decreasing with risk aversion, while it increases in our data if we use the initial risky share as a proxy for risk aversion.

Fourth, loss aversion generates some appetite for the guaranteed product without and with fees. The risky share expands significantly under loss aversion, which is consistent with the data. The effect is also increasing with the kink, which maps well our cross-sectional results. 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.

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 of older age. Both empirical and theoretical evidence is most consistent with these innovative products being successful at alleviating loss aversion among households.
REFERENCES


Célérier, Claire, and Boris Vallée, 2017, Catering to investors through security design: Headline rate and complexity, Quarterly Journal of Economics.


Hens, Thorsten, and M. O. Rieger, 2014, Can utility optimization explain the demand for structured investment products?, _Quantitative Finance_ 14, 673–681.


Kuhnen, Camelia M., and Andrei C. Miu, 2015, Socioeconomic status and learning from financial information.


Ross, Stephen, 1976, Options and efficiency, _Quarterly Journal of Economics_ 90, 75–89.

Figure 1. Histogram of the Excess Expected Return and Yearly Mark-up of Structured Products and Mutual Funds. This figure shows the histogram of the excess expected returns offered by the representative structured products in our sample (908 products issued from 2002 to 2007) and all the standard equity funds, as well as the mark-up of the banks distributing them.
Panel A. Population share of participants and non-participants

Panel B. Share of financial wealth
invested in cash and traditional equity products

Figure 2. Household Risk-Taking in Sweden. This graph shows the share of Swedish households that participates to stock market in 2002, as well as the level of participation for households that do participation. The risky share is measured as described in section III.A
Figure 3. Adoption of Structured Products in Sweden (2000-2007): Fraction of Households Participating in Structured Products, Stocks, and Equity Funds

The figure 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 A. Percentage Change in Risky Share over the 2002-2007 period


Figure 4. The effects of structured products on household risky share across quintiles of cash share. This figure shows the change in the risky share, in % of financial wealth, over the 2002 to 2007 period for 2007 structured product participants versus equity fund or stock participants (that do not participate in structured products), broken down by cash share in 2002. The cash share of financial wealth is 1-risky share, the risky share including equity funds, stocks and retail structured products. The sample includes all households that participate in equity funds or stocks in 2002.
Figure 5. Change in the risky share over the 2002 to 2007 period for participants in equity funds, stocks or structured products. This figure shows the change in the risky share, in %, over the 2002 to 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, age categories and reluctance to take financial risk. 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. 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 preceding years.
Figure 7. Within Parish Share of Bank Branches Offering Structured Products over the 2002 to 2007 Period. This figure displays within in Swedish parish the share of branches offering structured products over the 2002 to 2007 period. We use this measure to instrument household likelihood to participate in structured products.
Panel A. Financial Wealth

Figure 8. 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 to 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 an urban area, and the gender of the household. All explanatory variables are defined in 2002.
Figure 9. 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 an urban area, and the gender of the household head. The sample is restricted to participants in each asset category.
Panel A. Guarantee

Panel B. Asian Option Length

Panel C. Yearly Markup

Figure 10. Product Design and Investor Characteristics. This figure displays coefficients from OLS regressions where the dependent variables are the guarantee level $g_t$, the length of the Asian Option $t_{n} - t_{1}$, and the yearly markup, as defined in section III. 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 an urban area, and the gender of the household head. The sample is restricted to structured product participants.
Panel A. Participation Rate

![Graph showing participation rate by wealth, IQ, age, and reluctance to take risk categories.]

Panel B. Initial Fee

![Graph showing initial fee by wealth, IQ, age, and reluctance to take risk categories.]

Panel C. Excess Expected Return

![Graph showing excess expected return by wealth, IQ, age, and reluctance to take risk categories.]

Figure 10. (cont.) Product Design and Investor Characteristics. This figure displays coefficients from OLS regressions where the dependent variables are the participation rate $p$, the initial fee, and the excess expected returns, as defined in section III. 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 an urban area, and the gender of the household head. The sample is restricted to structured product participants.
Panel A. Demand for Structured Product and Misperception (RRA=4)

No Fees

Fees

Panel B. The Effects of SP Participation on the Risky Share and RRA (Full Misperception)

The household does not perceive the effects of neither the Asian option nor the initial fee

Figure 11. Model Output: CRRA Utility Function.
Panel A. Demand for Structured Product and Loss Aversion

Panel B. The Effects of SP Participation on the Risky Share and Loss Aversion

The household does not perceive the effects of neither the Asian option nor the initial fee

Figure 12. Model Output: Loss Aversion Utility Function.
### Table I. Structured Product Summary Statistics and Pricing Outputs

#### Panel A: Total Sample (1,505 contracts)

<table>
<thead>
<tr>
<th>Issuance year</th>
<th>Mean</th>
<th>p1</th>
<th>p10</th>
<th>p50</th>
<th>p90</th>
<th>p99</th>
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<td>0.1</td>
<td>0.5</td>
<td>2.6</td>
<td>13.0</td>
<td>29.1</td>
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<td></td>
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</tr>
<tr>
<td>2006</td>
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<td></td>
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<tr>
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</tr>
</tbody>
</table>

**Design Parameters:**
- Term (months)
  - 2006: 40.1
  - 2002: 12.0
  - 2004: 17.9
  - 2006: 37.6
  - 2007: 60.5
  - 2007: 72.5
- Capital guarantee (%)
  - 2006: 100.2
  - 2002: 100.0
  - 2004: 100.0
  - 2006: 100.0
  - 2007: 100.0
  - 2007: 108.0
- Initial fee (%)
  - 2006: 7.0
  - 2002: 0.0
  - 2004: 1.0
  - 2006: 6.0
  - 2007: 12.0
  - 2007: 22.0

