Can Security Design Solve Household Reluctance to Take Risk?

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

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ABSTRACT

This paper investigates whether securities with a non-linear payoff design can solve household reluctance to take financial risks. To do so, we first exploit the staggered introduction of capital guarantee products in Sweden from 2002 to 2007 coupled with a comprehensive panel of household portfolio data. The fast and broad adoption of these products is associated with an increase in household exposure to stock markets. The effect is larger for households that are ex-ante more reluctant to take financial risks. We develop a lifecycle model of portfolio allocation to identify the underlying economic mechanism. The capital guarantee alleviates the negative effects of loss aversion (coupled with narrow framing) or pessimistic beliefs on household financial risk taking. The impact on risk-taking generates sizable welfare gains that increase with household reluctance to take financial risks.

JEL Codes: I22, G1, D18, D12.

Keywords: Security design, household finance, capital guarantee product, behavioral biases, stock market participation, risk-taking.

*Calvet: Department of Finance, EDHEC Business School, 16 rue du Quatre-Septembre, 75002 Paris, France, and CEPR, laurent.calvet@edhec.edu. Célérier: 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 are grateful to Francisco Gomes for making the code of his life-cycle model available to us and to Nick Barberis for his insights on recursive preference theory. We thank John Y. Campbell, Shawn Cole, Daniel Dorn (EFA discussant), Sebastian Ebert, Andra Ghent (discussant), Valentin Haddad (NBER discussant), Vincent Van Kervel (discussant), Lars Norden (discussant), Tarun Ramadorai (CEPR discussant), Daniel Schmidt (discussant), Emil Siriwardane, Andrei Shleifer, Erik Stafford and Christophe Tonetti (NBER discussant) for helpful suggestions. We also acknowledge helfpul comments from seminar participants at ArrowStreet Capital, Babson College, BI Business School, Columbia University, EDHEC, Erasmus University, Florida State University, Harvard University, HEC Paris, King's College, NHH Bergen, Tilburg University, the Toulouse School of Economics, UCLA, Universidad Católica de Chile, the University of Alberta, the University of Maastricht, University of Mannheim, University of Rochester, the University of Toronto, the University of Washington, Yale University, the Brazilian Finance Society, the IFSID Montreal conference, the 2017 EIEF Junior Finance conference, the 2016 AFFI-Eurofidai Conference, the 2017 meeting of the European Finance Association, the 2017 NBER Behavioral Finance meeting, the 2018 NBER Household Finance meeting, the 2018 Western Finance Association meeting, and the 2019 CEPR Household finance meeting. We thank Nikolay Antonov, Huseyin Aytug, George Cristea, Botir Kobilov and Alexey Vasilenko for excellent research assistance. The authors are grateful to IFSID for generous financial support. All errors are ours only.

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). Households with low exposures to the risk premium 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). The low household demand for risky assets also affects firms' costs of external funds.

Relatedly, another striking fact in household finance is the large amount of issuance of retail equity-linked products offering a capital protection, which we label *capital guarantee products* in the remainder of the study. These products represent more than \$ 5tn in outstanding volumes globally. In Sweden, their introduction led to a fast and broad adoption – 13% of the population within 5 years –, which contrast with the slower penetration of other innovative products with a clear economics rationale, such as ETFs. Despite this success, the effect of their introduction on household risk-taking has not been studied, nor has been the theoretical motivation behind their demand.

This paper therefore investigates both empirically and theoretically whether the non-linear payoff design of capital guarantee products, which caps the maximum loss investor can incur, affects household risk-taking. Can security design solve household reluctance to take financial risk? If so, through which economic mechanism? And are households better off as a result?

We first study empirically the introduction of capital guarantee products in Sweden during the 2000's. We exploit unique Swedish micro data with granular information on both household characteristics and their exact portfolio allocation (see Calvet, Campbell, and Sodini (2007)), which we merge with a dataset that contains detailed information on all synthetic capital guarantee products sold in Sweden since market inception (see Célérier and Vallée (2017)). The dataset offers a comprehensive coverage of the first five years of the development of the retail market for capital guarantee products for the whole population of Sweden.[1] We can therefore observe how the introduction of these innovative products impacted household holdings and risk ranking at the security level. We then develop a lifecycle model to identify the economic mechanism(s) that can rationalize our empirical finding. Leveraging this framework, we can also assess the potential

[1] The market developed from 2002 in Sweden.

welfare gains associated with the introduction of capital guarantee products.

Capital guarantee products in Sweden take the form of synthetic retail structured products, which have a mixed reputation among academics and regulators.[2] The first step of our empirical analysis is therefore to ensure that these products offer in expectation a significant share of the risk premium to households once we account for all aspects of these products: the disclosed fees, their exact payoff design, their ex dividend nature and the credit risk they bear. We therefore conduct a rigorous asset pricing assessment and find that despite relatively high total markups (1.6% per year) as previously found in the literature, these products do offer a significant share of the equity risk premium: 58% on average. Somewhat surprisingly, both these quantities, the yearly markups and exposure to the risk premium, are comparable in magnitude for mutual funds in Sweden over the same period. We compute yearly markups and exposure to the risk premium for funds by exploiting unique data on mutual fund fees and returns and applying the World CAPM.[3]

We then turn to measuring the impact of the introduction of capital guarantee products on household risk-taking. To do so, we develop a measure of financial risk-taking that takes into account the exposure to the risk premium offered by each financial product, as well as their fees, which we label *adjusted risky share*.[4] Equipped with this measure, which amounts to 24% on average for Swedish stock market participants in 2002, we first document that households that invest in capital guarantee products over our sample period increase significantly more their adjusted risky share than households that do not. The magnitude is large: over the five years following the introduction of capital guarantee products, the adjusted risky share increases twice as much for households that participate in these products than for households that do not: by 5 percentage points of financial wealth for CGP buyers versus 2.5 percentage points for other stock market participants.

Second, we establish that the effect of capital guarantee products on household risky share is strongly *positively* correlated with household initial reluctance to take risk, which we measure in three different ways: the initial share of financial wealth kept in bank deposits, the deviation

[2] See for instance Henderson and Pearson (2011), Célérier and Vallée (2017) and Vokata (2018).

[3] Gennaioli, Shleifer, and Vishny (2015) indicates similar magnitude for mutual funds in the US once taking into account all types of fees.

[4] The literature usually measures risk taking with the risky share, which is the weight of risky assets in the complete portfolio, without adjusting for the heterogeneity in the risk premium that each risky assets might offer based on the payoff design, beta and fees (see for example Calvet et al. (2007)).

from the adjusted risky share predicted by household demographic characteristics, and an elicited measure of reluctance to take risk from a survey of a subsample of the population. While the initial adjusted risky share is only 2% of financial wealth for the households that are in the highest quintile of our estimated measure of reluctance to take risk in 2002, it increases up to 16% for households that do participate to capital guarantee products versus only 8% for those that do not. The survey, which covers twins in Sweden, confirms this result: the effects of capital guarantee products on household risky share is twice larger for households that indicate that they are less willing to take financial risks.[5]

Third, when we investigate the portfolio composition of households who do participate in capital guarantee investment, we find that the quantity of capital guarantee products household invest in *increases* with their initial reluctance to take risk, following the same pattern as bank deposits, while being in sharp contrast to the one for traditional equity investments: the share of financial wealth invested in funds and stocks by households *decreases* with their with reluctance to take risk. The same is true across other household characteristics, such as age, IQ and wealth: the investment patterns are the same for capital guarantee products are for bank deposits, and opposite to the ones for equity funds or stocks.

To gain causal identification, we instrument the amount invested in capital guarantee products at the household level by a time-varying measure of bank idiosyncratic supply of capital guarantee products. We identify bank idiosyncratic supply shocks for each year exploiting data on the identity of the banks each household deposits money in. We then use bank-household relations to regress the share of financial wealth invested in capital guarantee investment on bank-year fixed effects while controlling for a large set of household characteristics, including demand for equity products as proxied by the time-varying risky share. We thus estimate more than 150 bank-year supply shocks. We then analyze the causal effects of the supply of capital guarantee products on household adjusted risky share in an instrumented panel model. To foster the robustness of this analysis we estimate the bank supply shocks and the causal effects in two different samples of the Swedish population. The instrument is a weighted average at the household level of the idiosyncratic supply shocks. We find that a 1 percentage point increase in the share of financial wealth invested in capital guarantee

[5]The estimated and elicited measures have a correlation of 0.2.

products leads to a 0.3 pp increase in adjusted risky share.[6]

Having empirically established that the introduction of capital guarantee products fosters household financial risk-taking and that the effect increases with their initial reluctance to take risk, we investigate theoretically the possible underlying economic mechanism and potential welfare gains. For this purpose, we augment the life-cycle model of Cocco, Gomes, and Maenhout (2005) along four key dimensions: first we introduce capital guarantee products in the investment set by precisely modeling the same design, embedded markup and illiquidity as the median product in Sweden. Second, we solve the model across a set of utility functions: Epstein-Zin, narrow framing, disappointment aversion (Gul et al., 1991; Routledge and Zin, 2010) and loss aversion with narrow framing (Barberis, Huang, and Thaler, 2006; Barberis and Huang, 2009). Third, we solve the model under across a set of beliefs: volatility misperception, probability weighting (Prelec, 1998), and crash risk. Last, we separately assess household's *decision* utility, *experienced* utility (Kahneman, Wakker, and Sarin, 1997), and bank gain.

We find that having an agent with loss aversion and narrow framing, or pessimistic beliefs, can match both directionally and quantitatively our main empirical facts: high demand for capital guarantee products, increase in risk-taking when the products are introducts, and heterogenous effect along the initial reluctance to take risk. We reject all other models, including a rational agent, such as one with an Epstein-Zin utility and objective beliefs.

We then turn to assessing the welfare gain associated with the introduction of capital products. By revealed preference, households should be better off under the lens of their *decision* utility when the products are introduced, and we indeed observe a large gain along this dimension. We however take a conservative approach by assessing household welfare through the lens of their *experienced* utility. We also estimate how welfare gains are shared between product providers and the household. We still find sizable welfare gain, except for households that exhibits a high level of risk-taking before the introduction of the products. Turning to how the surplus created by the introduction of capital guarantee products is split, we observe that, despite the comfortable markup that banks charge, households obtain the majority of this surplus.

This paper adds to the literature that studies the interaction between the design of financial

[6] In the absence of any substitution with traditional equity products, this elasticity would be around 0.55 pp, i.e. the average share of the risk premium obtained when investing in a capital guaranteed investment.

products and investor preferences. Célérier and Vallée (2017) describe how banks design financial products to cater to yield-seeking investors. In this paper, we show that security design can also mitigate household reluctance to take risk and hence increase their participation to the risk premium, which translates into a significant welfare gain.

This study also contributes to the strand of the household finance literature documenting the limited stock market participation and low risky shares of households (Calvet et al., 2007; Campbell, 2006). While several papers explore possible explanations for low risk-taking (Attanasio and Vissing-Jørgensen, 2003; Guiso and Jappelli, 2005; Barberis et al., 2006; Guiso, Sapienza, and Zingales, 2008; Haliassos and Bertaut, 1995; Hong, Kubik, and Stein, 2004; Kuhnen and Miu, 2017), our work speaks to both the cause of this low participation and an effective way to 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 et al., 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, 2018), 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 (Célérier and Vallée, 2017), thereby having a positive impact on investor welfare.[7] 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).

Our study builds on the rich literature that studies deviation from the neo-classical paradigm through utility functions (Tversky and Kahneman, 1979; Gul et al., 1991; Barberis et al., 2006), or beliefs (Prelec, 1998; Barberis, 2013). Relatedly, our paper expands the literature that studies portfolio allocation in a life-cycle model (Cocco et al., 2005; Gomes, Kotlikoff, and Viceira, 2008) by considering these alternative utility functions and beliefs and their effect on the optimal portfolio allocation.

[7] 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 capital guarantee products and presents the data for our empirical analysis. Section III describes the product design, and develops an asset pricing model to measure their markups and expected returns. In Section IV, we test whether investing in capital guarantee products leads to an increase in household risk-taking. We provide causal evidence for this relation in Section V. In Section VI, we develop a theoretical lifecycle model of portfolio allocation to study the mechanism that can explain the empirical effect we document. In Section VII, we discuss whether this product offers a welfare gain, and how it is divided between product providers and households. Section VIII concludes. An online Appendix provides additional empirical results and derivation of the theoretical propositions.

II. Background and Data

II.A. Background on Capital Guarantee Products

Capital guarantee products are retail investment products that offer some exposure to a risky asset and a protection for a substantial part of the capital, typically close to 100%. These products, therefore, provide investors with a way to obtain a share of the risk premium while capping the maximum loss they can incur if the risk materializes.

Product providers can use three different approaches to offer capital protection: through a synthetic product, a portfolio insurance strategy, or by building reserves. Synthetic products, also referred to as retail structured products, are passive, limited-horizon products with a non-linear payoff that depends on the performance of the underlying (Célérier and Vallée, 2017). Providers use derivatives to hedge the non-linear payoffs of these products. Portfolio insurance is a dynamic trading strategy that aims at managing the downside risk. Finally, product providers can offer some protection by building reserves that offset fluctuations in asset returns (for example the Euro life insurance contracts in France described in Hombert and Lyonnet (2019)). Reserves increase when asset returns are high and decrease when asset returns are low, allowing intertemporal smoothing: Investors receive positive transfers in years when returns are negative, and negative transfers in years when the returns are positive. Each approach has its own limitations. The synthetic structure minimizes hedging risk, but forces to use a close-end format. The use of reserves might face unraveling if investors internalize the role they play and base their investment decision on them.

Product designers might also choose a mix of these mechanisms, as for example with guaranteed variable annuities, and will typically underwrite the capital guarantee. This underwriting might generate systemic risk if hedging is partial or reserves are insufficient.

Capital guarantee products are widespread across the globe and represent more than $5 trillion of outstanding volumes. Table I provides summary statistics for the different types of capital guarantee products offered to retail investors across countries. Guaranteed variable annuities in the US represents a USD 1.6 trillion market (Ellul, Jotikasthira, Kartasheva, Lundblad, and Wagner, 2018). In China, structured certificates account for around $500 billion. In France, Euro-life insurance contracts stand for €1.4 trillion euros, or 60% of the GDP. The existence of capital guarantee products in many developed countries, and the large volume outstanding, speaks to the appeal of such security design for retail investors. However, we still know very little on whether they encourage investors to gain more exposure to the risk premium.

In Sweden, capital guarantee products are typically offered to retail investors in the format of retail structured products. While retail structured products have a mixed reputation due to the general high level of markups and the excessive complexity observed in some segments of the market, (Henderson and Pearson, 2011; Célérier and Vallée, 2017), those offering a capital-protection are relatively simple. In addition, while capital guarantee products do not allow for risk obfuscation by construction, Célérier and Vallée (2017) show that markups and complexity increase jointly with the risk inherent to the payoff structure. This result suggests that obfuscating risk allows to increase markup without reducing demand, which is not possible in the market of capital guarantee products. Nonethless, we fully account for the specificities of these products by including all fees and undisclosed markups in both the empirical and theoretical analyses as well as by confirming that both our empirical and theoretical results are robust when restricting the sample to the simplest products.

