## The demand for structured products: an experimental approach


Juan Carlos Matallín Sáez*
Finance and Accounting Dept.
Tel. +34 964 38 71 47
e-mail: matallin@cofin.uji.es

Adriana Gabriela Breaban
LEE & Economics Dept.
Tel. +34 964 38 76 30
e-mail: breaban@eco.uji.es

Iván Barreda Tarrazona
LEE & Economics Dept.
Tel. +34 964 38 76 33
e-mail: ivan.barreda@eco.uji.es

Mª Rosario Balaguer Franch
Finance and Accounting Dept.
Tel. +34 964 38 71 42
e-mail: rbalague@cofin.uji.es

Universitat Jaume I

Av. Sos Baynat s/n

12080 Castellón


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**Abstract:** Guaranteed investment funds are showing an important growth in the mutual fund industry. We analyze this type of fund's demand using the experimental methodology. Different types of structured guaranteed funds, with certain combinations of secured and additional benefits, are sequentially offered to university students who act as investors. Subjects also have the possibility to buy bonds. Our results show that information available to investors, and particularly the order in which it is presented, generates significant biases in their decision making which can have both positive and negative effects on their financial behavior. In fact, when the investment alternatives are made easier to compare, "too good to be true" investment offers get more easily spotted, while "guaranteed" investment products with a positive evolution result overvalued in comparison to bonds.



**Keywords:** investor behavior, experiment, guaranteed investment fund.



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## 1. INTRODUCTION

Structured products were originally developed in order to meet investors' specific needs that existing financial instruments did not fulfill. Although there is no uniform definition, the U.S. Securities and Exchange Commission considers that structured products are "securities whose cash flow characteristics depend upon one or more indices or that have imbedded forwards or options or securities where an investor's investment return and the issuer's payment obligations are contingent on, or highly sensitive to, changes in the value of underlying assets, indices, interest rates or cash flows" (SEC, 2003). Even though when structured products were first commercialized they were normally tied to important stock market indices, as these products developed, they became more frequently linked to a range of other underlying assets such as interest rates, currencies, energy contracts and commodities (Loven & Garås, 2008). Therefore, structured products give investors a possibility of gaining access to a wide range of markets and commodities, which in other circumstances might have seemed too risky, without actually owning the asset.

Structured products make up a significant part of most developed countries' financial systems. According to the SPA (Structured Products Association) over 180 billions USD were invested in the European fund market in 2005, 70 billions USD in the United States and almost 50 billions USD in the Asian market. In the last five years market trends have changed little. In terms of issuance in 2007, 63% of issued products were income products (considered to be less risky as they are linked to mature companies), and 35% of issued products categorized as growth products (normally linked to growing companies). At mid-year 2011, a somewhat smaller 58% of issuance was income-generating, with 40% of issuance tagged as growth products.

Parallel to the growth of structured products, the growth of the mutual funds industry over the recent decades highlights the ability of these funds to channel investors' money into the financial markets. Mutual funds make up a significant part of most developed countries' financial systems. About 45% of the households in the U.S. invest in them, according to ICI (2010). Investment in mutual funds is then a widespread activity which also non-specialized subjects undertake. In particular, many citizens invest in guaranteed mutual funds under the form of retirement plans.

The significant role of mutual funds in most markets has aroused both social and academic interest. Within this context, the aim of the present paper is to analyze demand for *guaranteed* mutual funds according to different levels of expected return differential when compared to a bond. For simplicity, we do not introduce any additional characteristics, many times a bit obscure to the investors, which these structured products might typically have: commissions, insurances, penalties, etc.

The demand for mutual funds has been extensively analyzed in the literature concerned with evaluating fund efficiency. Since the publication of works by Sharpe (1966) and Jensen (1968), a large number of studies have evaluated mutual funds. The evolution of asset pricing models has at the same time facilitated the development of several evaluation measures for fund performance, such as in the work of Ferson and Schadt (1996), Elton *et* *al.* (1999), Bollen and Busse (2005), Kosowski *et al.* (2006), among others. Another example of research on structured products demand is Breuer et al. (2007) who analyze them into a hedonic framing.[1]

Experimental analysis methodology has been applied extensively in the area of financial economics: literature reviews by Bossaerts (2001) for financial markets and by Cadsby and Maines (1998) for corporate finance provide an excellent overview. For the specific case of mutual funds, the use of experimental methodology is still relatively limited. For instance, Annaert et al. (2005) carried out an experimental study on capital guaranteed funds. Kliger et al. (2003) also opted for this approach to uncover inconsistency with the Expected Utility Theory in mutual fund investor behavior. Johnson and Tellis (2005) also study the same phenomenon experimentally, but with reference to stocks. Choi et al. (2006) design an experiment to study the role of commissions in fund investment, and find that to a large extent they are overlooked, even when they are pointed out in the information provided. Barreda *et al.* (2011a) recently analyzed the importance of providing accurate information about the socially responsible character of a mutual fund in order to help consumers express their ethical preferences.