#### Panel B: Representative Products (906 contracts)

<table>
<thead>
<tr>
<th>Issuance year</th>
<th>Mean</th>
<th>p1</th>
<th>p10</th>
<th>p50</th>
<th>p90</th>
<th>p99</th>
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<td>0.4</td>
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<td>2006</td>
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<td>2007</td>
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<td>2007</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Design Parameters:**
- Term (months)
  - 2006: 44.2
  - 2002: 12.5
  - 2004: 24.5
  - 2006: 48.0
  - 2007: 60.5
  - 2007: 72.5
- Capital guarantee (%)
  - 2006: 100.2
  - 2002: 100.0
  - 2004: 100.0
  - 2006: 100.0
  - 2007: 100.0
  - 2007: 108.0
- Initial fee (%)
  - 2006: 8.5
  - 2002: 0.0
  - 2004: 1.0
  - 2006: 11.0
  - 2007: 13.0
  - 2007: 22.0
- Participation rate (%)
  - 2006: 114.6
  - 2002: 30.0
  - 2004: 64.0
  - 2006: 110.0
  - 2007: 160.0
  - 2007: 220.0
- Asian option length (months)
  - 2006: 14.5
  - 2002: 0.0
  - 2004: 4.0
  - 2006: 13.0
  - 2007: 36.0
  - 2007: 60.0

**Underlying Asset Parameters:**
- Beta to world index
  - 2006: 1.1
  - 2002: 0.5
  - 2004: 0.9
  - 2006: 1.1
  - 2007: 1.3
  - 2007: 1.4
- Historical volatility
  - 2006: 0.2
  - 2002: 0.1
  - 2004: 0.1
  - 2006: 0.2
  - 2007: 0.3
  - 2007: 0.4
- Dividend Yields (%)
  - 2006: 2.0
  - 2002: 0.0
  - 2004: 0.5
  - 2006: 2.1
  - 2007: 3.0
  - 2007: 4.5

**Return Properties:**
- Yearly excess expected return (%)
  - 2006: 3.5
  - 2002: -1.6
  - 2004: 0.4
  - 2006: 3.5
  - 2007: 6.6
  - 2007: 10.9
- Exposure to risk premium (%)
  - 2006: 58.4
  - 2002: -26.1
  - 2004: 5.9
  - 2006: 59.0
  - 2007: 110.7
  - 2007: 182.0
- Yearly markup (%)
  - 2006: 1.3
  - 2002: -4.5
  - 2004: -0.3
  - 2006: 1.5
  - 2007: 2.8
  - 2007: 5.8

Panel A of this table reports summary statistics of the issuances of retail structured products in Sweden between 2002 and 2007. **Capital guarantee** represents the minimum fraction of the initial investment nominal amount that the household is guaranteed to receive at maturity. **Initial fee** represents the additional amount that the household pay above the principal at issuance, in % of principal, i.e. Issuance price - nominal amount). This fee affects the other design parameters of the product and should not be interpreted as a markup. **Participation rate** represents the coefficient applied to the positive performance of the benchmark asset. **Asian option length** represents the period over which the underlying asset performance is averaged to define the benchmark asset. These parameters are described in more details in Section 2. Panel B displays the output from the expected returns and markup calculation from Section 2. **Yearly excess expected return** represents the annualized expected return of the structured product over the maturity of the product, minus the riskfree rate for the same period (Swedish treasury rate). **Exposure to the risk premium** corresponds to the **Yearly excess expected return** divided by the World index market premium assumed for the calculation of the expected return. **Yearly markup** corresponds to the difference between the issuance price of product (nominal amount + initial fee) minus the fair replication value under the Black and Scholes framework described in Section 2 of a product, divided by the product maturity in years.
### Table II. Structured Product Participants: Summary Statistics