INSERT TABLE I

II.B. Data

Our empirical analysis relies mostly on the merge of two datasets: a dataset on all synthetic capital guarantee products issued in Sweden to retail investors since market inception, and a dataset on the portfolio composition and socio-demographic characteristics of the population of Swedish households from 2002 to 2007.

Capital Guarantee Products and Equity Funds

The data on synthetic capital guarantee products is part of the dataset compiled by Célérier and Vallée (2017) on retailed structured products issued in Europe from 2002 to 2010. The dataset includes not only comprehensive information on the underlying, maturity, volumes and fees of each capital guarantee investment, but also a text describing their payoff formula. We obtain the exact payoff structure of each capital guarantee investment through a text analysis of the pay-off description.[8]

Our sample of capital guarantee products includes 1,511 equity-linked capital guarantee products issued in Sweden over the 2002 to 2007 period, for a total volume of 8 billion dollars.[9] Panel A of Table III reports summary statistics on the product sample.

INSERT TABLE III

We also collect data on the age, family, geographical scope, and historical fees of all Swedish equity funds during the period from fund factsheets. For each fund, we have information not only on the total expense ratio (TER), which includes operation costs and management fees, but also on the total cost ratio (totalkostnadsandel in Swedish - TKA). TKA is a Swedish invention that extends TER to include transaction fees. Throughout our analysis we use TKA as proxy for fund fees as it is the most comprehensive and frequently available measure in the dataset. When missing, we impute TKA from the other fund fees reported in the fact sheet, controlling for age, family and geographical scope of the fund.

Finally, we use market data from FinBas[10], Datastream and Bloomberg for the returns, volatility and dividends of the underlying assets of capital guaranteed investments, and for the mutual funds.

Household Asset Allocation and Socio-Demographics

[8] See Célérier and Vallée (2017) for the precise methodology.

[9] In Sweden, the large majority of capital guarantee products offer equity exposure (87% of the products).

[10] FinBas is a financial database maintained by the Swedish House of Finance.

The household portfolio data, described in Calvet et al. (2007), is a panel of financial wealth and income data covering all Swedish households over the 2000 to 2007 period. The panel contains the detailed breakdown of the wealth of each household across real estate, cash, equity mutual funds, stocks, and capital guarantee products. Importantly, within financial wealth, the panel also provides security-level information on the amount invested in any assets, which are identified by the International Security Identification Number (ISIN).[11] Statistics Sweden collected this highly disaggregated household-level data on wealth for the purpose of a wealth tax over this period. The data comes from a variety of sources, including the Swedish Tax Agency, welfare agencies, and the private sector. Financial institutions have supplied information to the tax agency on their customers' deposits, interest paid or received, security investments, and dividends. The data additionally provides unique identifiers of the institutions where bank accounts are held. Importantly, non-taxable securities and securities owned by investors below the wealth tax threshold are included. 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 household portfolio data is of uniquely high quality since the information comes directly from tax filings: it covers the entire population and provides the exact portfolio composition. We, however, do not observe the value of households' defined contribution pension savings. These pension savings include assets in private pension plans and in public defined contribution accounts that were established in a 1999 pension reform. According to official statistics, defined contribution pension savings had an aggregate value of $25.6 billion in Sweden at the end of 2002, whereas aggregate household financial wealth invested outside pension plans amounted to $131.3 billion. Our data set therefore contains 84 percent of household financial wealth. In addition, while we observe the total value of endowment insurance products, a form of tax-favored saving, we do not observe the allocation of these assets. Here, we are conservative for the purpose of our analysis and assume that 100% of endowment insurance products are invested in equity funds.

The data also include detailed household socio-demographics characteristics such as the level of education, income, location at the parish level, gender and age of the household head.

[11]Bonds and bond mutual funds, which we can also observe, are infrequent.

Elicited Reluctance to Take Risk

We exploit a survey conducted on the population of twins in Sweden that collects information on preferences and behavioral biases. The Swedish Twin Registry (STR) is the largest twin registry in the world and it routinely administers surveys to Swedish twins (Lichtenstein, Sullivan, Cnattingius, Gatz, Johanson, Carlström, Björk, Svartengren, Volk, Klareskog, de Faire, Schalling, Palmgren, and Pedersen, 2006). Here, we use data from the survey SALTY, which is a collaborative effort between researchers in epidemiology, medicine and economics initiated in 2007. SALTY is the first major survey of twins which features an entire section specifically dedicated to economic decision-making (Cesarini, Johannesson, Magnusson, and Wallace, 2012). Beginning in early 2009, the survey was sent out to 24,914 Swedish twins born between 1943 and 1958. In the spring of 2010, final reminders were sent out to those who did not initially respond to the survey. The data collection was completed in the summer of 2010. The survey generated a total of 11,743 responses, equalling a response rate of 47.1%. Out of the respondents 11,418 (97.2%) gave informed consent to have their answers stored and analyzed.

In this paper, we concentrate on the following question of the survey to measure reluctance to take financial risks: "Are you a person who is willing to take financial risks or trying to avoid financial risks?" on a 1 to 10 scale.[12]

Sample Construction

We build our final sample the following way. First, we drop households with a head younger than 25 years old and with financial wealth in 2002 below $200. Second, because we investigate the effects of the introduction of capital guarantee products on household risk taking over the 2002-2007 period, we only keep households that are observable over the total period.[13] Our final sample consists of 3,112,214 households.

We then merge the household portfolio data with the capital guarantee investment data and equity fund data using the unique ISIN identifiers of each financial asset the household has invested

[12] While the survey also includes several questions related to behavioral biases, there is unfortunately very little heterogeneity in participants' answers for these questions.

[13] In our dataset, a household exits every time the composition of adults of the household changes, due to either death, divorce, marriage or change in partnership. The households exiting the panel data are on average 2.5 y.o. younger, and have a somewhat lower financial wealth and income than the average household in the sample.

in. The dataset resulting from merging the two previous sources creates the ideal setting to investigate how the development of capital guarantee 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 capital guarantee products.

II.C. Summary Statistics

Table IV presents demographic and financial characteristics for the total sample of 3.1 million households, the sample of households participating in stock markets in 2002 of 2.1 million households, or 68.5% of the total sample, and the sample of households that have participated at least once in capital guarantee products, of 430,000 households, or 13.8% of the total sample.

INSERT TABLE IV

Panel A offers a preliminary picture of Swedish households' investment behaviors as of 2002. While the stock market participation rate in Sweden is relatively high compared to other developed economies (68.5%), the share of financial wealth invested in risky assets conditional on this participation remains modest at 34.5%, far below what institutional investors have.[14] Participants mostly invest in risky assets through equity funds, which represent 23.7% of their financial wealth on average (median is 17.9%), while individual stocks represent only 9.3% on average (median is 1.4%).

When comparing the demographic characteristics between the three groups: whole population, stock market participants, and capital-guaranteed investments participants, we notice some heterogeneity, for instance on financial wealth, age and income, that requires precise controls when implementing our empirical analysis.

An additional take-away from the raw data is the broad adoption of capital-guaranteed investments despite their recent introduction. Figure 1 shows the evolution of the share of households participating in capital guarantee products and in other stock market products over the 2002 to 2007 period.[15] Despite the usual reluctance of households to invest in equity funds and stocks, capital guarantee products quickly gain traction within a few years in Sweden. At the end of 2007,

[14] We discuss in detail theoretical benchmarks for this quantity in the theoretical framework.

[15] 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.

13.8% of Swedish households in our final sample have participated at least once in this new product class and invest a significant fraction of their financial wealth in these products.

INSERT FIGURE 1

This extensive margin effect also translates into a significant effect at the intensive margin. Panel B of Table IV indicates that conditional on investing in capital-guaranteed investments, households allocate 11% on average of their financial wealth to this type of investments in 2007, more than individual stocks. We also observe that the increase in the share invested in equity products over the period 2002-2007 amounts to 69% on average for participants to capital guarantee products, versus 32% for the population of participants in standard equity products.

III. Design, Markup and Expected Returns

To study whether capital guarantee products foster risk-taking, we must first investigate whether these products actually provide investors with a share of the risk premium. We, therefore, start our analysis by implementing a rigorous and large-scale asset pricing model to derive the embedded markup and expected returns of the products.

For this purpose, we extend the Black and Scholes framework to derive a closed-form expression that fully captures the specificities of the products we consider, such as their option features, their ex dividend nature, the initial fee that is paid at investment, and the issuer credit risk. The relative homogeneity in product design we observe across capital guarantee products in Sweden allows for the standardization of this asset-pricing model.

We find that capital guarantee products offer a share of the risk premium that is comparable in magnitude to the one offered by the most popular household risky investment, equity mutual funds.

III.A. Product Design

The capital guarantee product *Aktieobligation Europa Trygg 98, ISIN: SE0001940107,* issued by Nordea Bank in 2004 with a volume of USD19.3m, provides a representative example of this class of financial products in Sweden. The payoff of this product is designed as follows:

The product has a maturity of 3 years and a fee of 2% is charged at issuance. The product return is linked to the performance of the Eurostoxx 50 index as follows: at maturity the product offers a minimum capital return of 100% plus 80% 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 7 months, and does not include dividends.

A capital guarantee product issued at time t is therefore typically defined by the following 6 parameters, listed with their corresponding value from the previous example:

1. an initial fee *init* charged when the product is originated at date 0, *(init=2%)*
2. a maturity date T *(T = t + 36 months)*,
3. an underlying asset or index, S_t, *(Eurostoxx 50)*
4. an Asian option period *(Last 7 monthly observations)*,
5. a participation rate p, *(80%)*
6. a guaranteed rate of return g. *(100%)*

Let the benchmark return R_T^* denotes the average performance of the underlying measured at prespecified dates $t_1 < \cdots < t_n$:

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

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 capital guarantee product between issuance and maturity is

$$1 + R_{g,T} = \frac{1 + \max(p\, R_T^*; g)}{1 + init}. \tag{2}$$

The initial fee is paid in addition to the nominal amount invested at the initial date. Hence, the investor obtain a net capital protection of $g/(1 + init)$.

The capital guarantee products are typically structured as notes, and therefore bear the credit risk of the bank structuring them.

Panel B of Table III provides summary statistics on the six previously defined design parameters for the sub-sample of products that possess this representative design. These products represents 55% of the retail capital guarantee products made during our sample period in Sweden, and 60% of the corresponding volumes. The average volume for a capital guaranteed investment issuance is around \$5 million. In terms of design, the median maturity is 4 years, the median guarantee is 100% notwithstanding an initial fee of 11%, and the participation rate stands at 110%.[16]

III.B. Markups and Expected Returns: Methodology

In order to measure the risk and return properties of the representative capital guarantee product, we develop a tailored pricing model based on the absence of arbitrage that accounts for all the design parameters. We assume that under the risk-adjusted measure $\mathbb{Q}$, the underlying asset follows a geometric Brownian motion:

$$\frac{dS_t}{S_t} = (r_f - q)dt + \sigma dZ_t, \tag{3}$$

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

Let $\mathbb{E}_0^{\mathbb{Q}}$ denotes the expectation operator conditional on the information available at date 0. Under the risk-adjusted measure $\mathbb{Q}$, the mean return on the capital guarantee product is equal to the risk-free rate, $\mathbb{E}_0^{\mathbb{Q}}(1 + R_{g,T}) = e^{r_f T}$, which by equation (2) implies the following pricing result.

PROPOSITION 1 (Fair pricing of capital guarantee product): *The fair initial fee is given by:*

$$init = e^{-r_f T}\left[1 + g + p\, M_1^{\mathbb{Q}}\, N(d_1) - (p+g)\, N(d_2)\right] - 1, \tag{4}$$

[16] The fact that the participation rate is higher than 100% despite the capital protection is made possible by the Asian option feature and the ex-dividend nature of the benchmark return.

where $M_1^{\mathbb{Q}}$ and $M_2^{\mathbb{Q}}$ denote the first two moments under $\mathbb{Q}$ of the benchmark return:

$$M_1^{\mathbb{Q}} = \mathbb{E}_0^{\mathbb{Q}}(1+R_T^*) = \frac{1}{n}\sum_{i=1}^{n} e^{(r_f-q)(t_i-t_0)}, \tag{5}$$

$$M_2^{\mathbb{Q}} = \mathbb{E}_0^{\mathbb{Q}}\left[(1+R_T^*)^2\right] = \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} e^{[2(r_f-q)+\sigma^2][\min(t_i,t_j)-t_0]+(r_f-q)|t_j-t_i|}, \tag{6}$$

$(w^{\mathbb{Q}})^2$ denotes the variance of the log benchmark return:

$$(w^{\mathbb{Q}})^2 = Var_0^{\mathbb{Q}}\left[\ln(1+R_T^*)\right] = \ln\left[M_2^{\mathbb{Q}}\,(M_1^{\mathbb{Q}})^{-2}\right], \tag{7}$$

and d_1 and d_2 are Black-Scholes normalized ratios:

$$d_1 = \frac{1}{w^{\mathbb{Q}}}\left[\ln\left(\frac{p}{p+g}\right) + \ln(M_1^{\mathbb{Q}}) + \frac{(w^{\mathbb{Q}})^2}{2}\right] \tag{8}$$

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

The gross markup is the difference between the fair initial fee and the initial fee investors pay. When the underlying follows a geometric Brownian motion with drift $\mu - q$ and volatility σ under the physical measure $\mathbb{P}$, the expected return on the capital guaranteed product, $\mathbb{E}^{\mathbb{P}}(1+R_{g,T})$, is also available in closed form, as we show in the Online Appendix.

The sub-sample of representative products covers 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 6%. We then convert it into our model input $\mu = \ln[1+\mathbb{E}(R_{m,t})]/t$, where $t = 1/12$ if μ is expressed in yearly units. We set σ equal to the historical volatility over the 1990 - 2007 period. We use the latest dividend yield before the product's 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 apply Proposition 1 to calculate the gross markup and add the CDS spread of the issuer to adjust for the credit risk. Finally, we scale this markup by the product maturity in year to obtain a net yearly markup that is directly comparable to mutual fund yearly fees. We then derive the expected return the investor earns as per Proposition **??** of the Online Appendix. The yearly excess expected return is obtained by annualizing this expected return and subtracting the risk-free rate, i.e. the rate of Swedish Treasury bills of corresponding maturity.

III.C. Markups and Expected Returns: Results

Panel B of Table III reports summary statistics on the yearly markups and excess expected returns obtained through the described methodology. There are two important take-aways. First, the cost to households/ the profitability to the banks of retail capital guarantee products represents 1.6% of the invested amount per year on average. Second, yearly excess expected returns for these products are significantly positive with an average of 3.5%, or more than half of the equity risk premium we assume.[17] More than 90% of products earn a positive risk premium. These results confirm that retail capital guarantee products allow households to earn a significant part of the risk premium.