Most of the above-mentioned literature analyzes investor behavior and demand for mutual funds from an aggregate perspective. In contrast, the present study proposes an analysis from the experimental economics approach, which allows analysis of individual investor behavior according to different variables such as expected return or risk. This alternative approach also allows us to evaluate the effect that the level of available information has on investor behavior and, consequently, on the demand for the funds. The empirical study was undertaken in the Laboratory for Experimental Economics (LEE) at the Universitat Jaume I where a sample of university students made investment decisions according to different expected return and information conditions. They had to invest a fixed amount of money either in a bond or in a structured product which secured part of the invested capital and yielded additional benefits if the stock market showed a positive evolution.

Our results show that information available to investors, and particularly the order in which it is presented, generates significant biases in their decision making that can have both positive and negative effects on their behavior. In fact, when the investment alternatives are made easier to compare, “too good to be true” investment offers get more easily spotted, while “guaranteed” investment products with a positive evolution result overvalued in comparison to bonds.

The paper is organized as follows: in the next section we outline the design of the experiment. We analyze then the results obtained in the experiment. After that, the main conclusions drawn are presented.[2]

## 2. EXPERIMENTAL DESIGN

As mentioned above, experimental analysis methodology is used in this research. Experimental economics is an area of applied economics, since it essentially consists of statistical data analysis to test economic theories. Fundamental references for this methodology are Davis and Holt (1993), Friedman and Sunder (1994), Kagel and Roth (1995) and Bardsley *et al.* (2009). What differentiates this methodology from others is that the data

[1] Regarding the Spanish funds market we can mention Marín and Rubio (2001), Ciriaco and Santamaría (2005) and Matallín (2006).
[2] The experimental instructions and the experimental questionnaire are available upon request to the authors.

studied come from decisions taken by monetarily motivated subjects in an environment controlled by the researcher. This control allows the researcher to design the experiment in such a way that when testing a hypothesis, it is possible to filter out the potential effect that other unwanted variables might have on the objective being studied. We can therefore observe how investor behavior changes in specific situations, and make more thorough use of individual decisions and the possible material and non-material incentives that might explain these decisions at any given moment. With the observations we obtain we can then perform a statistical analysis to determine the significance of our results.

A total of 514 undergraduate students from different majors, mainly business, engineering and psychology, participated in the between-subjects study: 287 in Treatment 1 and 227 in Treatment 2. Our experiment basically consisted of the agents having to choose between two investment options in 60 different scenarios: a risk free asset (a bond) and a structured guaranteed fund with different combinations of secured and additional benefits.

In Treatment 1, the scenarios were sequential and the secured part of the fund rose gradually from 97% to 112% of the invested amount. Besides, a benefit linked to stock market revaluation, which also grew sequentially in 5 period cycles, was added up (See Table 1). The subjects were informed that there was a 60% probability for the revaluation to be positive and a 40% probability for it to be negative. Participants also had the possibility of buying risk free bonds which yielded a 3% yearly interest in the 30 first scenarios and a 7% interest in the 30 last scenarios.

In Treatment 2, the exact same 60 scenarios where presented also sequentially but in random order, independent for each subject, to a new pool of subjects.

In both treatments, after the 60 scenarios, one subject per session casted a die to randomly determine which one out of the 60 scenarios would be paid for all subjects participating in that session. This method of asking for 60 decisions and actually paying for one of them is incentive compatible and widely used in experimental economics: random lottery incentive mechanism / strategy method.

Our target was, within each treatment, to observe any changes in the way the capital was invested in the risky or risk free assets in each scenario when the expected return varied, and between the treatments, to see if the ordering in which the investment scenarios were presented made a difference in investment.