<table>
<thead>
<tr>
<th>Financial characteristics (in 2000 $):</th>
<th>All Participants</th>
<th>Structured Participants</th>
<th>Fund Participants</th>
<th>Stock Participants</th>
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<tr>
<td>Yearly Income</td>
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<td>Median 22,037</td>
<td>Mean 28,338</td>
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<td>10th % 11,593</td>
<td>90th % 38,227</td>
<td>10th % 13,484</td>
<td>10th % 25,378</td>
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<tr>
<td>Total Wealth</td>
<td>Mean 157,406</td>
<td>Median 110,988</td>
<td>Mean 237,092</td>
<td>Mean 311,789</td>
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<td>10th % 3,360</td>
<td>90th % 432,605</td>
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<tr>
<td>Financial Wealth</td>
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<td>Median 15,961</td>
<td>Mean 64,636</td>
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<td></td>
<td>10th % 2,123</td>
<td>90th % 114,733</td>
<td>10th % 262,902</td>
<td>10th % 167,691</td>
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<td>Total Liability</td>
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<td>10th % 180,713</td>
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<td>Traditional Equity Products</td>
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<td>Median 1,492</td>
<td>Mean 34,035</td>
<td>Mean 53,106</td>
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<td>90th % 36,957</td>
<td>10th % 428</td>
<td>10th % 592</td>
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<tr>
<td>Equity Products Incl. Structured Products</td>
<td>Mean 24,500</td>
<td>Median 1,773</td>
<td>Mean 34,035</td>
<td>Mean 53,106</td>
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<td>90th % 39,914</td>
<td>10th % 428</td>
<td>10th % 592</td>
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<tr>
<td>Stocks</td>
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<td>Median 0</td>
<td>Mean 20,358</td>
<td>Mean 882</td>
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<tr>
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<td>10th % 0</td>
<td>90th % 10,371</td>
<td>10th % 0</td>
<td>10th % 0</td>
</tr>
<tr>
<td>Funds</td>
<td>Mean 11,199</td>
<td>Median 909</td>
<td>Mean 31,928</td>
<td>Mean 52</td>
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<td>Mean 8,170</td>
<td>Median 134</td>
<td>Mean 12,855</td>
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<td>10th % 65,381</td>
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<td>Mean 792</td>
<td>Mean 882</td>
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<td>Median 0</td>
<td>Mean 31</td>
<td>Mean 0</td>
</tr>
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<td></td>
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<td>90th % 0</td>
<td>10th % 0</td>
<td>10th % 0</td>
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<td>Structured Products</td>
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<td>Median 0</td>
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<td>Residential Real Estate</td>
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<td>Median 73,129</td>
<td>Mean 118,924</td>
<td>Mean 172,737</td>
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<td>90th % 303,687</td>
<td>10th % 121,618</td>
<td>10th % 393,422</td>
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<tr>
<td>Non Residential Real Estate</td>
<td>Mean 23,426</td>
<td>Median 0</td>
<td>Mean 28,133</td>
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<td></td>
<td>10th % 0</td>
<td>90th % 6,955</td>
<td>10th % 18,171</td>
<td>10th % 51,425</td>
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<td>Demographics</td>
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<tr>
<td>Household Head Age</td>
<td>Mean 52.5</td>
<td>Median 52.0</td>
<td>Mean 48.8</td>
<td>Mean 52.2</td>
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<tr>
<td></td>
<td>10th % 31.0</td>
<td>90th % 76.0</td>
<td>10th % 60.0</td>
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<td>Family Size</td>
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<td>Median 1.0</td>
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<td>Mean 2.3</td>
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<td></td>
<td>10th % 1.0</td>
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<td>10th % 4.0</td>
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<td>Number of Dep.Children</td>
<td>Mean 0.6</td>
<td>Median 0.0</td>
<td>Mean 0.9</td>
<td>Mean 0.7</td>
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<td></td>
<td>10th % 0.0</td>
<td>90th % 2.0</td>
<td>10th % 2.0</td>
<td>10th % 2.0</td>
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<tr>
<td>Stockholms Area in (in %)</td>
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<td>Median 1.0</td>
<td>Mean 0.2</td>
<td>Mean 0.2</td>
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<td></td>
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<td>90th % 1.0</td>
<td>10th % 1.0</td>
<td>10th % 1.0</td>
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<tr>
<td>Years of Schooling</td>
<td>Mean 12.1</td>
<td>Median 9.0</td>
<td>Mean 12.5</td>
<td>Mean 12.6</td>
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<td></td>
<td>10th % 6.0</td>
<td>90th % 16.0</td>
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<td>10th % 12.0</td>
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<td>IQ Score</td>
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<td>Household Head Male (in %)</td>
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<tr>
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<td>Mean 0.0</td>
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<td>90th % 1.0</td>
<td>10th % 0.0</td>
<td>10th % 0.0</td>
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### Table II. Structured Product Participants: Summary Statistics - Continued

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<th>Sample</th>
<th>All</th>
<th>Structured Participants</th>
<th>Fund Participants</th>
<th>Stock Participants</th>
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<tbody>
<tr>
<td>N= 3,994,605</td>
<td>N= 437,529</td>
<td>N= 1,976,083</td>
<td>N= 1,420,638</td>
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<td><strong>Share of financial wealth in (%):</strong></td>
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<td></td>
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<tr>
<td>Traditional Equity Products</td>
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<td>27.7</td>
<td>36.7</td>
<td>37.4</td>
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<td>Equity Products Incl. Structured Products</td>
<td>23.1</td>
<td>37.3</td>
<td>36.7</td>
<td>37.4</td>
</tr>
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<td>Stocks</td>
<td>6.6</td>
<td>8.9</td>
<td>8.0</td>
<td>18.4</td>
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<td>Equity Funds</td>
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<td>16.7</td>
<td>26.9</td>
<td>17.6</td>
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<tr>
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<td>2.1</td>
<td>1.8</td>
<td>1.4</td>
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<td>ETFs</td>
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<td>Structured Products</td>
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<td>Cash</td>
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<td>53.1</td>
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<td><strong>Participate in (%):</strong></td>
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<tr>
<td>Traditional Equity Products</td>
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<td><strong>Participated at least once in (%):</strong></td>
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<td>39.5</td>
<td>37.5</td>
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<td>3.9</td>
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<td>Equity Products Including Structured Products</td>
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<td>100.0</td>
<td>3.2</td>
<td>3.9</td>
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<td>3.2</td>
<td>3.9</td>
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<tr>
<td>Cash</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
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<td><strong>2002-2007 pp change in share of financial wealth invested in (%):</strong></td>
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<tr>
<td>Traditional Equity Products</td>
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<td>Equity Products Including Structured Products</td>
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<td>0.7</td>
<td>0.4</td>
<td>0.5</td>
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This table reports summary statistics of the main financial and demographic characteristics of Swedish households at the end of 2007. The first sample is the total population of Swedish households, the second sample is structured product participants, the third sample is fund participants and the last sample is stock participants.
Table III. Change in Risky Share and Participation in Structured Products