Panel A of Figure 2 displays the distribution of yearly markups and excess expected returns for the capital guarantee products in our sample.

INSERT FIGURE 2

In Table **??** of the Online Appendix, we conduct a sensitivity analysis that shows that these results are not driven by a particular set of parameters. Furthermore, Table **??** in the online appendix 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.

For comparison purposes, we leverage our dataset on all equity funds available in Sweden over the 2002-2007 period to obtain the fees and to calculate the expected returns they offer by applying the World CAPM to their historical returns. Results are displayed in Panel C of Table III and Panel B of Figure 2. Equity mutual fund fees, which include transaction costs, operation costs and management fees as described in Section II.*II.B*, amount to 2.2% on average during our sample period. We find mutual fund betas to be around 0.9 on average. When taking into account fees

[17] Our estimate of the share of the risk premium investors obtain has almost no sensitivity to our risk premium assumption.

and a risk premium of 6%, we therefore find that average mutual fund excess expected returns are around 3.2%.

When comparing the markups and expected returns of capital-guaranteed products and mutual funds, we observe that the magnitudes are similar across products but dispersions are lower for mutual funds. This finding hence suggests that banks have comparable financial incentives to market equity mutual funds and retail capital guarantee products.[18]

IV. Measuring the Impact of Capital Guarantee Products on Household Risk-Taking

The previous section documents that the capital guarantee products marketed to Swedish households offer them a large fraction of the risk premium even when accounting for embedded markups. We now test whether the introduction of these products has an impact on household risk-taking.

IV.A. Measuring Household Risk Taking

We introduce a novel measure of household financial risk-taking: the *adjusted risky share*. The literature usually measures household risk-taking as the share of their financial wealth invested in equity products (e.g. Calvet et al. (2009b)), hence assuming that each equity product provides the same (full) exposure to a similar risk premium, while this is typically not the case. The risk exposure of an equity product indeed varies with its underlying asset, its payoff design and its fees. For example, a capital guarantee product on the Euro Stoxx 50 with a high markup offers a lower share of the risk premium than a low-fee mutual fund invested in emerging markets.

We first measure the marginal impact of investing in an equity product p on risk taking as the fraction of the equity premium η_p an investor receives in expectation when investing in this product:

$$\eta_p = \frac{\mathbb{E}(R_{p,T} - e^{r_f T})}{\mathbb{E}(R_{m,T} - e^{r_f T})}.$$

We then compute η_p for all the equity products Swedish households have invested in over our sample period, which include stocks, equity funds, and capital guarantee products. We assume

[18] Discussions with practitioners also support this hypothesis.

that $\mathbb{E}(R_{m,T} - e^{r_f T})$, the market risk premium, amounts to 6%, and obtain $\mathbb{E}(R_{p,T} - e^{r_f T})$ from the asset pricing results in Section III.*III.C* for capital guarantee products and equity funds. For simplicity, we assume that $\eta = 1$ for stocks, and $\eta = 0.5$ for allocation funds.[19]

Panels B and C of Table III provide summary statistics for the fraction of the equity premium η offered by capital guarantee products and equity funds, respectively. While we could expect capital guarantee investment to offer a lower share of the risk premium than equity mutual fund because of the guarantee embedded in the former products, both products actually offer approximately the same share of the risk premium, 55% to 58% on average. The higher level of fees and the lower betas of equity funds relatively to the betas of the underlying asset of capital guarantee products, respectively 2.2% on average versus 1.6%, and 0.9 versus 1.1, offset the gap in risk exposure induced by the design of capital guarantee products.

We finally calculate household risk-taking by taking the weighted average of the risk exposure η offered by each of the n products the household invests in. Therefore, the *adjusted risky share* w_h of household h is:

$$w_h = \sum_{i=1}^{n} \eta_i \times \frac{EquityProduct_{h,i}}{FinancialWealth_h},$$

where i spans the n assets included in the household portfolio across the three equity-linked asset classes: capital guarantee products, equity mutual funds, and stocks.

Panel C of Table IV provides summary statistics on the adjusted risky share of stock market participants: while the standard measure of the risky share amounts to 34.5% in 2002, the *adjusted risky share* amounts to 23.9% on average. The percentage change in the adjusted risky share is 0.6% for stock market participants versus 16.7% for participants in capital guarantee products, suggesting a positive correlation between participating in capital-protecting investment and risk-taking.

IV.B. Impact of Capital Gaurantee Products on Households' Adjusted Risky Share

We now investigate whether investing in capital guarantee products is associated with an increase in household risk-taking. To do so, we focus on the subsample of households participating in equity funds or stocks in 2002, and therefore estimate the effect at the intensive margin.[20]

[19] Allocation funds represent around 2% of household financial wealth.

[20] Our results are robust to including the whole population. However, effects on the extensive margin are minimal, which suggests that capital guarantee products do not address frictions to stock market participation.

Panel A of Figure 3 plots the predicted *adjusted risky share* in 2002 and in 2007 across two subsamples. The first subsample includes households that participate at least once in capital guarantee products over the 2002-2007 period, the "Participants in capital guarantee products". The second one, the "control group", includes households that do not participate in these products. We plot the *predicted* adjusted risky share to control for composition effects due to the heterogeneity in the socio-demographics across the two groups. We thus set a large set of socio-demographics at their mean value: financial wealth, age, year of education, gender and family size. We find that the risk-taking behaviors of the two groups diverge over the sample period: the gap in the adjusted risky share thus increases by more than 3 percentage points in 2007, or more than 10% of the baseline adjusted risky share.[21]

In Panel B of Figure 3, we restrict the sample to households that are taking low financial risks, and reproduce the same exercise. We identify households that are taking low financial risks as households in the highest quintile of bank deposit share of financial wealth in 2002. We observe that the divergence in risk-taking between capital guarantee investment participants and the control group is even more pronounced within this sample: the gap in the adjusted risky share is almost inexistent in 2002 and increases up to more than 8 percentage points (pp) in 2007. This 8 pp gap in adjusted risky share is particularly large when compared to the levels of adjusted risky share for this sample of the population: participants in capital guarantee product and the control group have an adjusted risky share of only 2% in 2002. In 2007, capital guarantee investment participants have an adjusted risky share twice larger than non-participants, 16% versus 8%.

INSERT FIGURE 3

We confirm this result by running the following cross-sectional regression on the evolution of the adjusted risky share:

$$\Delta_{2007,2002}(w_h) = \alpha + \beta\, \mathbb{1}_{CP,h} + \lambda' x_h + \varepsilon_h, \tag{9}$$

where $\Delta_{2007,2002}(w_h)$ denotes the growth rate in adjusted risky share of household h measured using Davis and Haltiwanger (1992) growth measure[22], $\mathbb{1}_{CP,h}$ is a dummy indicating whether household

[21] Using the unconditional adjusted risky share with a matched control group yields similar results.

[22] The Davis and Haltiwanger (1992) growth measure limits the extreme values created by low denominator values

h has participated at least once in capital guarantee products from 2002 to 2007, x_h is a vector of household characteristics, and ε_h is the error term. The vector x_h of household characteristics includes the percentage changes in income and in financial wealth over the 2002-2007 period and fixed effects for the number of children, household size, gender, localities, years of education, and deciles of financial wealth, income, age and risky share in 2002.

The coefficient of the variable $\mathbb{1}_{CP,h}$ in Column 1 of Table V confirms that households that participate in capital guarantee investment over the 2002-2007 period increase their adjusted risky share significantly more than households that do not not. The percentage change in the adjusted risk share is 21 percentage points higher for participants in capital guarantee products, while on average households increased their risky share by only 0.7% over the period.

INSERT TABLE V

IV.C. Heterogeneity along Household's Reluctance to Take Risk

We now test whether the impact of capital guarantee products on household risk-taking significantly varies with household reluctance to take financial risks, as Panel B of Figure 3 suggests. To do so, we use both revealed and elicited measures of household reluctance to take financial risks, exploiting information on household exact portfolio allocation in 2002 for the former, and data from the survey on behavioral biases and preferences among the twin subsample of the population for the latter.

IV.C.1. **Estimated Reluctance to Take Risk**

To estimate the revealed household reluctance to take financial risks, we run the following specification:

$$w_{h,2002} = \alpha + \lambda' x_{h,2002} + \gamma' \Phi_h + \varepsilon_h,$$

where $w_{h,2002}$ is the household adjusted risky share in 2002, $x_{h,2002}$ are the control variables that are commonly used in life-cycle models, i.e. age, income, and financial wealth. To allow for non-

in a standard growth rate. Its exact specification is:

$$\Delta_{2007,2002}(w_h) = \frac{2 * (w_{h,2007} - w_{h,2002})}{w_{h,2007} + w_{h,2002}}$$

linearity, we control for these household characteristics using decile fixed effects. We also include fixed effects for the regional location to control for possible supply effects due to the heterogeneous density of bank branches across regions.

We then split the residual of this regression ε_h into quintiles and define as $6 - quintile(\varepsilon_h)$ the revealed reluctance to take financial risks. The rationale is the following: both household preferences and economic circumstances drive financial risk-taking. We therefore control for the economic circumstances to isolate the preferences component central to our study.

We investigate how the effects of capital guarantee investment on household risk-taking vary along household reluctance to take risk by estimating the following regression:

$$\Delta_{2007,2002}(w_h) = \alpha + \beta_0 \mathbb{1}_{CP,h} + \beta_1 \mathbb{1}_{CP,h} \times RiskReluctance_h + \lambda' x_h + \varepsilon_h, \tag{10}$$

where x_h includes fixed effects for deciles of wealth, income, and age.

Figure 4 plots the incremental change in adjusted risky share for participants in capital-guarantee investments over the measure of revealed reluctance to take risk. The incremental change is monotonically increasing with the revealed reluctance to take risk.[23] The magnitude is particularly large: among the quintile of households that are the most reluctant to take risk ex ante, the growth in adjusted risky share is 50 pp higher for participants in capital guarantee investments than for non-participants. The gap in risky share growth amounts only to 12 pp among the lowest quintile of estimated reluctance to take risk. Columns (2) to (6) in Table V confirm this result by estimating equation (9) within each level of reluctance to take risk and by extending the set of household controls, including fixed effects for family size, gender, decile of ex-ante risky share, number of children and locality on top of fixed effects for deciles of financial wealth, income and age. The coefficient of $\mathbb{1}_{CP,h}$ indicates that the effect of participating in capital-protecting investment on the change in risky share increases from -3.7 pp (Column 2) to 56.1 pp (Column 6)

INSERT FIGURE 4

This relationship between the size of the incremental change in adjusted risky share for participants in capital guarantee investments and their revealed reluctance to take risk suggests that

[23]We obtain a comparable result when using the ex-ante bank deposit share of the financial wealth as a proxy for household reluctance to take risk.

these products are particularly effective at fostering risk-taking for households that are initially the less prone to it.

IV.C.2. **Elicited Reluctance to Take Risk**

We further confirm the previous result on the relationship between the increase in adjusted risky share for capital guarantee investments participants and their initial reluctance to take risk by exploiting the survey data from the twin sample.

Consistent with our previous approach, we first regress the answer to the question "Are you a person who is willing to take financial risks or trying to avoid financial risks?" on the usual set of household characteristics to obtain a conditional measure of elicited reluctance to take risk.

We then use the residual from this regression, in place of the estimated reluctance to take risk, in equation (10). By construction the sample size is significantly reduced, as the survey data is only available for the twin sample. Results are displayed in Figure 5. We observe a similar relationship between household preferences and the effect associated with participating in capital guaranteed products: the increase in adjusted risky share associated with participation in capital guarantee investments is significantly more pronounced among households reluctant to risk as elicited in the survey.

INSERT FIGURE 5

IV.D. An Equivalent to Bank Deposits?

To better understand the relationship between household initial reluctance to take risk and the size of the increase in their adjusted risky share when they buy capital guarantee products, we investigate whether households invest in these products the same way as in traditional equity products, such as stocks or mutual funds.

We first run the following cross-sectional OLS regressions on the share of financial wealth invested in each financial asset - capital guarantee products, bank deposits, stocks and equity funds - at the end of 2007 on the sample restricted to participants in the corresponding financial product:

$$\omega_{j,h} = \alpha_j + \beta RiskReluctance_h + \lambda_j' x_h + \varepsilon_{h,j},$$

where $\omega_{j,h}$ is the share of financial wealth invested in asset class j. The vector of characteristics, x_h, includes fixed effects for deciles of financial wealth, income, age and years of education in 2002.

Figure 6 plots the predicted share of financial wealth invested in each asset as a function of the revealed household reluctance to take risk. Household reluctance to take risk, measured in 2002, is negatively related with the extent of household investment into stocks and mutual funds in 2007, which is consistent with persistence in household preferences. On the other hand, household reluctance to take risk is positively related to the amount of financial wealth that households invest in both bank deposits and capital guarantee products as of 2007. The sharp contrast between the pattern of investment in capital guarantee products versus in traditional equity products, and the similarity with the one for bank deposits, suggests that households perceive capital guarantee products to be closer to bank deposits than to traditional equity products, most likely as both protect the capital invested.

INSERT FIGURE 6

In a second step, we investigate whether the share of financial wealth invested in capital guarantee products varies with households characteristics such as IQ, financial wealth and age, the same way as the share of financial wealth invested in cash, funds and stocks. The results displayed in Table VI confirm that household investment patters are similar for capital guarantee products as for bank deposits, but differ for funds and stocks. For example, while the share of financial invested in bank deposits and capital guarantee products decreases with IQ and increases with age (columns (1) and (2)), it is the opposite for funds and stocks (columns (3) and (4)).

INSERT TABLE VI

IV.E. Robustness

We conduct a set of robustness tests to ensure that mechanical effects or specification artifacts are not driving our main results.

We first ensure that the effects of capital guarantee products on household risky share are not driven by variations in the adjusted risky share resulting from investment passive returns, as opposed to active investment decisions. Our result could for instance be driven by a drop in mutual fund value during our sample period.

To correct for the passive change in the adjusted risky share, we define the active change in the adjusted risky share between $t-n$ and t by:

$$A_{h,t} = w_{h,t} - w^{p}_{h,t},$$

where $w_{h,t}$ is the observed adjusted risky share in year t and $w^{p}_{h,t}$ is the adjusted risky share at the end of year t assuming the household does not trade between years $t-n$ and t. $w^{p}_{h,t}$ is calculated by applying to each asset of the household portfolio the realized returns of this asset between $t-n$ and t.

In Columns 1 and 2 of Table VII, we run our baseline specifications with the active change of the adjusted risky share between 2002 and 2007 as the dependent variable. The effect of capital guarantee investment participation on household adjusted risky share, as well as the coefficient on the interaction term with household reluctance to take risk, are similar bur slightly lower when passive variation is taken out. Thus, our main results are not driven by passive variation in portfolio weights caused by investment returns over the period.