According to Miller (1965) “Everybody knows that there is a finite span of immediate memory and that for a lot of different kinds of test materials this span is about seven items in length… and there is a span of absolute judgment that can distinguish about 7 categories.” That is, the ability of people to keep in mind and compare a large set of options is limited. In our case we presented each subject with 60 binary choices. In Treatment 1 the information was presented sequentially so that it was much easier for the subjects to compare the different assets across the scenarios. According to the psychological research on the matter, in Treatment 1, subjects should be able to recall and easily compare at least each group of 5 scenarios with stable fixed returns and increasing index-performance related returns. However, in Treatment 2, the sequence of scenarios did not follow any logic and what was “stored in memory” was a juxtaposition of offers with different values whose number increased steadily in time. Malhotra (1982) found that respondents experienced information overload when they were presented with 10, 15, 20 or 25 choice alternatives. If the independence of irrelevant alternatives held in our case this would be no problem, because all of these binary choices were independent, in the sense that only one of the 60 scenarios was to be selected in the end, and all other 59 choices were totally irrelevant for determining the payment to the particular subject. No matter how attractive or unattractive an investment seen in prior scenarios was, that should not have any weight in the binary decision being presented in a particular scenario. However, if the subject tries to keep in mind all the investment options that are sequentially presented to him/her in order to carry out a global comparison, he/she will soon be confronted to his/her memory and judgment limits.

The experiments were programmed in PHP and Java and carried out in the Laboratory for Experimental Economics (LEE) at Universitat Jaume I in Castellón, Spain. Even if students are not professional investors, we are interested in the valuation of the characteristics of a guaranteed fund by the general public. In general, the experimental method is widely used with university students in the USA and Europe. Besides, various authors, such as Smith *et al.* (1988) and King *et al.* (1992), have obtained equivalent results using professionals and students by carrying out parallel experiments. In order to give a real value to each of the decisions made using experimental units (EU), the equivalence of 1 € = 8,000 EU was introduced, so that an average of 163.962 EU (20.5 €) per participant was earned during the experiment. The use of money in this type of experiment is crucial, since its objective is for the subject-investors to take economic decisions that, like in the real world, will have consequences for their own financial situation, rather than declaring a hypothetical intention. The importance of using real incentives for eliciting preferences when subjects risk aversion is at play has recently been highlighted by Barreda *et al.* (2011b).

The experiment consists of three parts. The first part is the most central of this research, in which subjects make investment decisions in each of the 60 scenarios. The second part of the experiment is a risk aversion test using a lottery task. And finally, in the last part of the experiment, subjects fill out a personal questionnaire.

For the first part of the experiment, subjects were given a document with specific instructions about their tasks. These directions were also explained to them by the experimentalist. The experiment was then run for each subject on an individual computer using a specific program in PHP and Java. A screen appeared for each scenario and the investor had to choose where to invest her total endowment of 100.000 EU between two investment alternatives, “A” or “B”. We ran 60 scenarios changing the conditions of these investment options.

The investment alternative “A” is a fixed return bond. Equation [1] describes the final value of the investment ($V_{n,j}$) for the $j$ setting as the result of reinvesting the initial $V_0$ up to $n$ periods, given a $r_j$ capitalization. In the experiment setting, $n$ is equal to 3 years and $V_0$ is 100.000 EU. In Treatment 1, for scenarios going from 1 to 30, this investment yields a 3% annual interest which implies within 3 years a 9% appreciation. In order to simplify the investor’s calculations, the yields were taken into account with a simple capitalization. Starting with the scenario number 31 up to the 60$^{th}$, the bond yields a 7% yearly which means a 21% $r_j$ in three years.

$$V_{n,j}^{A} = V_0\left(1+r_j\right) \qquad [1]$$

On the other hand, the alternative “B” is to invest in a structured investment fund. At the end of a three year period, this investment fund has a final value as the expression [2] shows. The first component represents a guaranteed part of the investment (1+$g_j$) which varies from 97% to 112% depending on the scenario. Technically speaking, it is when this percentage is equal or higher than 100% that we can actually consider the fund a guaranteed mutual fund. The second component yields an extra value depending on the positive evolution of an index representing the stock market. In each of the scenarios, subjects obtain $p_j$, a percentage of the appreciation of the stock market ($r_{mj}$) due to this second component. As equation [2] shows, this component is asymmetric, given that it yields an additional benefit in case the stock market appreciates, but does not entail losses when the stock indicator doesn’t have a good performance. This asymmetry is typical of the options. Actually, the mutual guaranteed funds are products normally structured by means of investment in bonds which at the due date provide the invested capital security, and the payment of an option premium which is bounded to a certain stock market evolution gives us the second component.

$$V_{n,j}^{B} = V_0\left(1+g_j\right) + V_0 \cdot \max\left(0, p_j \cdot r_{m,j}\right) \qquad [2]$$

Every five scenarios the value of the percentage of the appreciation $p_j$ is successively: 10, 30, 60, 100 and 110 percent. So this structure is repeated twelve times through the whole experiment which has 60 scenarios. Table 1 summarizes the values of $g_j$ and $p_j$ parameters in each scenario for the fund investment “B” as well as $r_j$ for the bond investment “A”. Please note that the particular order of the scenarios presented in Table 1 was only used in Treatment 1, while in Treatment 2 the same scenarios were presented in different random orders to each of the subjects.