<table>
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<tr>
<th>Sample</th>
<th>Change in Risky Share (p.p.)</th>
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<th></th>
<th></th>
<th>All</th>
<th>IQ Restricted</th>
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<tbody>
<tr>
<td></td>
<td>All</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>All</td>
<td>IQ Restricted</td>
<td>All</td>
<td>All</td>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(8)</td>
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<tr>
<td>SP participation dummy</td>
<td>3.67***</td>
<td>8.53***</td>
<td>5.48***</td>
<td>2.29***</td>
<td>-0.67***</td>
<td>14.30***</td>
<td>4.55***</td>
<td>2.13***</td>
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</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.09)</td>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.09)</td>
<td>(0.52)</td>
<td>(0.22)</td>
<td>(0.33)</td>
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<td>SP participation dummy interacted with:</td>
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<tr>
<td>- financial wealth</td>
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<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td>All</td>
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<tr>
<td>2002 Risky Share (%)</td>
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<td>32.0</td>
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<tr>
<td>Change in Risky Share (p.p.)</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>- Mean</td>
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<td>6.9</td>
<td>8.1</td>
<td>4.3</td>
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</table>

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 to 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 to 2007 period was 3.6 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. Instrumental Variable Analysis

<table>
<thead>
<tr>
<th>First Stage</th>
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<tr>
<td></td>
<td>Structured Product Participant</td>
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<td></td>
<td>(0.022)</td>
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<td>Structured Product Participant</td>
<td>Yes</td>
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<td>Individual Controls</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>735,859</td>
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</tbody>
</table>

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 to 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 an 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 to 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

<table>
<thead>
<tr>
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<th>Share of Financial Wealth Invested in Cash, in %</th>
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<tbody>
<tr>
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<tr>
<td>SP Share of Financial Wealth</td>
<td>-0.620*** (0.002)</td>
</tr>
<tr>
<td>SP Share of Financial Wealth × Financial Wealth (log)</td>
<td>0.117*** (0.002)</td>
</tr>
<tr>
<td>SP Share of Financial Wealth × IQ Score</td>
<td>0.012*** (0.002)</td>
</tr>
<tr>
<td>SP Share of Financial Wealth × Age</td>
<td>0.010*** (0.000)</td>
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</table>

Controls

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Household FE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Year FE</td>
<td></td>
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</table>

Observations

<table>
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<tr>
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<th>5,252,612</th>
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<td>R²</td>
<td>0.0470</td>
<td>0.0489</td>
<td>0.0470</td>
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</table>

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. We display t-statistics below their coefficients of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.
Table VI. Portfolio Allocation across Household Characteristics

<table>
<thead>
<tr>
<th>Share of Financial Wealth Invested in:</th>
<th>Structured Products</th>
<th>Stocks</th>
<th>Equity Mutual Funds</th>
<th>Cash</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Financial Wealth (log)</td>
<td>-3.884***</td>
<td>4.238***</td>
<td>0.607***</td>
<td>-3.407***</td>
</tr>
<tr>
<td></td>
<td>(0.053)</td>
<td>(0.117)</td>
<td>(0.064)</td>
<td>(0.097)</td>
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<td>IQ Score</td>
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<td>0.551***</td>
<td>0.634***</td>
<td>-0.707***</td>
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<td></td>
<td>(0.029)</td>
<td>(0.029)</td>
<td>(0.035)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.039***</td>
<td>-0.083***</td>
<td>-0.033***</td>
<td>0.071***</td>
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<tr>
<td></td>
<td>(0.006)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.009)</td>
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*Controls*

<table>
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</thead>
<tbody>
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<td>Province FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Individual Controls</td>
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<tr>
<td>Observations</td>
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<td>115,196</td>
<td>115,196</td>
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<td>0.11</td>
<td>0.03</td>
<td>0.04</td>
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</table>

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 an 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.
Appendix A. Proofs

We use the following result throughout the Appendix. If $V$ is lognormally distributed and the standard deviation of $V$ is $s$, then

$$E[\max(V - K, 0)] = E(V) N(d_1) - K N(d_2)$$  \hspace{1cm} (A1)

for every $K > 0$, where

$$d_1 = \frac{\ln[E(V)/K] + s^2/2}{s}$$

and $d_2 = d_1 - s$.

A.1. Moments of the Benchmark Return

Since $E_Q^0(S_{t_i}/S_{t_0}) = e^{(r_f - q)(t_i - t_0)}$ for every $i$, the first moment of the benchmark return is

$$M_1^Q = \frac{1}{n} \sum_{i=1}^{n} E_Q^0 \left( \frac{S_{t_i}}{S_{t_0}} \right) = \frac{1}{n} \sum_{i=1}^{n} e^{(r_f - q)(t_i - t_0)}.$$

The second moment satisfies

$$M_2^Q = \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} E_Q^0 \left( \frac{S_{t_i} S_{t_j}}{S_{t_0} S_{t_0}} \right).$$

If $i \leq j$, then

$$E_Q^0 \left( \frac{S_{t_i} S_{t_j}}{S_{t_0} S_{t_0}} \right) = E_Q^0 \left[ \left( \frac{S_{t_i}}{S_{t_0}} \right)^2 \frac{S_{t_j}}{S_{t_i}} \right]$$

$$= e^{(r_f - q)(t_j - t_i)} E_Q^0 \left[ \left( \frac{S_{t_i}}{S_{t_0}} \right)^2 \right].$$