In Columns 3 and 4 of Table VII, we restrict the control group to households that buy at least one mutual fund during our sample period, so that our analysis covers only households that actively invest in risky products during that period. The coefficient of the variable $\mathbb{1}_{SP,h}$ indicates that capital guarantee investment participants increase their risky share by an additional 3.7 pp over the 2002 to 2007 period compared to mutual fund buyers that do not participate in capital guarantee investments. The coefficient is lower compared to the main model but still economically significant and increasing with household reluctance to take risk. This test suggests that the majority of the effect we document comes from households making larger purchases of CGPs than mutual funds, or funding their purchases with more bank deposits than households from the control group.

Capital guarantee investments also offer less liquidity than traditional equity products. To ensure that our results are not driven by households not being able to exit capital guarantee products, while they can exit mutual funds or stocks, we restrict our control group to households that do not fully exit an investment position during the sample period. Columns 5 and 6 provide the coefficient of our baseline specification in this setting. Once again, we observe that our results are consistent both directionally and quantitatively when implementing this robustness test.

INSERT FIGURE VII

Finally, we measure the elasticity of the adjusted risky share to the share of financial wealth invested in capital guarantee products in a panel analysis. We thus confirm that the risky share increases when households buy capital guarantee investments and that this is not, for example, that participants in capital guarantee investments have bought other products simultaneously, or that the control group has divested. We run the following specification:

$$w_{h,t} = \alpha + \beta\, \omega_{CGP,h,t} + \lambda' x_{h,t} + \gamma_h + \varepsilon_h, \tag{11}$$

where γ_h are household fixed effects and $x_{h,t}$ a vector of time-varying characteristics such as income and wealth.

Column 1 of Table VIII reports that the sensitivity of the adjusted risky share to the share of financial wealth invested in capital guarantee products is equal to 0.27. Because $\eta = 0.58$ for capital guarantee products on average, the result suggests that households fund 47% of the amount invested in capital guarantee products with bank deposits ($0.27/0.58 = 0.47$). Column 2 shows that the sensitivity is higher for households that are more reluctant to take risk.

INSERT TABLE VIII

V. Instrumental Variable Analysis

An important limitation of our baseline result is that the decision of buying capital guarantee investments is by nature endogenous. Capital guarantee investment participants might increase their adjusted risky share even if these products are not offered by banks, which would result in an upward bias in our OLS estimates. On the other hand, participants and non-participants in capital guarantee products are likely to differ along unobservable time-varying characteristics, which could also bias the OLS estimates, downwards or upwards.

These potential sources of endogeneity call for an instrumental variable analysis.

V.A. Bank Time-Varying Idiosyncratic Shocks

We use time-varying idiosyncratic shocks to the supply of capital guarantee products to instrument household investment in these products.

To measure these supply shocks separately from household demand shocks, we adapt the econometric framework of Amiti and Weinstein (2018). We first exploit identifiers for the 25 Swedish banks households deposit money in as of 2002 to identify household-bank relationships. We then split our household sample randomly into two, and measure the time-varying supply of capital guarantee investments at the bank level on the first part of the sample with the following panel specification:

$$\omega_{cpi,h,t} = \alpha + \gamma' \, \Phi_{b,t} + \lambda' \, x_{h,t} + \varepsilon_{h,t}, \tag{12}$$

where $\omega_{cpi,h,t}$ is the share of financial wealth of household h invested in CGPs in year t, and $\Phi_{b,t}$ is a matrix of bank-year fixed effects. $\gamma = (\gamma_{b,t})_{1 \leq b \leq B, 2002 \leq t \leq 2007}$ therefore measures bank-year idiosyncratic supply shocks. While we cannot control for demand using household $\times$ year fixed effects as in Amiti and Weinstein (2018) because households rarely buy the same type of products from two different banks in the same year, we control for demand of equity-linked products using a large set of household characteristics $x_{h,t}$ that include fixed effects for wealth, age and income deciles - calculated independently for each year-, as well as revealed reluctance to take risks in 2002, years of education, locality, gender and family size.

The empirical model in equation (12) can easily be understood by contemplating the standard explanations for what causes the issuance of CGP by a bank to vary. If the issuance varies because of changes in the demand for these products, we would measure that as arising from household characteristics such as income, wealth, age and revealed reluctance to take risk that we can mostly control for in our specification. Similarly, if the supply of CGP increases because of a bank access to the technology to structure CGP, we would capture that with the bank time varying fixed effects.

We then calculate households' weighted exposure to the bank idiosyncratic supply shocks on the second half of the household sample:

$$exposure_{h,t} = \sum_{b=0}^{25} share_b \times \gamma_{b,t}$$

where $share_b$ is the ratio of the household deposit in bank b over their total bank deposit, measured in 2002. We use this weighted-exposure to supply shocks as a Bartik (1991)-type, or shift-share, instrument for participating in capital guarantee products.

V.B. Panel Framework

While the orthogonality of a shift-share instrument to household characteristics might be unlikely to hold in the cross-section, as banks and households are not matched randomly, our analysis relies on a different identifying assumption. As we estimate our instrumental variable in a panel model, our identification results from quasi-random bank time-varying shocks, as in Borusyak, Hull, and Jaravel (2018), rather than from the household exposure to specific banks.[24] We estimate the following model:

$$w_{h,t} = \alpha + \beta\, \widehat{\omega_{CGP,h,t}} + \lambda' x_{h,t} + \gamma_h + \varepsilon_h,$$

where $\widehat{\omega_{CGP,h,t}}$ is instrumented by $exposure_{h,t}$.

The inclusion of household and year fixed effects implies that bank-year shocks should be correlated with time-varying household unobservable characteristics to affect the orthogonality assumption of the instrument. In addition, because we estimate the supply shocks on a distinct household sub-sample, the time-varying household characteristics that are correlated with the shocks should also be correlated across households within the same bank, after controlling for a large set of characteristics including location and location × year fixed effects. We also measure the weights on banks $share_b$ ex-ante, in 2002, to limit issues related to the shock possible serial correlation (Borusyak et al., 2018).

V.C. Results

Columns 3 to 5 of Table VIII report the results of the instrumental variable analysis. Column 3 displays the coefficients of the first stage. It confirms that a higher supply intensity of capital guarantee products from a given bank significantly increases the amount invested in capital guarantee investments for households in a relationship with this bank, even when controlling for detailed

[24]Goldsmith-Pinkham, Sorkin, and Swift (2019) provides a discussion of the validity of the identification strategy we use in a similar context.

household characteristics. The instrumental variable analysis is estimated on half of the sample, the other half having been used to estimate the supply intensity $exposure_{h,t}$. The F-statistics of 395 is significantly above the threshold for strong instruments (Stock and Yogo, 2005).

Columns 4 and 5 provide the coefficients of the two-stage least square estimates. The positive and significant coefficient on the instrumented quantity of CGPs confirms our central result and strengthens its causal interpretation: offering CGPs is associated with a significant increase in the adjusted risky share of households. The larger magnitude of the coefficient in the instrumented specification suggests that sources of endogeneity are biasing our results downwards: households participating in capital guarantee investments would have actually reduced their risky share in the absence of these products. In column 5, we interact the instrumented share of wealth invested in CGP with the measure of revealed reluctance to take risk. We find that the positive change in adjusted risky share is increasing with households reluctance to take risk, which provides for a causal interpretation of the cross-sectional result from the previous section.

INSERT TABLE VIII

VI. Can Economic Theory Explain the Impact of Capital Guarantee Products on Household Risk-Taking?

This section investigates the theoretical mechanisms that can explain the impact on household portfolios of the introduction of capital guarantee investments we observe in our data. To answer this question, we develop in Section VI.A a lifecycle model with capital guarantee products. Section VI.B considers explanations based on preferences, including narrow framing and loss aversion. We then investigate in Section VI.C the role of subjective beliefs.

VI.A. A Lifecycle Model with Capital Guarantee Products

We extend the lifecycle model of Cocco Gomes and Maenhout (2005) to the case of structured products. The framework incorporates both the nonlinear payoffs and illiquidity of these contracts.

We consider an agent living at dates $t = 1, ...T$. Every period, she receives a stochastic labor income Y_t and can consume and trade financial assets. The labor income process is defined as in Cocco, Gomes and Maenhout (2005). Let RA denote the retirement age. Before retirement ($t \leq RA$), labor income is the product of a permanent component, Y_t^P, and a transitory component, Y_t^H:

$$Y_t = Y_t^P \; Y_t^H.$$

The permanent component is specified by $Y_t^P = e^{f(t;Z_t)+\nu_t}$, where $f(t; Z_t)$ is a deterministic fixed effect and ν_t follows a random walk: $\nu_{t+1} - \nu_t \sim \mathcal{N}(0, \sigma_u^2)$. The transitory component of income is given by $Y_t^H = e^{\varepsilon_t}$. After retirement ($t > RA$), retirement income is $Y_t = \lambda \; Y_{RA}^P$, where λ is a replacement ratio.

The agent can trade a riskless asset, a stock, and structured products of staggered maturities. All structured products are identical except for the issue and maturity dates. Every period t, the agent can invest in a structured product issued at date t and maturing at date $t + M$. The investment cannot be accessed before the maturity date. We denote by $1 + R_{g,t+M}$ the gross return on the guaranteed product between t and $t + M$.

We assume for simplicity that the agent can hold at most one type of structured product at a given point in time. Her position at the beginning of period t can therefore be described by the following state vector

$$(X_t, K_t, CR_t, \tau_t),$$

where X_t denotes cash on hand, defined as the sum of labor income and the value of holdings of the riskless asset, stocks, and structured products reaching maturity at the beginning of period t, K_t denotes the illiquid capital previously invested in a structured product, CR_t, denotes the gross cumulative return of the benchmark since the contract's origination. By definition, $\tau_t = 0$ if the contract matures at t or if the agent does not hold a structured product at date $t - 1$. The cumulative return excludes dividends.

The control variables at t are (i) consumption, C_t, (ii) investment in the illiquid product issued at t, I_t, and (iii) the share of liquid wealth invested in the stock, α_t. We impose the constraint $I_t = 0$ whenever $\tau_t > 0$, so that the agent only invests in one type of structured contract.

We now provide the laws of motion driving wealth accumulation.[25] Cash on hand at the

[25] To simplify the exposition, we present the wealth dynamics under the assumption that the maturity of structured products exceeds 1 time period: $M > 1$. We refer the reader to the appendix for the version of the model corresponding to $M = 1$.

beginning of period $t+1$ is given by

$$X_{t+1} = Y_{t+1} + (X_t - I_t - C_t)\left[1 + R_f + \alpha_t(R_{m,t+1} - R_f)\right] + (1 + R_{g,t+1})K_t \mathbb{1}_{\{\tau_t = 1\}},$$

where R_f denotes the riskless rate and $R_{m,t+1}$ the net return on the stock.

We now turn to the dynamics of the other state variables. If $\tau_t = 0$, the household has the possibility of investing in a capital guarantee contract. If the household does not take advantage of this opportunity, the capital invested in the capital protected product is $K_{t+1} = I_t = 0$ and the state variable τ_{t+1} is 0 next period. If instead the investor purchases the capital guarantee product ($I_t > 0$), the capital invested in the guaranteed product is $K_{i,t+1} = I_{i,t}$, the cumulative return of the benchmark is $CR_{i,t+1} = e^{-q}(1 + R_{m,t+1})$, and the maturity of the illiquid investment is $\tau_{i,t+1} = M - 1$ next period. Note that the value of the illiquid contract is not updated at intermediate dates, which entails no loss of generality in the present model.

If $\tau_t > 0$, the agent cannot modify her position in the structured product, so that $\tau_{t+1} = \tau_t - 1$. We consider two subcases. If $\tau_t \geq 2$, investments in the CGP remain illiquid next period. The capital stock is therefore $K_{t+1} = K_t$ and the cumulative return is $CR_{t+1} = e^{-q}\,(1 + R_{m,t+1})\,CR_t$ next period. By contrast, if $\tau_t = 1$, investments in the capital guarantee product become available next period, so that $K_{t+1} = 0$. We derive the conditional distribution of $(R_{m,t+1}, R^*_{t+1})$ conditional on the cumulative return CR_t in the Online Appendix.

VI.B. The Role of Preferences

The agent has recursive utility over consumption streams:

$$V_t = \left[(1-\delta)\, C_t^{1-1/\psi} + \delta p_t \left(\mu_{t+1}\right)^{1-1/\psi}\right]^{\frac{1}{1-1/\psi}} \tag{13}$$

where $t = 1, ..., T-1$, p_t is the probability that the agent is alive at $t+1$ conditional on being alive at date t, and $\mu_{i,t+1}$ is the certainty equivalent of future consumption, which is defined below. We rule out the bequest motive, so that $V_T = (1-\delta)^{1/(1-1/\psi)}\, C_T$ at the terminal date. We consider several specifications of preferences.

First, the specification $\mu_{t+1} = [\mathbb{E}(V_{t+1}^{1-\gamma})]^{1/(1-\gamma)}$, which corresponds to the utility of Epstein and

Zin. The corresponding framework nests the lifecyle model of (Cocco et al., 2005) when agents can only trade the riskless asset and the stock, and the chosen utility function is expected utility.

Second, we consider the recursive specification with narrow framing developed by Barberis and Huang (2009):

$$\mu_{t+1} = \left[\mathbb{E}_t(V_{t+1}^{1-\gamma})\right]^{\frac{1}{1-\gamma}} + b_0 \mathbb{E}_t v(W_{t+1} - W_t)$$

where

$$v(x) = \begin{cases} x & \text{if } x \geq 0, \\ \lambda x & \text{if } x \leq 0, \end{cases}$$

and $\lambda \geq 1$ is a kink parameter.

We solve the model numerically for all preference specifications. We consider a contract with the median 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%, and an Asian option of a length of 4 years. These inputs translate into a p, the percentage of index performance the investor receives through the capital guarantee investment, 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 capital guarantee investment, 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.

Among the set of utility specifications we consider, only *Narrow framing with loss aversion* (Barberis and Huang 2009) can match the three empirical facts we aim for: high demand for capital protection, increase in the adjusted risky share, and heterogeneity of the effect along household initial reluctance to take risk. In Figure 7, we plot as illustration the demand for capital guarantee products over the life-cycle in panel A, as well as the increase in risk-taking as a function of the initial willingness to take risk in panel B.

INSERT FIGURE 7

While these findings show that Barberis and Huang preferences are broadly consistent with the data, one would like to know which features of these preferences are important to explain the increase in the adjusted risky share triggered by CGPs. In particular, one would like to better understand the role of loss aversion. For this reason, we consider a preference specification that does not incorporate loss aversion but includes narrow framing:

$$\mu_{i,t+1} = \left[\mathbb{E}_t(V_{t+1}^{1-\gamma})\right]^{\frac{1}{1-\gamma}} + b_0 \left[CE_t(W_{t+1}) - W_t\right],$$

where $CE_t(W_{t+1}) = [\mathbb{E}_t(W_{t+1}^{1-\gamma})]^{\frac{1}{1-\gamma}}$. In the Online Appendix, we report that financial innovation does not trigger an increase in the adjusted risky share under this specification.