As in real financial markets the value of $r_{m,j}$ is not known, for this experiment we consider it a random variable with a normal distribution. Even though any simulated data could be used, it seemed convenient for this variable to be comparable to real markets. For this reason the mean and standard deviation of this distribution are taken from real data of the last years of the Ibex 35, representative of the Spanish stock market. We have taken the annualized standard deviation of the Ibex 35 daily return over the three year period 2008-2010 and the annualized mean of the daily return over the past 10 years to avoid a distribution biased by the recent market trend. As this mean is positive, the probability of a positive $r_{m,j}$ is higher than that of a negative value, which is something expected from the equity risk premium hypothesis.

Subjects are informed about investment in stock markets being a risky investment and the standard deviation and the distribution of $r_{m,j}$ values are also reported in the instructions. These values are generated with a normal distribution for the 3-year return with 46.8% variance and 12.021% mean parameters.

After the 60 scenarios were run and all subjects made their choices, the program provided randomly a value for $r_{m,j}$ drawn from the aforementioned normal distribution. Immediately afterwards, one of the subjects volunteered to cast a die in order to randomly obtain a value *j'* from 1 to 60 which selected the paid scenario in that session[3]. Thus, participant's earnings were determined by expression [1] or expression [2] depending on each subject's decision in the chosen period *j'*. Therefore, subjects who decided to invest in option A received the amount corresponding to equation [1] and for those who choose investment B, their earnings were determined by equation [2] according to the value of $r_{m,j}$ and the parameters $g_j$ and $p_j$ for the selected scenario *j'*.

In the second part of the experiment, we used a lottery to try to assess the subjects' risk aversion and afterwards we analyzed if the observed differences in their decisions were related to their risk attitude.

Finally, the third part of the experiment consisted of a questionnaire with demographic and idiosyncratic data. The first three questions were meant to reveal the financial knowledge level of the participant. The following four questions evaluated how important investment yields and risks are for the subject and whether there is any asymmetric perception in the evaluation of gains and losses. The last four questions evaluated subject's rationality when selecting investments which are efficient in the mean-variance framework.

[3] In fact, two role-play dice were used, the regular one with six faces (1-6) determined the first digit and the second one with 10 faces (0 to 9) determined the second digit. Note that the 6 in the first dice could mean either 0 when accompanied with any value greater than 0 in the second die, or 6 when the second die showed a 0.

## Table 1

Along the 60 scenarios, the table reports the values of the 3-year return ($r_j$) in [1] for the A investment. For the B investment, we report the values of the 3-year return of the guaranteed part, ($g_j$) in [2], and the percentage over the stock market 3-year return of the option part, ($p_j$) in [2].