Since $\ln(S_{t_i}/S_{t_0})$ is normal with mean $(r_f - q - \sigma^2/2)(t_i - t_0)$ and variance $\sigma^2(t_i - t_0)$, we infer that

$$E_Q^0 \left[ \left( \frac{S_{t_i}}{S_{t_0}} \right)^2 \right] = e^{2(r_f - q - \sigma^2/2)(t_i - t_0) + 2\sigma^2(t_i - t_0)}$$

$$= e^{2[r_f - q + \sigma^2](t_i - t_0)}.$$  \hspace{1cm} (A2)

Hence

$$E_Q^0 \left( \frac{S_{t_i} S_{t_j}}{S_{t_0} S_{t_0}} \right) = e^{2[r_f - q + \sigma^2](t_i - t_0) + (r_f - q)(t_j - t_i)}.$$
Thus

\[ \mathbb{E}_0^\mathbb{Q} \left( \frac{S_t}{S_0} \right) = e^{[2(r_f-q)+a^2][\min(t_i,t_j)-t_0] + (r_f-q)|t_j-t_i|}. \]

for all \( i \) and \( j \), and equation (6) holds.

By a similar derivation, the first and second moments of the benchmark return under the physical measure \( \mathbb{P} \) satisfy (9) and (10).

Specialized Example. Assume that the benchmark is computed \( f \) times a month over the last \( Y \) months of the product. The frequency is 1 when the index is recorded every month, 2 if this is every two weeks, or 0.5 if this is every two months, etc. In our notation, the number of observations is \( n = Yf \) and the time interval between two consecutive observations is \( t_i - t_{i-1} = 1/(12f) \) in annual units. The instants at which the index is recorded are therefore

\[ t_i = T - \frac{n-i}{12f}, \]

where \( i = 1, \ldots, Yf \). We also assume that \( t_0 = 0 \).

Let

\[ a = e^{r_f-q}, \quad b = e^{\frac{2(r_f-q)+a^2}{12f}}, \]
\[ a^P = e^{\mu-q}, \quad b^P = e^{\frac{2(\mu-q)+a^2}{12f}}. \]

We easily infer from equations (5), (6), (9), and (10) the following results

\[ M_1 = \frac{a^{12fT}}{n} \left( 1 - a^{-n} \right) \]
\[ M_2 = \frac{b^{12fT}}{n^2(a-1)} \left[ 2a \frac{1 - (b/a)^{-n}}{1 - (b/a)^{-1}} - (a + 1) \frac{1 - b^{-n}}{1 - b^{-1}} \right] \]
\[ M_1^P = \frac{(a^P)^{12fT}}{n} \left( 1 - (a^P)^{-n} \right) \]
\[ M_2^P = \frac{(b^P)^{12fT}}{n^2(a^P-1)} \left[ 2a^P \frac{1 - (b^P/a^P)^{-n}}{1 - (b^P/a^P)^{-1}} - (a^P + 1) \frac{1 - (b^P)^{-n}}{1 - (b^P)^{-1}} \right] \]

where \( n = Yf \).

A.2. Proof of Proposition 1

The gross return on the guaranteed product, defined by (2), satisfies

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

The mean return on the structured product, \( \mathbb{E}_0^\mathbb{Q}(1 + R_{g,T}) \), is therefore given by a Black-Scholes type formula.
Lemma A1 (Expected return on the structured product under $\mathbb{Q}$). The mean return on the structured product under the risk-adjusted measure is given by

$$
\mathbb{E}_0^Q (1 + R_{g,T}) = \frac{1 + g + p M_1^Q N(d_1) - (p + g) N(d_2)}{1 + \text{init}}.
$$

(A4)

Furthermore, the mean return $\mathbb{E}_0^Q (1 + R_{g,T})$ strictly increases with the participation rate $p$ and the guaranteed return $g$.

Proof of Lemma A1. In order to price the structured product, we approximate the distribution of the benchmark return $1 + R^*_T$ as of date $t = 0$ under the risk-adjusted measure $\mathbb{Q}$ by a lognormal with mean $M_1^Q$ and second moment $M_2^Q$, as the Edgeworth expansion implies (Turnbull and Wakeman 1991). The variance of the log benchmark return is then given by equation (7), which follows from the properties of the lognormal distribution.

The average return on the structured product can be written as

$$
\mathbb{E}_0^Q (1 + R_{g,T}) = \frac{1 + g + p \mathbb{E}_0^Q [\max(1 + R^*_T - 1 - g/p; 0)]}{1 + \text{init}}.
$$

We infer from (A1) that

$$
\mathbb{E}_0^Q [\max(1 + R^*_T - 1 - g/p; 0)] = M_1^Q N(d_1) - (1 + g/p) N(d_2),
$$

where $d_1$ is defined by equation (8) and $d_2 = d_1 - w^Q$. The expected return on the guaranteed product therefore satisfies (A4).

The monotonicity of the expected return, $\mathbb{E}_0^Q (1 + R_{g,T})$, with respect to $g$ results directly from the definition of the return on the guaranteed product, $R_{g,T}$, in equation (2).

We now derive the monotonicity of the expected return with respect to the participation rate $p$. The argument used for $g$ does not apply in general because if $g$ and $R^*_T$ are both negative, a contract with a higher participation rate would incur a larger loss. The proof relies instead on the partial derivative of the function

$$
\varphi(g,p) = 1 + g + p M_1^Q N(d_1) - (p + g) N(d_2)
$$

with respect to $p$.