Similarly, we consider generalized disappointment aversion, a recursive specification that includes loss aversion but does not take narrow framing into account.[26] We verify in the Online Appendix that generalized disappointment aversion does not explain the increase in the adjusted risky share exhibited by households initially reluctant to take risk. While this analysis is of course not exhaustive, it suggests that the combination of loss aversion and narrow framing is important to explain the main empirical fact dcumented in earlier sections.

VI.C. The Role of Subjective Beliefs

We next investigate the role of pessimistic subjective beliefs over the payoff distribution of the risky asset. The empirical evidence suggests that some households find the stockmarket unattractive due to a distribution that is less favorable than the physical measure $\mathbb{P}$. Probability weighting is one of the key building blocks of prospect theory and can be a key driver of financial decisions. Similarly, Shiller documents that a substantial fraction of households anticipate a crash of XX% with probability XX%. A capital guarantee product may then increase risk-taking because it can mitigate concerns about stockmarket index returns. Of course other households may be irrationally exuberant about stockmarket investing, but these households likely have a high risky share and are unlikely to drive the demand for capital guarantee products.

We consider the probability weighting approach of (Prelec, 1998). Let $F(r)$ denote the cumulative distribution function of the yearly log return on the stockmarket index, $r_{m,t}$, under the physical probability measure $\mathbb{P}$. The subjective belief is specified by the subjective cumulative distribution

[26]The certainty equivalent μ_{t+1} is implicitly defined by:

$$(\mu_{t+1})^{1-\gamma} = \mathbb{E}(V_{t+1}^{1-\gamma}) + (\lambda - 1)\mathbb{E}\left\{\left[V_{t+1}^{1-\gamma} - (\kappa\mu_{t+1})^{1-\gamma}\right] 1_{\{V_{t+1} < \kappa\mu_{t+1}\}}\right\},$$

where $\lambda \geq 1$ is a kink parameter and κ controls the disappointment threshold. This specification coincides with Gul's (1991) disappointment aversion if $\kappa = 1$.

function:

$$F(r) = \exp\{-b\,[-\ln F(r)]^a\},$$

where a and b are strictly positive constants.

In Figure 8, we report the results of the lifecycle model when the agent has Epstein-Zin utility and the Prelec probability weighting. We set $a = 0.5$ and let b vary from 0.6 to 1.3. We observe that the model generates an increase in the adjusted risky share. Introducing subjective beliefs for an Epstein-Zin agent also allows to match our empirical facts.

INSERT FIGURE 8

In the Online Appendix, we show that our results are qualitatively robust to alternative specifications of pessimistic subjective beliefs. For instance, we consider a subjective probability distribution that is a mixture of the physical measure $\mathbb{P}$ and a crash. Consistent with Shiller, the crash is -50% with a probability varying between 0 and 0.6. Alternatively, we consider that the household consider that the volatility of the index exceeds the volatility level under $\mathbb{P}$, while the mean return is the same under the subjective and physical distribution. We verify that both approaches also explain the increase of the adjusted risky share triggered by capital guaranteed product. Thus, the results of Figure 8 are strongly robust to alternative specifications.

Overall, the results of the section show that the increase in risk-taking documented in Sections IV and V is consistent with a lifecycle model of consumption and portfolio choice. The canonical Epstein-Zin model with rational expectations does not deliver this result because the stock is an attractive product in such an environment. The increase in risk-taking is consistent, however, with preferences combining loss aversion and narrow framing (Barberis and Huang, 2009), or with pessimistic subjective beliefs, specified for instance by probability weighting (Prelec, 1998), subjective disaster risk, or volatility misperception.

VII. Welfare Implications

We then explore whether the increase in risk-taking translate into a higher *experienced* utility for the agent. Figure **??** plots experienced utility with and without including capital guarantee products in the investment set of the agent, as a function of the initial willingness to take risk.

INSERT FIGURE ??

These figures document a sizable gain associated with the introduction of capital guarantee products for the majority of households in both settings. Interestingly, households that were initially already taking a significant amount of risk before the introduction end up being worst off, as they substitute their equity products with capital guarantee products, thereby slightly reducing their risk exposure.

We then estimate that incorporating fees at the level we empirically observe represents around a third of the created surplus between the households and the banks. The sizable share allocated to banks naturally raises the question of why are households not implementing capital protection themselves, for instance by purchasing put options or by dynamically rebalancing their portfolios to obtain portfolio insurance. Both these actions however require a high level of sophistication, which most households do not possess. The effort required to implement these investment strategies is also not trivial, particularly for the portfolio insurance. The profit for the bank could be also driven down by competition or a regulatory cap.

VIII. Conclusion

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

The micro-evidence in this paper suggests that the introduction of retail capital guarantee investments increases significantly financial risk taking. Both empirical and theoretical evidence is most consistent with these innovative products being successful at alleviating household reluctance to take risk.

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Figures and Tables

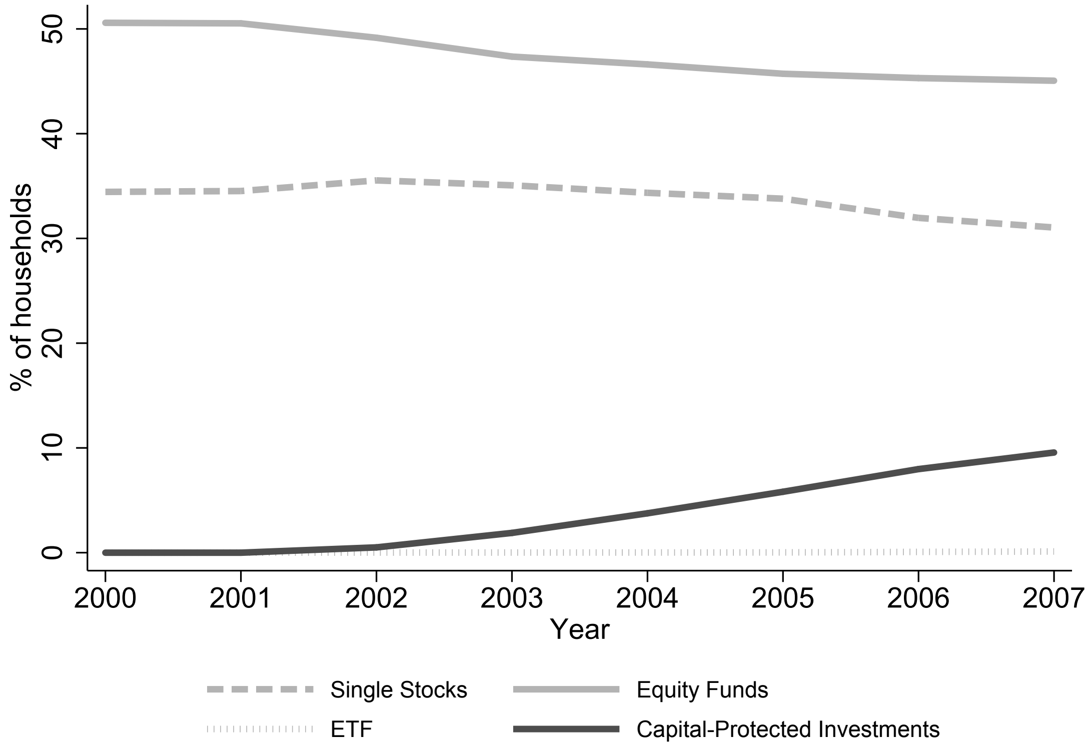
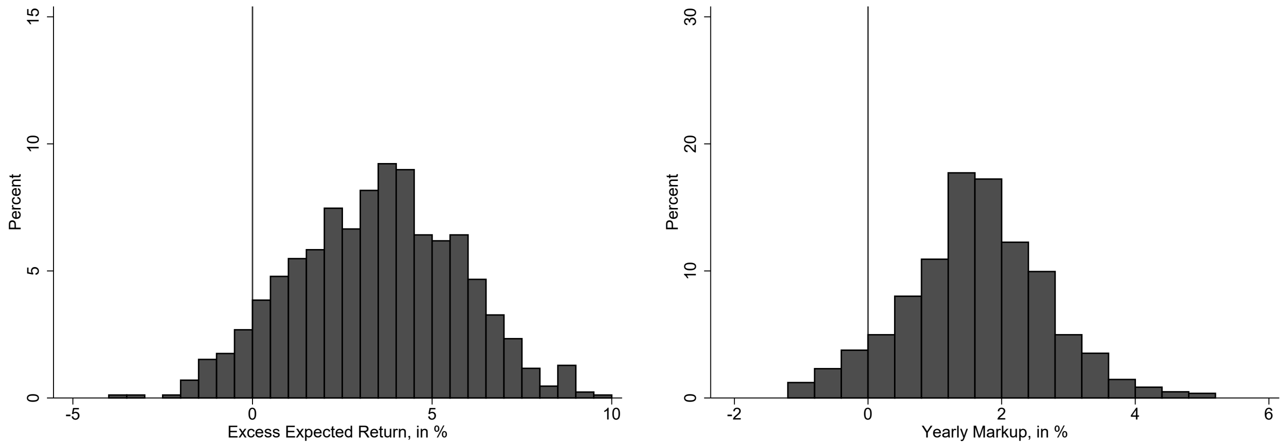


Figure 1. Adoption of Capital Guarantee Products in Sweden (2000-2007): Fraction of Households Participating in Capital Gaurantee Products, Stocks, and Equity Funds The figure shows the evolution of the share of Swedish households investing in equity markets through capital guarantee products (dark grey line), equity funds (grey line), single stocks (dashed line), and ETFs (dot line). Swedish banks started distributing retail capital guarantee products in 2000, the beginning of our sample period.

Panel A. Capital Guarantee Products



Panel B. Mutual Funds

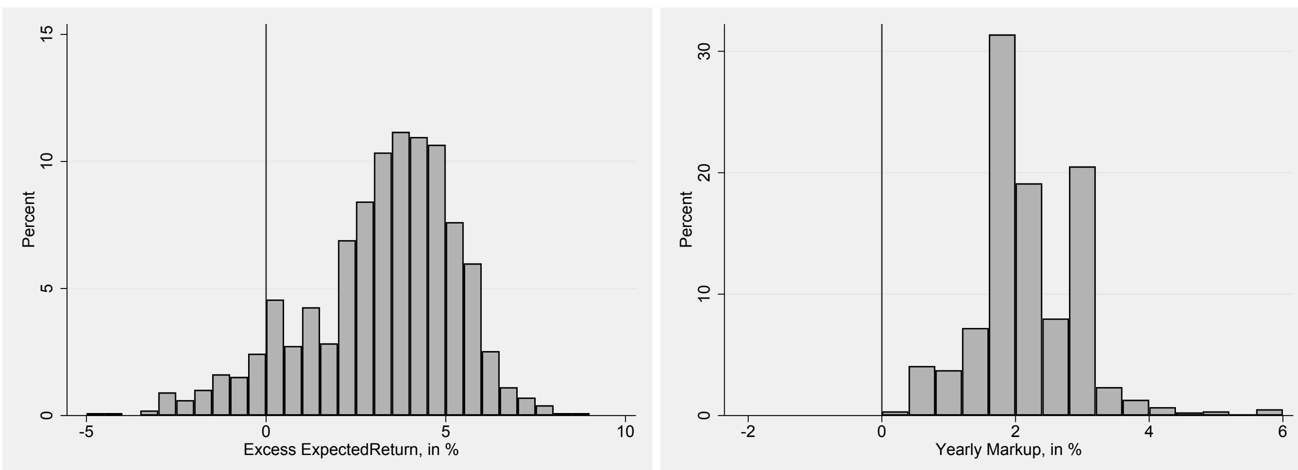


Figure 2. Histogram of the Excess Expected Return and Yearly Mark-up of Capital Guarantee Products and Mutual Funds. This figure shows the histogram of the excess expected returns offered by the representative capital guarantee products in our sample (858 products issued from 2002 to 2007) and all the standard equity funds, as well as the mark-up of the banks distributing them.

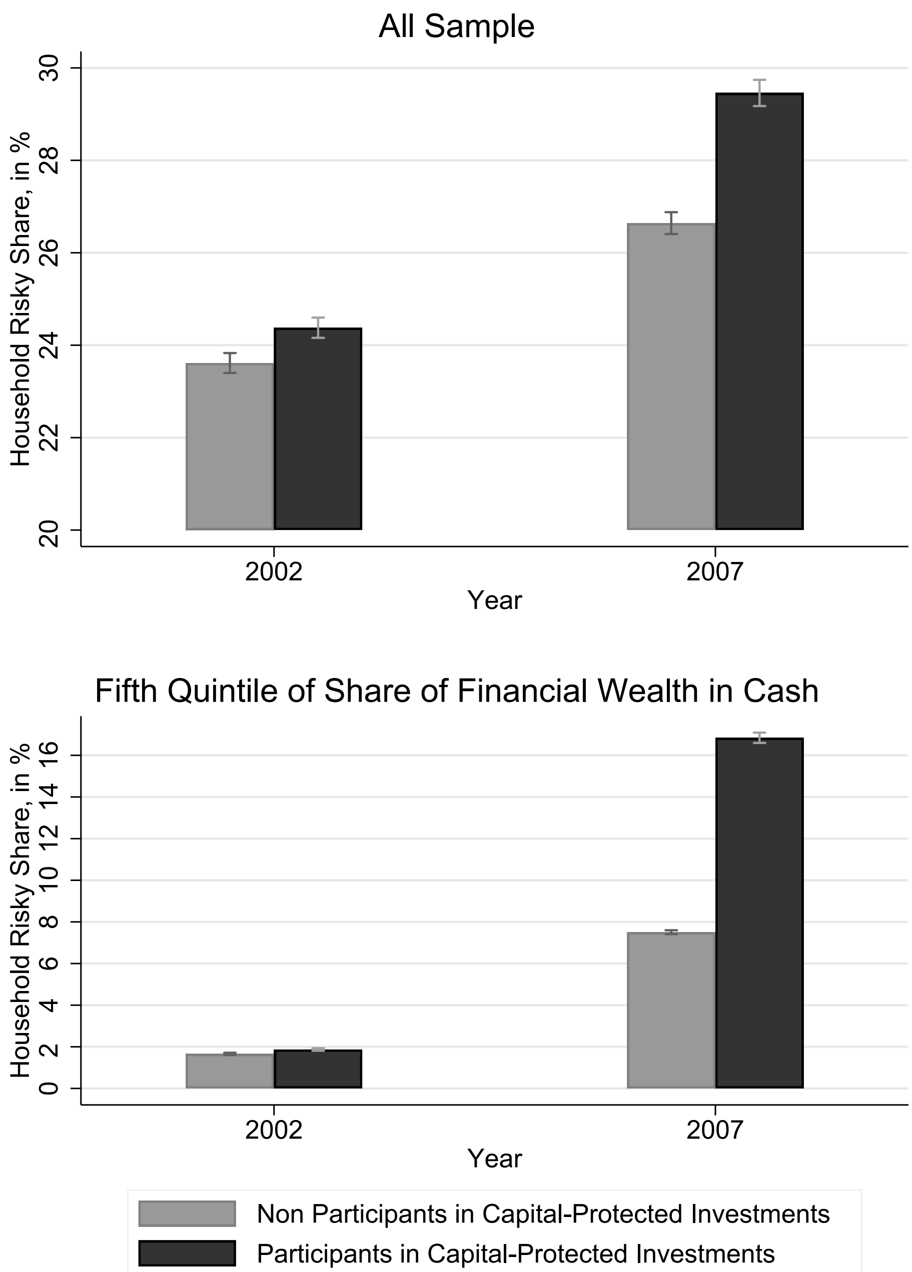


Figure 3. Household Risky Share in 2002 and 2007: Participants versus non-Participants. The upper part of this figure shows the estimated risky share for capital guarantee product participants versus equity fund or stock participants (that do not participate in capital guarantee investments) in 2002 and 2007. The lower part of the figure reproduces the same graph when restricting the sample to households in the fifth quintile of cash share of financial wealth in 2002.