| | Alternative A (Treasury bond) | Alternative B (structured mutual fund) | | | Alternative A (Treasury bond) | Alternative B (structured mutual fund) | |
|---|---|---|---|---|---|---|---|
| *Scenario* | Guaranteed 3-year return($r_j$) | Guaranteed 3-year return ($g_j$) | Percentage over the (+) stock market 3-year return ($p_j$) | *Scenario* | Guaranteed 3-year return($r_j$) | Guaranteed 3-year return ($g_j$) | Percentage over the (+) stock market 3-year return ($p_j$) |
| *1* | 9% | -3% | 10% | *31* | 21% | -3% | 10% |
| *2* | 9% | -3% | 30% | *32* | 21% | -3% | 30% |
| *3* | 9% | -3% | 60% | *33* | 21% | -3% | 60% |
| *4* | 9% | -3% | 100% | *34* | 21% | -3% | 100% |
| *5* | 9% | -3% | 110% | *35* | 21% | -3% | 110% |
| *6* | 9% | -1.5% | 10% | *36* | 21% | -1.5% | 10% |
| *7* | 9% | -1.5% | 30% | *37* | 21% | -1.5% | 30% |
| *8* | 9% | -1.5% | 60% | *38* | 21% | -1.5% | 60% |
| *9* | 9% | -1.5% | 100% | *39* | 21% | -1.5% | 100% |
| *10* | 9% | -1.5% | 110% | *40* | 21% | -1.5% | 110% |
| *11* | 9% | 0% | 10% | *41* | 21% | 0% | 10% |
| *12* | 9% | 0% | 30% | *42* | 21% | 0% | 30% |
| *13* | 9% | 0% | 60% | *43* | 21% | 0% | 60% |
| *14* | 9% | 0% | 100% | *44* | 21% | 0% | 100% |
| *15* | 9% | 0% | 110% | *45* | 21% | 0% | 110% |
| *16* | 9% | 3% | 10% | *46* | 21% | 6% | 10% |
| *17* | 9% | 3% | 30% | *47* | 21% | 6% | 30% |
| *18* | 9% | 3% | 60% | *48* | 21% | 6% | 60% |
| *19* | 9% | 3% | 100% | *49* | 21% | 6% | 100% |
| *20* | 9% | 3% | 110% | *50* | 21% | 6% | 110% |
| *21* | 9% | 6% | 10% | *51* | 21% | 8% | 10% |
| *22* | 9% | 6% | 30% | *52* | 21% | 8% | 30% |
| *23* | 9% | 6% | 60% | *53* | 21% | 8% | 60% |
| *24* | 9% | 6% | 100% | *54* | 21% | 8% | 100% |
| *25* | 9% | 6% | 110% | *55* | 21% | 8% | 110% |
| *26* | 9% | 7.5% | 10% | *56* | 21% | 12% | 10% |
| *27* | 9% | 7.5% | 30% | *57* | 21% | 12% | 30% |
| *28* | 9% | 7.5% | 60% | *58* | 21% | 12% | 60% |
| *29* | 9% | 7.5% | 100% | *59* | 21% | 12% | 100% |
| *30* | 9% | 7.5% | 110% | *60* | 21% | 12% | 110% |

## 3. RESULTS

### 3.1 Analysis of the risk aversion test and the subject's profile

We will first focus on the results obtained from the second and third part of the experiment which will give us information about the subjects profile and then, allow us to relate this information with the results obtained in the first part of the experiment.

Regarding the risk aversion test, eleven scenarios are displayed and subjects must choose one of the two possible options in each of the scenarios. The first option, which remains available along the eleven scenarios, is a risky one where subjects may obtain 48.000 EU or zero with 50% probability. The second option is a safe one and consists of a secure payment which goes from 4.000 UE in the first scenario, to 31.000 UE in the last one. After all choices are made, one of the eleven scenarios is randomly chosen[4] and also the 50% probability situation is solved by tossing a coin. Then the payment of each participant in the risk lottery is determined according to these events. An expected rational behavior would be to choose the risky option in the first scenarios and afterwards, with higher secured yields, switch to the safe option at some point of the decisions chain.

Table 2 shows the summarized results of the risk aversion test. Panel A differentiates the robust results from the ones that are not. It is obvious that a subject who changes his best option in more than one of the eleven risk scenarios cannot be considered as a robust one. As it is shown in the table, there is a high enough proportion of 91.29% of the subjects who are robust, so the data loss is very limited. The evolution of the percentage of subjects choosing one option or the other is shown in the Panel B. As it was expected, the percentage of subjects choosing the risky option decreases as the safe option value increases.

[4] This was done by a volunteer subject throwing a 12-sided die, where if 12 turns out he has to throw again.

## Table 2

Results of the risk aversion test on the second part of the experiment. Panel A shows the results distinguishing robust and not robust responses. Panel B shows the expected value of the two options and the evolution of the choices across scenarios for the robust subjects.