It is useful to show a few preliminary facts. We note that

$$
\frac{\partial d_1}{\partial p} = \frac{\partial d_2}{\partial p} = \frac{g}{p(p + g) w^Q},
$$

We also note that

$$
N'(d_2) = \frac{1}{\sqrt{2\pi}} \exp \left( -\frac{d_2^2}{2} \right) = \frac{1}{\sqrt{2\pi}} \exp \left[ -\frac{(d_1 - w^Q)^2}{2} \right]
$$
and therefore
\[ N'(d_2) = N'(d_1) \exp \left[ d_1 w^Q - \frac{(w^Q)^2}{2} \right]. \]

Since
\[ d_1 w^Q - \frac{(w^Q)^2}{2} = \ln \left( \frac{p}{p + g} \right) + \ln(M^Q_1), \]
we obtain that
\[ (p + g) N'(d_2) = p M^Q_1 N'(d_1). \]

Hence
\[
\frac{\partial \varphi}{\partial p}(g, p) = M^Q_1 N(d_1) - N(d_2) + p M^Q_1 N'(d_1) \frac{\partial d_1}{\partial p} - (p + g) N'(d_2) \frac{\partial d_2}{\partial p}
\]
\[ = M^Q_1 N(d_1) - N(d_2) + \frac{\partial d_1}{\partial p} \left[ p M^Q_1 N'(d_1) - (p + g) N'(d_2) \right] \]
and therefore
\[ \frac{\partial \varphi}{\partial p}(g, p) = M^Q_1 N(d_1) - N(d_2). \]

Since \( d_1 > d_2 \) and \( M^Q_1 > 1 \), we conclude that
\[ \frac{\partial \varphi}{\partial p}(g, p) > 0. \]

The function \( \varphi(g, p) \) strictly increases with the participation rate \( p \). We conclude that Lemma A1 holds.

Under the risk-adjusted measure \( Q \), the mean return on the structured product is equal to the risk-free rate,
\[ E_Q(1 + R_{g,T}) = e^{rT}, \]
which implies that Proposition 1 holds.

A.3. Pricing of Contracts with a Cap

A subset of contracts include a cap to the return that can be earned on the initial investment net of fee. The return on the structured product is then given by:
\[ 1 + R_{g,T} = \min \left[ 1 + \max(p R^*_T; g); \frac{1 + \text{cap}}{1 + \text{init}} \right] \]
where \( \text{cap} \) denotes the cap rate. The cap rate is generally higher than the guaranteed rate.

\[ ^{17} \text{A similar derivation implies that } \frac{\partial \varphi}{\partial g}(g, p) = N(-d_2) > 0. \]
Lemma A2 (Fair price of structured product with a cap). The fair initial fee is given by

\[ \text{init} = e^{-r_f T} \left[ 1 + g + p M_1^Q N(d_1) - (p + g) N(d_2) - p M_1^Q N(e_1) + (p + \text{cap}) N(e_2) \right] - 1, \]

where

\[ e_1 = \frac{1}{w_Q} \left[ \ln \left( \frac{p}{p + \text{cap}} \right) + \ln(M_1^Q) + \frac{(w_Q)^2}{2} \right] \]  \hfill (A5)

and \( e_2 = e_1 - w_Q \).

The fair initial fee is reduced by the presence of a cap.

Proof of Lemma A2. The return on the guaranteed product with a cap satisfies

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

for all realizations of \( R_T^* \). We infer from (A1) that the proposition holds. \[ \blacksquare \]

Lemma A3 (Expected return of the guaranteed product under \( \mathbb{P} \)). The expected return on the guaranteed product under the physical measure is

\[ \mathbb{E}^\mathbb{P} \left( 1 + R_{g,T} \right) = \frac{1 + g + p M_1^\mathbb{P} N(d_1^\mathbb{P}) - (p + g) N(d_2^\mathbb{P}) - p M_1^\mathbb{P} N(e_1^\mathbb{P}) + (p + \text{cap}) N(e_2^\mathbb{P})}{1 + \text{init}}, \]

where

\[ d_1^\mathbb{P} = \frac{1}{w_\mathbb{P}} \left[ \ln \left( \frac{p}{p + g} \right) + \ln(M_1^\mathbb{P}) + \frac{(w_\mathbb{P})^2}{2} \right], \]

\[ e_1^\mathbb{P} = \frac{1}{w_\mathbb{P}} \left[ \ln \left( \frac{p}{p + \text{cap}} \right) + \ln(M_1^\mathbb{P}) + \frac{(w_\mathbb{P})^2}{2} \right], \]

\[ d_2^\mathbb{P} = d_1^\mathbb{P} - w_\mathbb{P}, \text{ and } e_2^\mathbb{P} = e_1^\mathbb{P} - w_\mathbb{P}. \]

A.4. Joint Distribution of the Underlying and the Benchmark

We derive the joint distribution of the market and the benchmark. Let \( r_{m,T} = \ln(1 + R_{m,T}) \) and \( r_T^* = \ln(1 + R_T^*) \).

Lemma A4 (Joint distribution of the underlying and the benchmark). The vector \((r_{m,T}, r_T^*)'\) is Gaussian with mean \(\left[(\mu - \sigma^2/2)T; 2 \ln(M_1^\mathbb{P}) - 0.5 \ln(M_2^\mathbb{P})\right]'\) and variance-covariance matrix

\[ \begin{bmatrix} \sigma^2 T & \sigma_{m,b} \\ \sigma_{m,b} & (w_\mathbb{P})^2 \end{bmatrix}, \]  \hfill (A6)
where

\[ \sigma_{m,b} = \ln \left( \frac{\sum_{i=1}^{n} e^{(\mu-q+\sigma^2)(t_i-t_0)}}{\sum_{i=1}^{n} e^{(\mu-q)(t_i-t_0)}} \right). \] \hspace{1cm} (A7)

and \( w^P \) is defined by \([11]\).