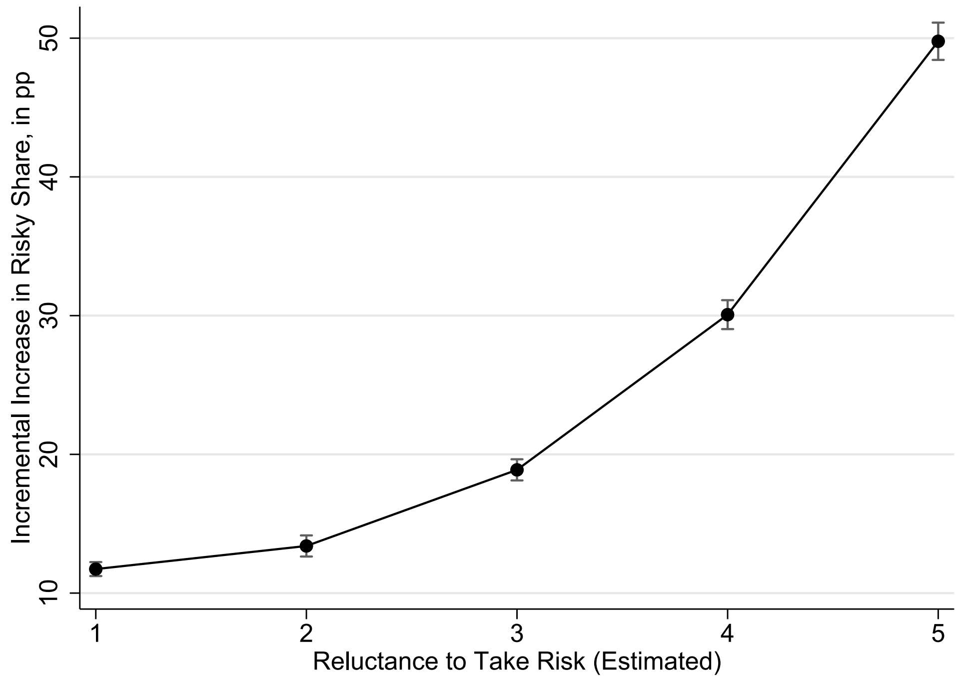


Figure 4. Incremental change in the risky share over the 2002 to 2007 period for participants in capital guarantee investments across reluctance to take risk (estimated). This figure shows the incremental change in the risky share, in pp, over the 2002 to 2007 period for 2007 capital guarantee investment participants versus equity fund or stock participants (that do not participate in capital guarantee investments), broken down by reluctance to take risk, as inferred in the data.

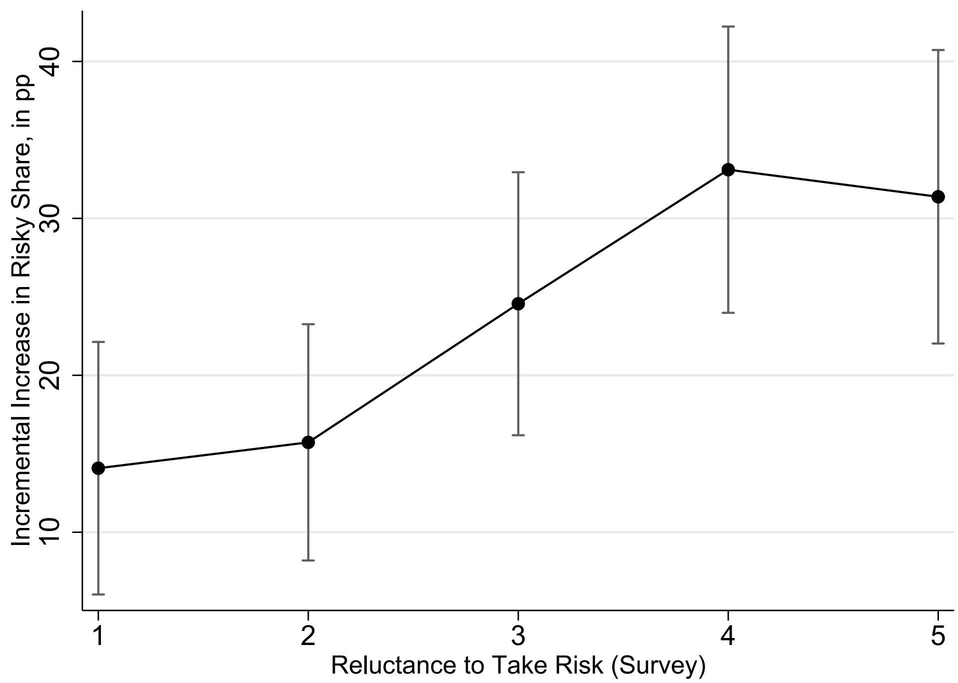


Figure 5. Incremental change in the risky share over the 2002 to 2007 period for participants in capital guarantee investments across reluctance to take risk (elicited). This figure shows the incremental change in the risky share, in pp, over the 2002 to 2007 period for 2007 capital guarantee investment participants versus equity fund or stock participants (that do not participate in capital guarantee investments), broken down by reluctance to take risk, as elicited in the survey.

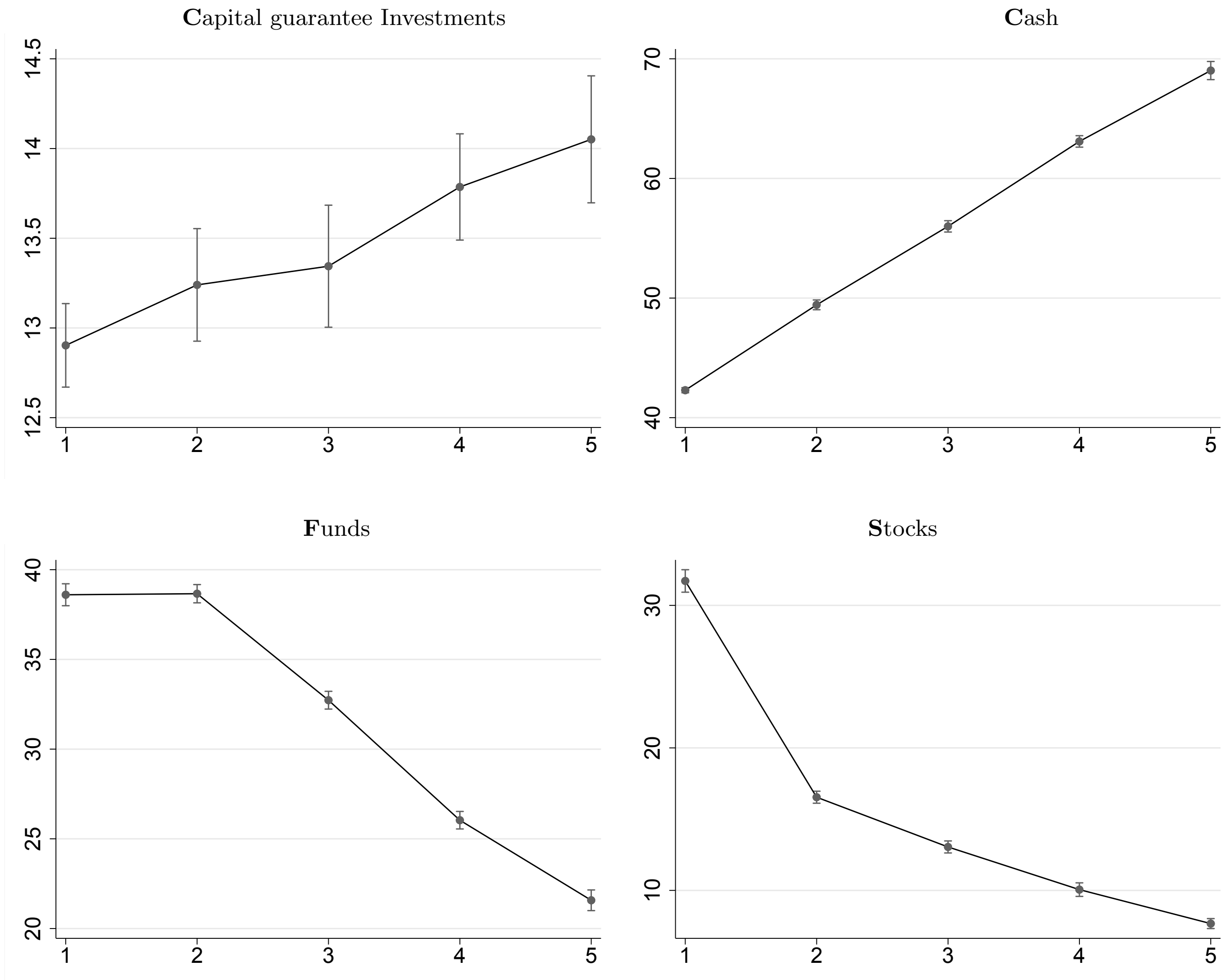


Figure 6. Portfolio Composition: Share of Financial Wealth Invested in Capital Guarantee Investments, Equity Funds, Stocks and Cash across Household Reluctance to Take Risk. This figure displays the estimated share of financial wealth invested capital guarantee products, cash, funds and stocks as of end of 2007. The sample is restricted to participants in each asset category.

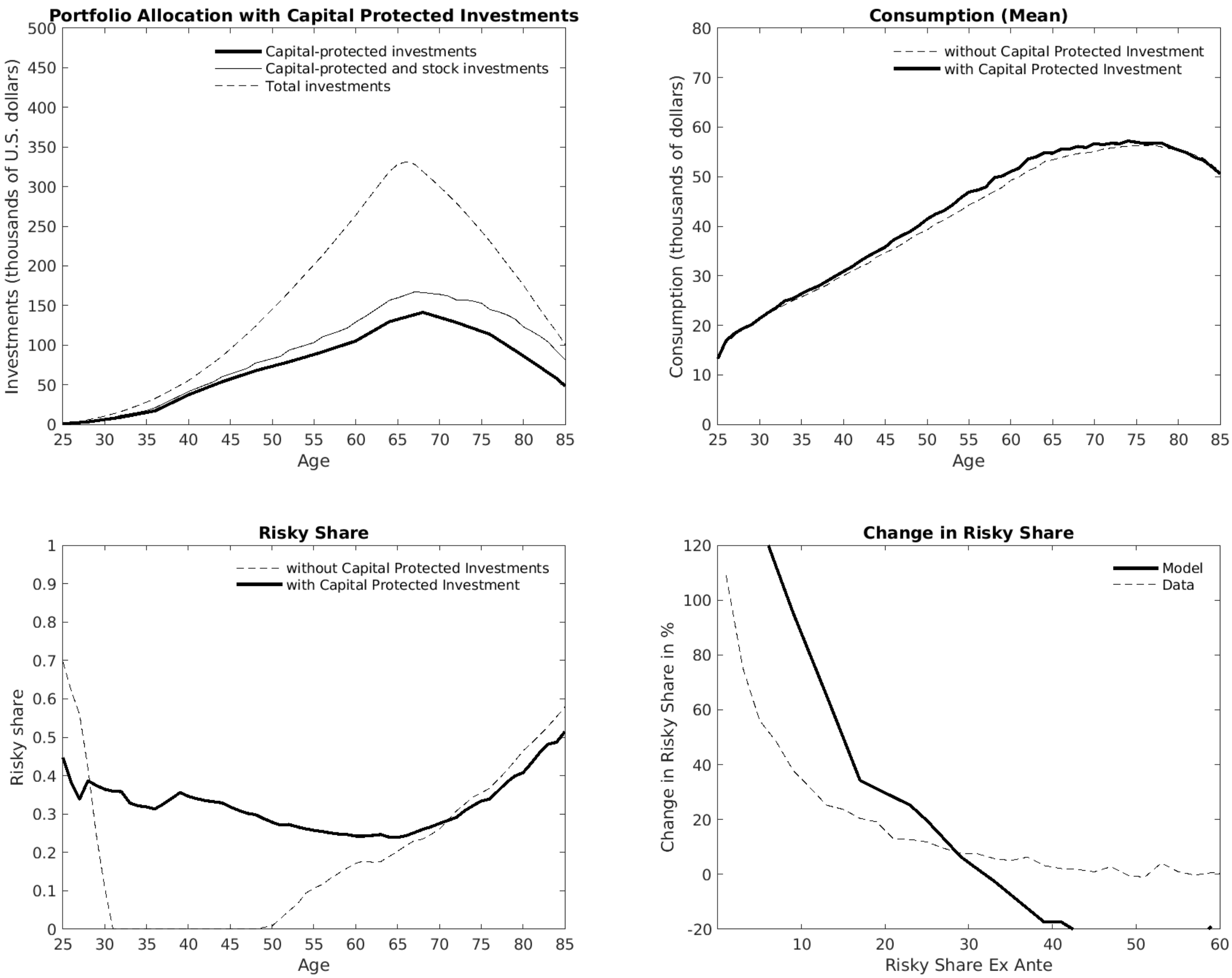


Figure 7. Portfolio Allocation, Change in Risk-taking and Consumption in a Life Cycle Model with Loss Aversion and Narrow Framing This figure displays the output of a lifecycle model with loss aversion coupled with narrow framing. The individual has a Barberis and Huang (2009)'s utility function with the following parameter $b_0 = 0.05$, $\lambda = 3.5$, $\gamma = 4$ and $\psi = 0.5$ and a risky share of 8% before the introduction of the capital gaurantee product.