Panel A

| Investors | % |
|---|---|
| Robust | 91.29% |
| Not robust | 8.71% |

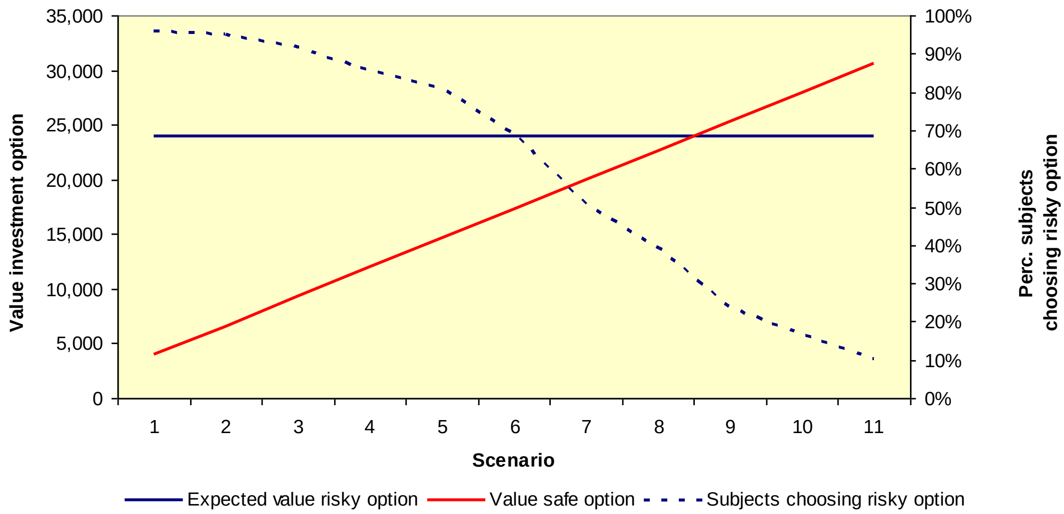
Panel B

| *Scenario* | Expected value risky option (EU) | Value safe option (EU) | Subjects that invest in risky option | Subjects that invest in safe option | Change from risky to safe option |
|---|---|---|---|---|---|
| *1* | 24,000 | 4,000 | 95.80% | 4.20% | |
| *2* | 24,000 | 6,500 | 95.04% | 4.96% | 0.76% |
| *3* | 24,000 | 9,333 | 91.60% | 8.40% | 3.44% |
| *4* | 24,000 | 12,000 | 85.50% | 14.50% | 6.11% |
| *5* | 24,000 | 14,666 | 80.92% | 19.08% | 4.58% |
| *6* | 24,000 | 17,333 | 68.70% | 31.30% | 12.21% |
| *7* | 24,000 | 20,000 | 50.38% | 49.62% | 18.32% |
| *8* | 24,000 | 22,666 | 39.31% | 60.69% | 11.07% |
| *9* | 24,000 | 25,333 | 23.66% | 76.34% | 15.65% |
| *10* | 24,000 | 28,000 | 16.79% | 83.21% | 6.87% |
| *11* | 24,000 | 30,666 | 10.31% | 89.69% | 6.49% |

There is a group of subjects which represent a 4.20% of the total who always choose the safe option, and on the contrary, there are 10.31% who always choose the risky option. This is shown in Figure 1. In the mean-variance framework the rational election is the safe one when its value is higher than the expected value of the risky option. This occurs between the 8th and 9th scenario; however the trend to choose the safe option begins well before, reflecting the risk aversion of some of the subjects.

## Figure 1

Percentage of investors choosing the risky option along the 11 scenarios of the lottery.



As mentioned before, the third part of the experiment consists of a questionnaire which provides additional information about subjects. A summary of the results is shown in Table 3. First of all there are some questions revealing subjects knowledge regarding financial products and markets. The first column in table 3 shows the answers to these questions which in aggregate terms indicate that 65.51% of the subjects present a poor financial knowledge. Therefore, looks like there can't be any overconfidence bias regarding what investors think about their own financial knowledge. This aspect is supported by the second column results where the practical understanding of participants about the Markowitz (1952) rule of median-variance is analyzed. An average of 57.14% of the investors makes use of this rule perfectly and they prove it by making rational choices between the trial portfolios with different expected yields and risk levels. Regarding the questionnaire part in which relevance of risk and yields of an investment is assessed, 77.70% of participants think that these are important variables. Finally, the last column shows the answers evaluating the loss aversion of investors, that is, whether there is an asymmetric behavior regarding profits and loses. The results indicate that only 18.47% of them show a clear loss aversion attitude.

**Table 3**

| | Financial knowledge self opinion | Mean-variance framework knowledge | Risk and return Importance opinion | Losses aversion |
|---|---|---|---|---|
| High | 34.49% | 57,14% | 77,70% | 18,47% |
| Low | 65.51% | 42.86% | 22,30% | 81,53% |

### 3.2 Aggregate results on guaranteed mutual funds investment.

Let us now analyze the main part of the experiment where investment decisions were taken. In Figure 2 we can observe that some people are highly risk loving or highly risk averse and they stick to their preferred option: the risky or the safe one respectively, both in the presence of highly positive or highly negative return differentials between the fund and the bond. However, most investors (approximately 90%) change their decision alongside the evolution of the expected return differential following a sigmoid logistic shape.

**Figure 2**

Percentage of investors choosing the structured fund according to its expected performance in relationship to the bond.