**Proof of Lemma A4.** The total return on the stockmarket index (with reinvested dividends) has a lognormal distribution:

\[ r_{m,T} = \ln(1 + R_{m,T}) \sim \mathcal{N}[(\mu - \sigma^2/2)T; \sigma^2T]. \]

The log benchmark return is approximately normal \( r^*_T = \ln(1 + R^*_T) \sim \mathcal{N}[(\mu^P; (w^P)^2] \). The covariance of the log market return and the log benchmark return can be computed as follows. We know that

\[
\mathbb{E}^P[(1 + R_{m,T})(1 + R^*_T)] = \mathbb{E}^P \left[ \frac{S_T e^{\theta T} S_{t_1} + S_{t_2} + ... + S_{t_n}}{nS_{t_0}} \right]
= \frac{e^{\theta T}}{n} \sum_{i=1}^{n} \mathbb{E}^P \left[ \frac{S_{t_0}}{S_0} \left( \frac{S_{t_i}}{S_{t_0}} \right)^2 \frac{S_T}{S_{t_i}} \right],
\]

and therefore

\[
\mathbb{E}^P[(1 + R_{m,T})(1 + R^*_T)] = \frac{e^{\theta T}}{n} \sum_{i=1}^{n} e^{(\mu-q)t_0} e^{[2(\mu-q)+\sigma^2](t_i-t_0)} e^{(\mu-q)(T-t_i)},
\]

or equivalently

\[
\mathbb{E}^P[(1 + R_{m,T})(1 + R^*_T)] = \frac{e^{\theta T}}{n} \sum_{i=1}^{n} e^{(\mu-q+\sigma^2)(t_i-t_0)}.
\]

Recall that if \( X = (X_1, X_2) \) is bivariate normal with mean \((\mu_1, \mu_2)'\) and variance-covariance matrix \( \Sigma = (\sigma_{i,j})_{1\leq i,j\leq 2} \), then

\[
\mathbb{E}^P(e^{X_1+X_2}) = \exp \left( \mu_1 + \mu_2 + \frac{\sigma_{1,1} + \sigma_{2,2} + 2\sigma_{1,2}}{2} \right) = \mathbb{E}(e^{X_1}) \mathbb{E}(e^{X_2}) \exp(\sigma_{1,2}),
\]

or equivalently

\[
\sigma_{1,2} = \ln \left[ \frac{\mathbb{E}(e^{X_1+X_2})}{\mathbb{E}(e^{X_1}) \mathbb{E}(e^{X_2})} \right].
\]

The covariance of \( r_{m,T} \) and \( r^*_T \) is therefore

\[
\text{Cov}(r_{m,T}; r^*_T) = \ln \left\{ \frac{\mathbb{E}^P[(1 + R_{m,T})(1 + R^*_T)]}{\mathbb{E}^P(1 + R_{m,T}) \mathbb{E}^P(1 + R^*_T)} \right\},
\]

which implies \([A7]\).
Appendix B. Additional Figures and Tables

Figure IA.1. 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 to 2007 period in the Swedish market.
Figure IA.2. Number of Distributors per Year. This figure shows the evolution of the number of structured product distributors over the 2002 to 2007 period.
Figure IA.3. 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 to 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 an urban area, and the gender of the household head. All explanatory variables are defined in 2002.
Figure IA.4. The Effect of Participating in Structured Products or Any New Fund on the Risky Share (2002 - 2007). This figure shows the evolution of the number of structured product and new fund distributors over the 2002 to 2007 period.
**Figure IA.5. Likelihood of Buying a New Fund.** This figure shows predicted probabilities estimated from logit regressions, where the dependent variable is an indicator variable for buying a new fund at least one year during the 2002 to 2007 period. The sample is restricted to stock market participants in 2002. 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 an urban area, and the gender of the household head. All explanatory variables are defined in 2002.
Panel A. Excess Expected Return

Panel B. Yearly Markup

Figure IA.6. Standard Equity Fund Excess Expected Returns, Yearly Markup and Investor Characteristics. This figure displays coefficients from OLS regressions where the dependent variables are the excess expected return and the yearly markup as defined in section III. 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 an urban area, and the gender of the household head. The sample is restricted to structured product participants.
### Table IA.1. Market Share (in Volume) of Structured Product Distributors