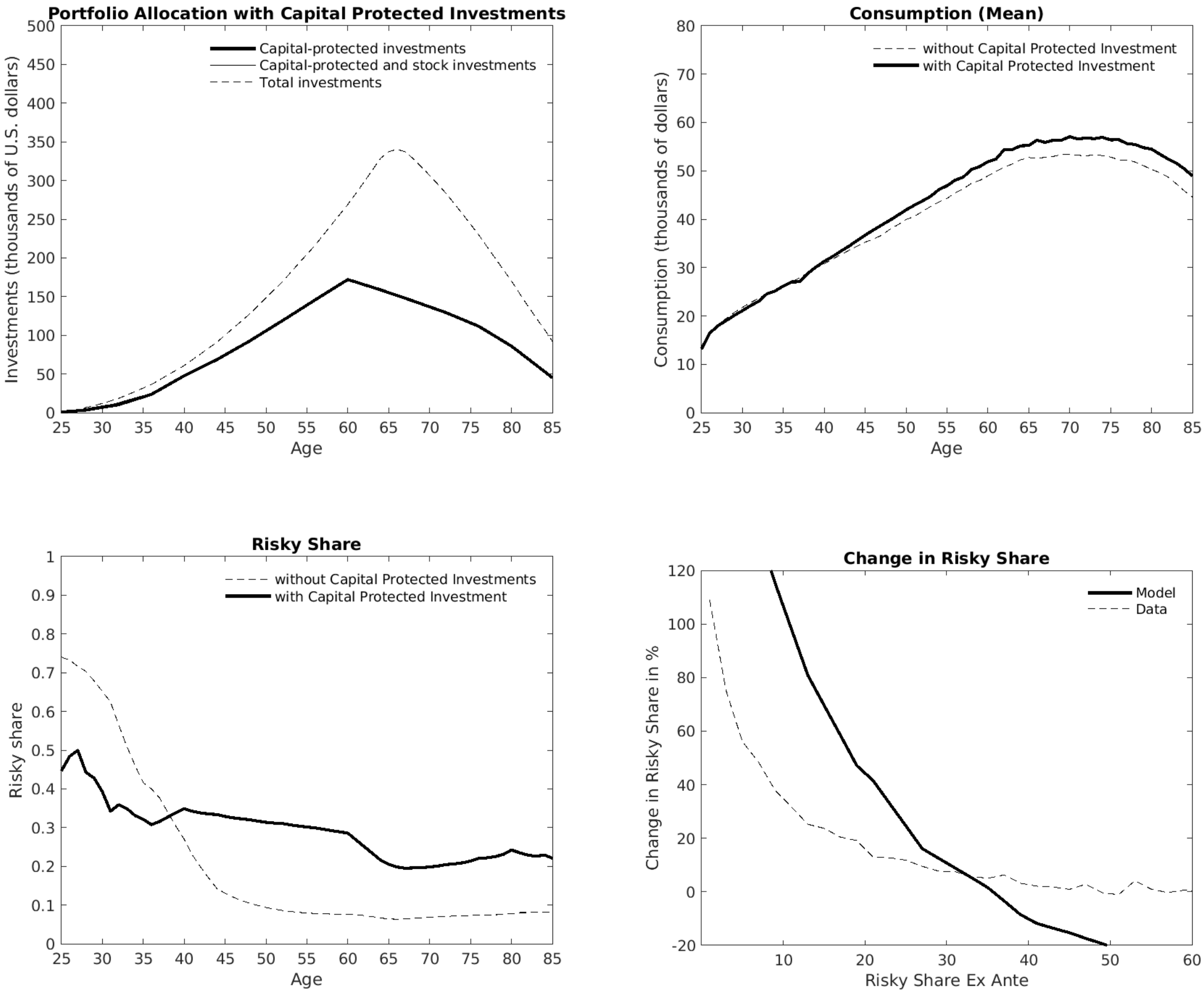
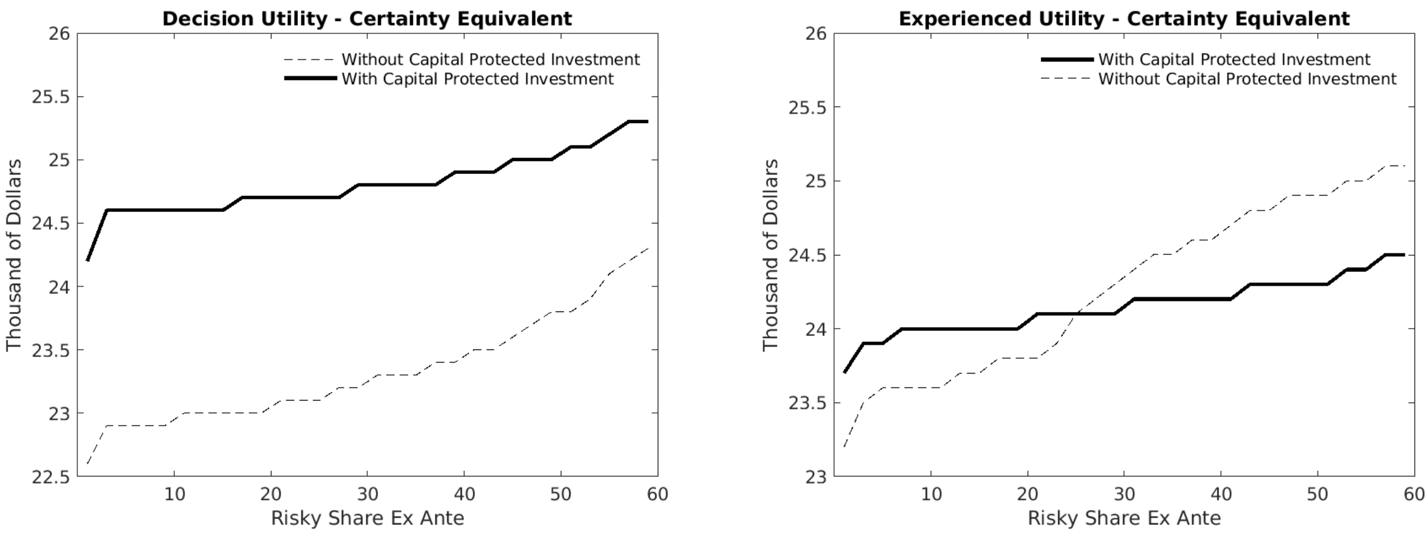


Figure 8. Portfolio Allocation, Change in risk-taking and Consumption in a Life Cycle Model with Probability Weighting (Prelec, 1998) This figure displays the output of a lifecycle model with probability weighting. In the first three figures, the individual has a Prelec (1998)'s utility function with the following parameter: $a = 0.5$, $b = 0.72$, $\gamma = 4$ and $\psi = 0.5$ and a risky share of 8% before the introduction of the capital gaurantee product. The last figure plots the % impact of capital guarantee across individuals with a risky share ex-ante from 0% to 50%, corresponding to value of b from 0.6 to 1.1.

Panel A. Loss Aversion with Narrow Framing (Barberis and Huang, 2001)



Panel B. Probability Weighting (Prelec (1998) weighting function)

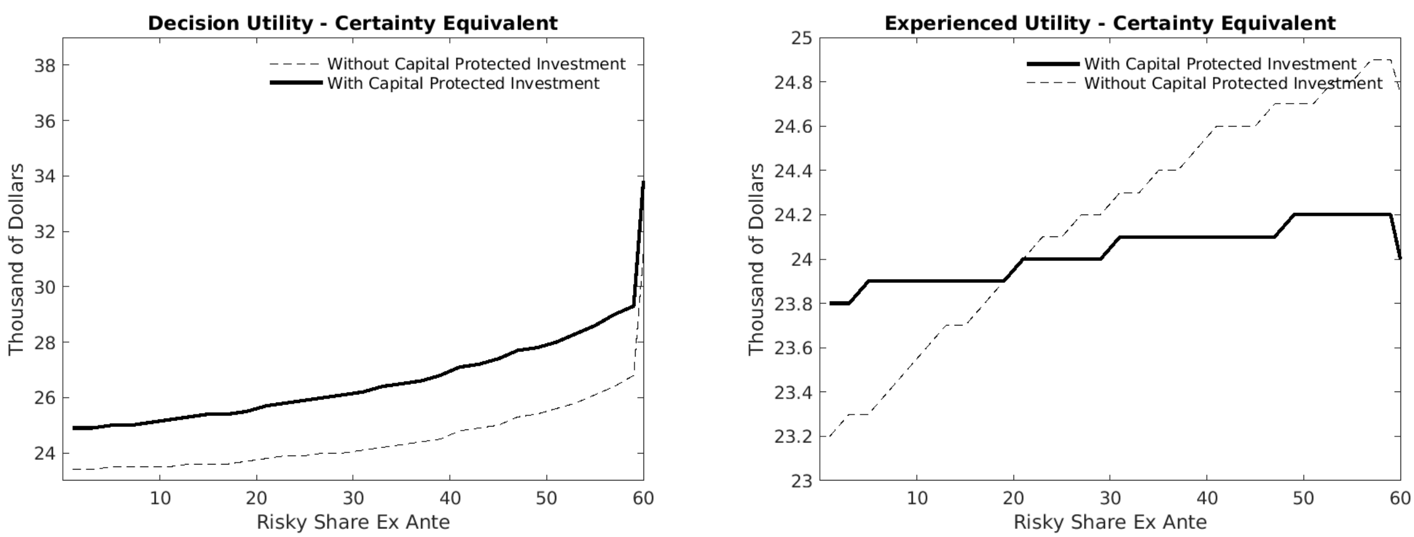


Figure 9. Household Decision and Experienced Utility with and without Capital Guarantee Investments

Table I. Capital Guarantee Investments Around the World

Product Type	**Country**	**2015 Outstanding Volumes $USD**	**Reference**	**Structure**
Structured Products with Capital Guarantee	Europe	300 bn	ESMA	Synthetic
Structured Certificate of Deposits	USA	25 bn		Synthetic
Guaranteed Life Annuities	USA	1.72tn	Ellul et al (2019)	Synthetic / Reserves
Market-linked Guaranteed Investment Certificates	Canada	CAD 100bn	(estimated)	
Euro Contracts	France	1.4tn	Hombert and Lyonnet (2019)	Reserves
Principal Protected Notes	US	400bn		Synthetic
Principal Protected Notes	Canada	30bn		Synthetic
Chinese Structured Deposits	China	1.8 tn		Synthetic
Uridashi Structured Bonds	Japan	tbd		
Autocallable Notes	South Korea	93.2 bn		

Volumes of capital guarantee products around the world. 3% of total personal financial wealth invested in products with a capital guarantee

Table II. Household Risk-Taking Across Countries in 2015

Country	Percent of Aggregate Financial Wealth Invested in Equity	Percent of the Population that Participates	Median Percent of Financial Wealth Invested in Equity for Equity Participants
Austria	27.48%	13.29%	24.76%
Belgium	38.28%	28.59%	35.73%
Croatia	n/a	4.28%	64.36%
Czech Republic	22.93%	9.25%	30.00%
Denmark	34.05%	37.52%	44.71%
Estonia	56.45%	4.41%	42.31 %
France	22.35%	17.52%	21.74%
Germany	11.09%	21.24%	27.54%
Greece	20.87%	2.10%	20.00%
Italy	32.14%	8.03%	30.00%
Luxembourg	32.06%	22.68%	20.00%
Poland	27.78%	1.89%	35.42%
Portugal	20.75%	6.46%	40.91%
Slovenia	25.93%	8.47%	37.65%
Spain	32.38%	4.82%	39.15%
Sweden	41.20%	57.72%	44.74%
EU	25.05%	15.9%	37.5%
United Kingdom	10.96%	25.70%	7.06%
United States	35.21%	51.88%	40.00%
China	n/a	10.08%	19.88%

Sources: Survey of Health, Ageing and Retirement in Europe (SHARE), OECD National Accounts Data, European Central Bank Data, English Longitudinal Study of Ageing (ELSA), Survey of Consumer Finances, and the China Household Finance Survey (CHFS). Note that statistics for the Netherlands and the US are for 2013 and 2016, respectively.
Switzerland has a participation rate of 36.56% and a median percent of financial wealth invested in equity, among equity participants, of 35.71%.
Israel has a percent of aggregate financial wealth invested in equity of 22.44%, a participation rate of 13.24%, and a median percent of financial wealth invested in equity, among equity participants, of 41.30%.

Table III. Product Design, Markups and Expected Returns - Summary Statistics

Panel A: Total Sample of capital guarantee products (1,511 contracts)

	Mean	**p1**	**p10**	**p50**	**p90**	**p99**
Issuance year	2006	2002	2004	2006	2007	2007
Volume ($ million)	5.2	0.1	0.5	2.6	13.0	29.1
Design Parameters:						
- Term (months)	40.1	12.0	17.9	37.6	60.5	72.5
- Capital guarantee (%)	100.2	100.0	100.0	100.0	100.0	108.0
- Initial fee (%)	7.0	0.0	1.0	6.0	12.0	22.0

Panel B: Representative capital guarantee products (858 contracts)

	Mean	**p1**	**p10**	**p50**	**p90**	**p99**
Issuance year	2006	2002	2004	2006	2007	2007
Volume ($ million)	4.9	0.0	0.4	2.9	12.1	27.5
Design Parameters:						
- Term (months)	44.2	12.5	24.5	48.0	60.5	72.5
- Capital guarantee (%)	100.2	100.0	100.0	100.0	100.0	108.0
- Initial fee (%)	8.5	0.0	1.0	11.0	13.0	22.0
- Participation rate (%)	114.6	30.0	64.0	110.0	160.0	220.0
- Asian option length (months)	14.5	0.0	4.0	13.0	36.0	60.0
Asset Pricing Inputs:						
- Historical volatility	0.2	0.1	0.1	0.2	0.3	0.4
- Dividend Yields (%)	2.0	0.0	0.5	2.1	3.0	4.5
- CDS premium (%)	0.2	0.08	0.11	0.15	0.32	0.49
Asset Pricing Outputs:						
- Beta to world index	1.1	0.5	0.9	1.1	1.3	1.4
- Yearly markup (%)	1.6	-1.7	0.0	1.6	3.0	6.1
- Yearly excess expected return (%)	3.5	-1.6	0.4	3.5	6.3	8.9
- η (%)	57.6	-26.1	6.7	59.1	104.5	148.4

Panel C: Standard Equity Funds (1,430 funds)

	Mean	**p1**	**p10**	**p50**	**p90**	**p99**
Volume in 2007 ($ million)	29.4	0.0	0.0	0.6	41.7	730
Asset Pricing Outputs:						
- Beta to world index (%)	0.9	0.0	0.4	1.0	1.3	1.5
- Yearly markup (%)	2.2	0.5	1.4	2.0	3.0	4.6
- Yearly excess expected return (%)	3.2	-2.7	0.1	3.6	5.6	7.3
- η (%)	55.3	0.0	0.0	59.6	93.0	122.2

Panel A of this table reports summary statistics of the issuances of retail capital guarantee investments 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 pays above the principal at issuance, in % of principal. Panel B displays summary statistics for the sample of representative products and the output from the expected returns and markup calculations from Section 3. *Participation Rate* represent 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. *Yearly Excess Expected Return* represents the annualized expected return of the capital guarantee investment over the maturity of the product, minus the risk-free rate for the same period (Swedish treasury rate). η corresponds to the *Yearly Excess Expected Return* divided by the World index market premium assumed for the calculation of the expected return (6%). *Yearly Markup* corresponds to the difference between the issuance price of the product 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. Panel C of this table reports summary statistics of all the equity funds available in Sweden between 2002 and 2007. We obtain the beta of the fund by applying the World CAPM over the longest time-series available of the fund returns. *Yearly Markup* corresponds to the sum of the fees paid by retail investors (management plus entry fees) when investing in the fund. *Yearly Excess Expected Return* represents the fund beta that we apply to a risk premium of 6% to which we substract *Yearly Markup*. η corresponds to the *Yearly Excess Expected Return* divided by the 6% World index market premium assumed for the calculation of the expected return.