Comparing the two treatments shown in Figure 2 we can see that in Treatment 1, when the scenarios are easier to compare, the percentage of people investing in the guaranteed fund is greater (full dots are normally placed higher than hollow dots). So, in contrast with rational behavior, investors have a higher preference for the fund when they can easily compare the independent scenarios and observe that the fund offers increasingly higher expected gains, while the bond's remain constant. This observation supports the idea that investors may suffer from a "past returns" or "trend" illusion, similar to Chartism, due to which they tend to believe that a good history is in some way guarantee of a good future performance, even in totally independent realizations as those presented in our experiment. We will support these casual observations statistically in the next section.

If we analyze Figure 3, which describes the evolution along the scenarios of the percentage of investment in the guaranteed fund (option B), behavioral paths can be identified. As it has already been mentioned, the experiment consists of 60 scenarios with a $p_j$ (percentage of the stock market appreciation) structure repeated every 5 periods. The guaranteed 3 year return of the mutual fund offers 97% in the first group of 5 periods, while the Treasury bond ensures a 109% of the investment for the same time horizon. In the first period, with an additional 10% yield over the stock market appreciation for the mutual fund, only 18% of the participants prefer the risky (although guaranteed) option, which seems to indicate that a maximum 12% loss is compensated for them by a highly positive expectation on the evolution of the stock market.

In Treatment 1, within this first group of five scenarios there is a maximum investment in the B option in the third scenario where a 78.9% of participants decide that a 12% maximum loss from investing in the mutual fund instead of the bond is compensated by a 60% percentage on a possible stock market appreciation. In the subsequent 4th and 5th scenario we surprisingly observe a fall in the mutual fund investment: 77.5% and 71.8% of investors decide to invest in the fund for a $p_j$ value of 100% and 110% respectively. This pattern is not rare in Treatment 1: in the second group of five scenarios a similar phenomenon is also observed, that is, mutual fund investment rises from 21.1% in the first scenario up to 85% in the 4th scenario where it reaches the maximum and finally in the last scenario, when the $p_j$ value goes beyond 100%, investment in the fund drops to 79%. This extreme concavity feature is repeated along the whole Treatment 1, specially in the scenarios 1 to 30 where the difference between the guaranteed three years return of the Treasury bond and the guaranteed part of the mutual fund is narrower than it is for the scenarios from 31 to 60.

This is the most striking result of this experiment. While one would expect a monotonic increase in investment together with the increase in the percentage related to the stock market appreciation, we observe that for percentages of 100%, or higher, investment in the structured product in fact nearly always decreases in Treatment 1. We call this the "too good to be true effect", which has strong implications for the advertisement of structured products. Offering such high premium as 110% of the stock market appreciation could be conveying to the investor the idea that the event that the stock market rises is highly unlikely, because otherwise we would not be offering such great premia. The attractiveness of structured funds is maximized in our experiment for premia offering around 60% of the appreciation in the stock market.

However, comparing Treatment 1 and Treatment 2 in Figure 3, we can easily observe that the too good to be true effect vanishes as soon as the subjects are not able to easily compare all the possible investments. That is, if they see the 100% and 110% premia in random order (without observing the increase in each 5 scenario sequence) they do not infer any negative signal in such attractive offers. Spotting “nearly incredible” offers becomes harder when comparing offers becomes cognitively harder. This again has strong implications for financial regulatory authorities. Clearly organizing and categorizing existing investment opportunities can help investors a lot in discriminating reasonable offers from highly unlikely to be fulfilled one’s. We still do not know how many times yet a Ponzi scheme will be successful in alluring naïve investors.