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

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

### Table IA.2. Sensitivity Analysis

<table>
<thead>
<tr>
<th>Upward Adjustment to Underlying Asset Volatility</th>
<th>+1%</th>
<th>+2%</th>
<th>+3%</th>
<th>+4%</th>
<th>+5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resulting Average Underlying Asset Volatility</td>
<td>0.19</td>
<td>0.20</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>Yearly Mark-up (in %)</td>
<td>1.32</td>
<td>1.14</td>
<td>0.96</td>
<td>0.77</td>
<td>0.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yearly Excess Expected Return</th>
<th>with Risk Premium=4%</th>
<th>1.85</th>
<th>2.01</th>
<th>2.16</th>
<th>2.32</th>
<th>2.48</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with Risk Premium=5%</td>
<td>2.66</td>
<td>2.80</td>
<td>2.95</td>
<td>3.10</td>
<td>3.25</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=6%</td>
<td>3.50</td>
<td>3.64</td>
<td>3.77</td>
<td>3.91</td>
<td>4.05</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=7%</td>
<td>4.38</td>
<td>4.50</td>
<td>4.63</td>
<td>4.76</td>
<td>4.89</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=8%</td>
<td>5.29</td>
<td>5.40</td>
<td>5.52</td>
<td>5.64</td>
<td>5.76</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure to the Risk Premium</th>
<th>with Risk Premium=4%</th>
<th>46.4</th>
<th>50.2</th>
<th>54.1</th>
<th>58.0</th>
<th>61.9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with Risk Premium=5%</td>
<td>53.2</td>
<td>56.1</td>
<td>59.0</td>
<td>61.9</td>
<td>64.9</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=6%</td>
<td>58.4</td>
<td>60.6</td>
<td>62.9</td>
<td>65.2</td>
<td>67.5</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=7%</td>
<td>62.6</td>
<td>64.3</td>
<td>66.1</td>
<td>68.0</td>
<td>69.9</td>
</tr>
<tr>
<td></td>
<td>with Risk Premium=8%</td>
<td>66.1</td>
<td>67.5</td>
<td>69.0</td>
<td>70.5</td>
<td>72.0</td>
</tr>
</tbody>
</table>
### Table IA.3. Links between Structured Product Characteristics

<table>
<thead>
<tr>
<th>Participation rate, in %</th>
<th>Yearly Markup in %</th>
<th>Excess Expected Return in %</th>
<th>Exposure to the Risk Premium in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.02***</td>
<td>0.05***</td>
<td>0.75***</td>
<td></td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.05)</td>
<td></td>
</tr>
<tr>
<td>Guarantee, in %</td>
<td>-4.31***</td>
<td>-0.10***</td>
<td>-1.71***</td>
</tr>
<tr>
<td>(0.49)</td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.47)</td>
</tr>
<tr>
<td>Initial Fee, in %</td>
<td>5.03***</td>
<td>-0.09***</td>
<td>-1.58***</td>
</tr>
<tr>
<td>(0.18)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.39)</td>
</tr>
<tr>
<td>Length of the Asian Options (in months)</td>
<td>0.31***</td>
<td>-0.08***</td>
<td>-1.25***</td>
</tr>
<tr>
<td>(0.09)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Term, in months</td>
<td>0.32***</td>
<td>0.03***</td>
<td>0.46***</td>
</tr>
<tr>
<td>(0.08)</td>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.10)</td>
</tr>
</tbody>
</table>

Year FE: Yes, Yes, Yes, Yes
Observations: 906, 906, 906, 906
$R^2$: 0.552, 0.281, 0.528, 0.528

Note: This table displays coefficients from OLS regressions. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.
Table IA.4. Change in Risky Share and Participation in Structured Products

<table>
<thead>
<tr>
<th></th>
<th>Panel A: IQ Sample</th>
<th>Panel B: Controlling for IQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All (1)</td>
<td>Q1 (2)</td>
</tr>
<tr>
<td>SP participation dummy</td>
<td>3.415***</td>
<td>8.510***</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.142)</td>
</tr>
<tr>
<td>Province fixed effect</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>734,797</td>
<td>177,355</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.063</td>
<td>0.065</td>
</tr>
</tbody>
</table>

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 to 2007 period. The sample is restricted to households participating in stock markets in 2002. The coefficient in column 1 means that the increase in stock market exposure over the 2002 to 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 IA.5. Active Change in Risky Share and Participation in Structured Products

<table>
<thead>
<tr>
<th>Sample</th>
<th>Active Change in Risky Share, in p.p.</th>
<th>Quartiles of 2002 Risky Share</th>
<th>All</th>
<th>IQ Restricted</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>SP participation dummy</td>
<td>2.94***</td>
<td>9.73***</td>
<td>5.67***</td>
<td>1.83***</td>
<td>-2.33***</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.15)</td>
<td>(0.17)</td>
<td>(0.15)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>SP participation dummy interacted with:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- financial wealth</td>
<td>-0.28***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IQ score</td>
<td>-0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- age</td>
<td>0.11***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This table displays OLS regression coefficients. The dependent variable is the active 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 to 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 to 2007 period was 2.9 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 IA.6. Change in Risky Share and Participation in Structured Products: Control Group Restricted to Fund Buyers

<table>
<thead>
<tr>
<th>Sample</th>
<th>Change in Risky Share (p.p.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Quariles of 2002 Risky Share</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>SP participation dummy</td>
<td>2.616***</td>
</tr>
<tr>
<td>(0.060)</td>
<td>(0.094)</td>
</tr>
<tr>
<td>SP participation dummy interacted with:</td>
<td></td>
</tr>
<tr>
<td>- financial wealth</td>
<td>0.137*</td>
</tr>
<tr>
<td>(0.071)</td>
<td></td>
</tr>
<tr>
<td>- IQ Score</td>
<td>-0.024</td>
</tr>
<tr>
<td>(0.038)</td>
<td></td>
</tr>
<tr>
<td>- Age</td>
<td>0.061***</td>
</tr>
<tr>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>Province fixed effect</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,132,591</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.049</td>
</tr>
</tbody>
</table>

Summary Statistics

<table>
<thead>
<tr>
<th>2002 Risky Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Range</td>
</tr>
<tr>
<td>- Mean</td>
</tr>
<tr>
<td>- Median</td>
</tr>
<tr>
<td>Change in Risky Share (p.p.)</td>
</tr>
<tr>
<td>- Mean</td>
</tr>
<tr>
<td>- Median</td>
</tr>
</tbody>
</table>

This table displays OLS regression coefficients. The control group is restricted to households that have bought a fund over the 2002-2007 period. 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 to 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 to 2007 period was 3.6 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.