Table IV. Household Demographics, Financial Characteristics and Portfolio Allocation at the Start (2002) and End (2007) of the Sample Period: Summary Statistics

Sample	All (1) N= 3,112,214				Traditional Equity Product Participants (2) N=2,132,264, 68.5%				Capital Guarantee Investment Participants (3) N= 427,980, 13.8%			
	Mean	Median	p10	p90	Mean	Median	p10	p90	Mean	Median	p10	p90
					Panel A. 2002							
Financial characteristics (in 2000 $, thousands):												
Financial Wealth	33.8	11.3	2.5	73.0	45.0	17.8	4.6	93.0	73.0	38.1	8.1	149.7
Cash	14.7	6.8	2.1	31.8	17.5	8.3	2.8	37.5	26.8	13.0	3.7	57.7
Traditional Equity Products	15.7	1.4	0.0	30.5	22.9	4.7	0.3	44.0	37.0	12.4	0.4	80.9
Stocks	7.1	0.0	0.0	6.4	10.4	0.3	0.0	11.2	13.5	0.9	0.0	22.4
Equity Funds	8.1	0.6	0.0	19.9	11.9	2.8	0.0	28.8	22.2	7.9	0.0	54.6
Other Financial Wealth	2.7	0.0	0.0	6.9	3.6	0.0	0.0	10.2	7.3	0.0	0.0	20.2
Fixed Income Funds	1.0	0.0	0.0	0.4	1.3	0.0	0.0	1.8	2.6	0.0	0.0	6.9
Bonds	1.6	0.0	0.0	3.0	2.2	0.0	0.0	5.1	4.4	0.0	0.0	12.0
Real Estate Wealth	82.4	41.8	0.0	205.0	105.9	66.8	0.0	240.0	132.8	87.0	0.0	279.7
Total Wealth	116.3	65.1	3.1	263.6	150.9	97.4	7.9	311.2	205.8	141.5	26.6	397.6
Total Debt	33.3	11.1	0.0	88.8	40.7	18.3	0.0	102.5	36.8	13.7	0.0	91.9
Demographics												
Household Head Age	53.1	52.0	33.0	76.0	52.0	52.0	32.0	73.0	55.1	56.0	37.0	72.0
IQ Score	5.2	5.0	3.0	8.0	5.3	5.0	3.0	8.0	5.4	5.0	3.0	8.0
Reluctance to Take Fin. Risk	3.0	3.0	1.0	5.0	2.9	3.0	1.0	5.0	2.8	3.0	1.0	5.0
Family Size	2.1	2.0	1.0	4.0	2.3	2.0	1.0	4.0	2.2	2.0	1.0	4.0
Number of Children	0.2	0.0	0.0	1.0	0.2	0.0	0.0	1.0	0.2	0.0	0.0	1.0
Stockholm Area, in %	18.9	0.0	0.0	100.0	17.5	0.0	0.0	100.0	16.9	0.0	0.0	100.0
Years of Schooling	11.4	11.0	8.0	15.0	11.8	11.0	8.0	15.0	11.9	12.0	8.0	16.0
Household Head Male, in %	60.0	100.0	0.0	100.0	63.5	100.0	0.0	100.0	62.9	100.0	0.0	100.0
Disposable Income (in 2000$)	27.5	22.8	10.5	48.0	31.5	28.0	12.3	52.0	35.3	30.9	14.2	57.0
% Households that participate in												
Traditional Equity Products	68.5	100.0	0.0	100.0	100.0	100.0	100.0	100.0	92.9	100.0	100.0	100.0
Stocks	40.7	0.0	0.0	100.0	59.4	100.0	0.0	100.0	67.0	100.0	0.0	100.0
Equity Funds	53.5	100.0	0.0	100.0	78.1	100.0	0.0	100.0	79.7	100.0	0.0	100.0
% Share of financial wealth invested in (2002 participants only)												
Traditional Equity Products					34.5	29.3	3.8	74.2	42.4	40.8	8.6	79.0
Stocks					9.3	1.4	0.0	30.2	10.5	3.3	0.0	32.4
Equity Funds					23.7	17.9	0.0	57.3	29.8	26.3	1.7	62.5
Cash					57.2	59.4	16.5	94.2	45.4	42.9	11.8	83.7
					Panel B. 2007							
% Share of financial wealth invested in												
Capital Guarantee Investments	1.6	0.0	0.0	2.5	2.1	0.0	0.0	6.1	11.3	7.0	0.0	28.2
ETFs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
Traditional Equity Products	28.1	17.6	0.0	75.5	39.2	37.4	0.4	80.8	49.8	50.9	15.1	82.6
Stocks	6.4	0.0	0.0	21.8	9.1	0.3	0.0	31.6	9.7	2.2	0.0	31.6
Equity Funds	17.3	2.7	0.0	55.7	24.4	17.3	0.0	62.9	24.7	20.7	0.0	56.1
Cash	67.7	75.4	19.0	100.0	55.9	55.4	14.8	98.8	41.8	38.6	11.3	78.1
2002-2007 % change in:												
Financial Wealth					31.4	38.2	-62.3	113.4	54.9	55.9	-11.3	124.5
Income					13.6	12.1	-20.6	48.8	15.3	13.2	-22.3	56.3
% Share of fin. wealth in equity					31.9	59.6	-184.9	139.5	69.2	77.7	-24.7	158.6
					Panel C. Household Adjusted Risky Share							
In 2002					23.9	18.6	1.9	54.1	29.1	26.0	4.8	57.5
In 2007					27.0	23.1	0.1	59.5	32.6	30.8	7.9	59.3
2002-2007 % Change					0.6	14.3	-188.5	118.5	16.7	15.3	-74.7	114.6

Table V. Participation in Capital Guarantee Products, Financial Risk-Taking and Reluctance to Take Risk

Sample	2002-2007 Percentage Change in Adjusted Risky Share (Δw_h)						
		Quintiles of Estimated Reluctance to Take Risk					
	All (1)	Q1 (2)	Q2 (3)	Q3 (4)	Q4 (5)	Q5 (6)	Survey
$\mathbb{1}_{CP_h}$	21.25***	-3.71***	4.30***	16.95***	35.78***	56.14***	9.18**
	(0.24)	(0.21)	(0.28)	(0.36)	(0.49)	(0.49)	(4.36)
$\mathbb{1}_{CP_h}\times$ Elicited Reluctance to Take Risks							4.25***
							(1.31)
Elicited Reluctance to Take Risks							-4.47***
							(0.90)
Fixed Effects (2002 value)							
Risky Share Deciles	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Wealth Deciles	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income Deciles	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Deciles	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Years of Education	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Children	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls							
2002-2007 Change in fin. wealth	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2002-2007 Change in income	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,128,055	425,611	425,610	425,611	425,611	425,611	8,549
R^2	0.111	0.139	0.073	0.072	0.071	0.080	0.149
Summary Statistics							
$\mathbb{E}[w_{h,2002}]$	24%	57%	31%	18%	8.8%	5.4%	
$\mathbb{E}[\Delta w_h]$	0.7%	-32%	-14%	1.9%	15.3%	32.9%	

This table displays OLS regression coefficients. The dependent variable is the percentage change in the adjusted risky share from 2002 to 2007. The adjusted risky share is the weighted average of the fraction of the risk premium the household gets through each security of its portfolio, including equity funds, stocks and retail capital guarantee investments. $\mathbb{1}_{CP_h}$ is a dummy variable equal to one if the household invested at least once in capital guarantee investments 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 23.1 pp higher for households who participated in capital guarantee investments than for the ones that did not. Standard errors are clustered at the parish level. Standard errors are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table VI. Portfolio Allocation Across Household Characteristics

	Share of Financial Wealth Invested in: (in %)			
	Capital Guarantee Investments	Cash	Stocks	Funds
	(1)	(2)	(3)	(4)
Reluctance to Take Risks	0.377***	6.579***	-4.758***	-4.486***
	(0.032)	(0.029)	(0.029)	(0.040)
IQ Score	-0.211***	-0.250***	0.078***	0.177***
	(0.024)	(0.018)	(0.022)	(0.018)
Financial Wealth (log))	-3.376***	-6.440***	1.797***	-1.090***
	(0.046)	(0.042)	(0.067)	(0.054)
Age (years)	0.019***	0.222***	0.010**	-0.080***
	(0.006)	(0.007)	(0.005)	(0.006)
Fixed Effects				
Gender	Yes	Yes	Yes	Yes
Family Size	Yes	Yes	Yes	Yes
Number of Children	Yes	Yes	Yes	Yes
Locality	Yes	Yes	Yes	Yes
Observations	85,988	727,177	380,915	604,779
R^2	0.098	0.241	0.160	0.085

This table displays OLS regression coefficients. The dependent variable is the share of financial wealth invested in capital guarantee investment products (column 1), cash (column 2), stocks (column 3), and equity funds (column 4) as of 2007. The sample is restricted to households participating in each asset class in 2007. Individual controls include a household head gender dummy, fixed effects for the size of the household, the number of children and the locality. Standard errors are clustered at the parish level. Standard errors are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table VII. Participation in Capital Guarantee Products and Financial Risk-Taking: Robustness

Model	2002 -2007 Percentage Change in Adjusted Risky Share (Δw_h)					
	Active Change in Adjusted Risky Share		Active Participants Only		Excluding Exits	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}_{CP_h}$	14.05***	-11.08***	3.70***	-9.53***	15.72***	-8.64***
	(0.27)	(0.34)	(0.17)	(0.28)	(0.24)	(0.24)
$\mathbb{1}_{CP_h} \times$ Reluctance to Take Risks		8.71***		4.73***		8.45***
		(0.16)		(0.11)		(0.10)
Reluctance to Take Risks		-9.61***		-3.74***		-4.70***
		(0.18)		(0.19)		(0.14)
Fixed Effects (2002 value)						
Risky Share Deciles	Yes	Yes	Yes	Yes	Yes	Yes
Financial Wealth Deciles	Yes	Yes	Yes	Yes	Yes	Yes
Income Deciles	Yes	Yes	Yes	Yes	Yes	Yes
Age Deciles	Yes	Yes	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes	Yes	Yes
Years of Education	Yes	Yes	Yes	Yes	Yes	Yes
Family Size	Yes	Yes	Yes	Yes	Yes	Yes
Number of Children	Yes	Yes	Yes	Yes	Yes	Yes
Locality	Yes	Yes	Yes	Yes	Yes	Yes
Controls						
2002-2007 Change in fin. wealth	Yes	Yes	Yes	Yes	Yes	Yes
2002-2007 Change in income	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,114,038	2,114,038	1,228,219	1,228,219	1,941,527	1,941,527
R^2	0.058	0.061	0.214	0.215	0.245	0.249

This table displays OLS regression coefficients. The dependent variable is the *active* change in risky share in Columns 1 and 2 and the percentage change in the adjusted risky share from 2002 to 2007 in columns 3 to 6. The adjusted risky share is the weighted average of the fraction of the risk premium the household gets through each securities of its portfolio, including equity funds, stocks and retail capital guarantee investments. We compute the active change in the risky share by applying to each asset of the household portfolio the realized returns of this asset between 2002 and 2007 and compute the change in the adjusted risky share relative to this *passive* adjusted risky share. $\mathbb{1}_{CP_h} \times$ is a dummy variable equal to one if the household invested at least once in capital guarantee investments over the 2002 to 2007 period. The sample is restricted to households participating in stock markets in 2002. In Columns 3 and 4 the sample is further restricted to active participants only, i.e. to households that have actively invested in an equity fund or a capital guarantee products. Columns 5 and 6 exclude exits from stock markets. Standard errors are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table VIII. Percentage Change in Risky Share and Participation in Capital Guarantee Investments: Instrumented Panel Analysis

	OLS Panel		Instrumented Panel		
			First Stage	Second Stage	
	Risky Share, in %		Capital Guarantee Inv. Share	Risky Share, in %	
	(1)	(2)	(3)	(4)	(5)
CP Inv. Share	0.27***	-0.31***			
	(0.01)	(0.01)			
CP Inv. Share × Risk Reluctance		0.19***			
		(0.00)			
Bank-Idiosyncratic Supply			1.26***		
			(0.06)		
$\widehat{CPInv.Share}$				0.64***	-2.39***
				(0.14)	(0.07)
$\widehat{CPInv.Share}$ × Risk Reluctance					1.03***
					(0.03)
Controls					
Year FE	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes
Income Deciles FE	Yes	Yes	Yes	Yes	Yes
Age Deciles FE FE	Yes	Yes	Yes	Yes	Yes
Years of Education	Yes	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes	Yes
Observations	4,164,828	4,164,828	4,125,252	4,125,252	4,125,252
R^2	0.817	0.818	0.484		
$F-Statistics$			395.95		

Columns 1 and 2 display the results of a panel analysis with household and year fixed effects where the dependent variable is the adjusted risky share, in % of financial wealth. Columns 3 to 6 display the results of the instrumental variable analysis. In the first stage (Column 3), the dependent variable, *Capital Guarantee Inv. Share*, is the share of financial wealth invested in capital guarantee products. The independent variable is a time-varying measure of bank supply of capital guarantee investment. In the second stage, we estimate a panel model with household and year fixed effects where the dependent variable is the adjusted risky share, in % of financial wealth. The sample is restricted to household participating in stock markets in 2002. Standard errors are clustered at the locality level and are displayed below their coefficient of interest. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table IX. Household Welfare Gains Predicted by the Models

Model Name	Parameters	% Change in Risky Share	Gain in Utility, Equivalent Initial Amount in $	% Share of Surplus Going to the Household
Loss Aversion with Narrow Framing	λ=3.5	95.4%	358	57.9%
Probability Weighting	b=0.72	115.3%	382	62.7%
Volatility Misperception	Misperception=50%	112.3%	319	64.5%
Probability of Crash	P Crash=50%	105.8%	352	56.8%

Changes in risky share and welfare gains for a household with a risky share ex ante of 8% (p 25 in the Swedish population).