**Figure 3**

Guaranteed mutual fund investment along the 60 scenarios of the experiment

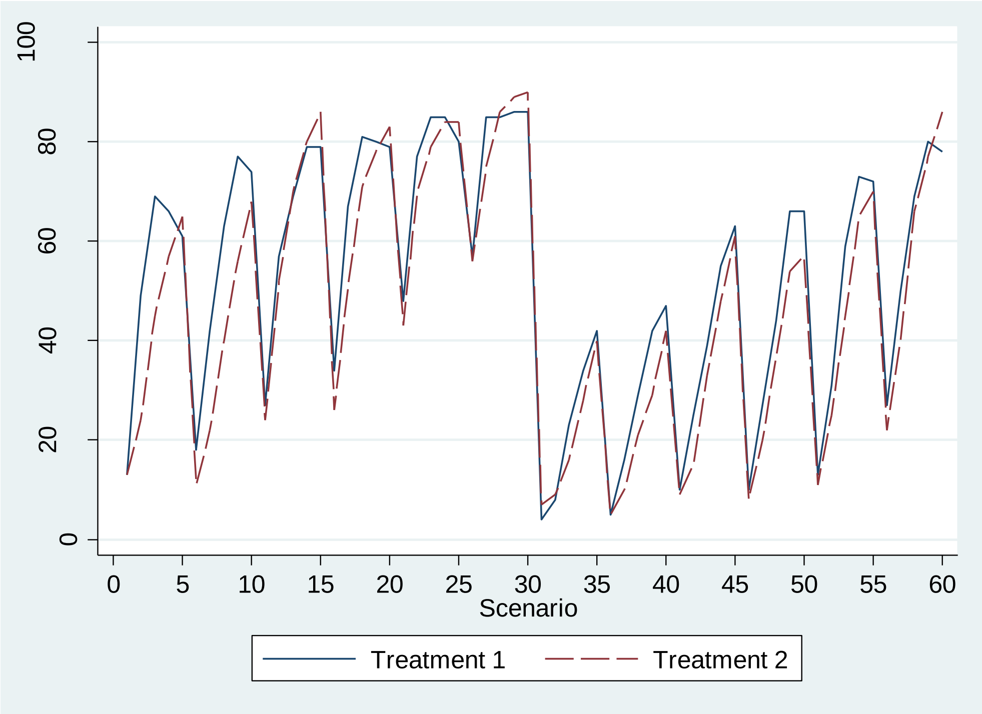
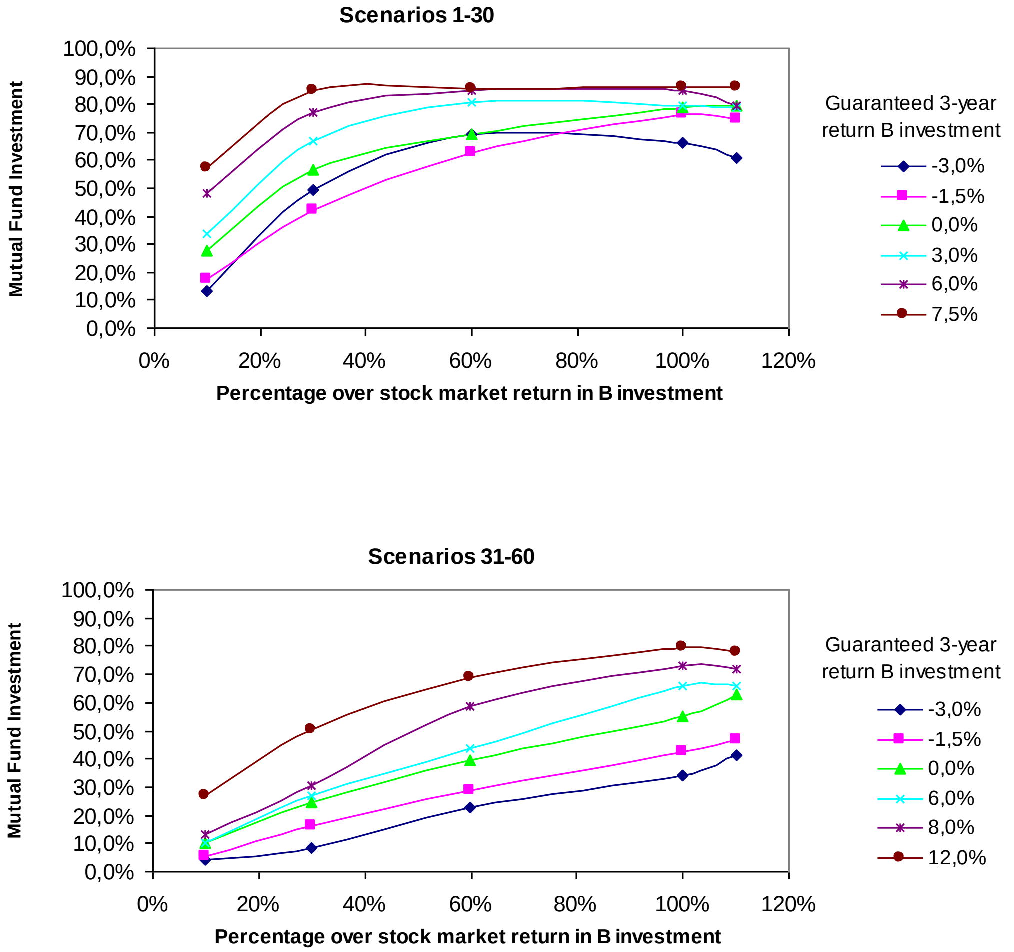



Figure 4 shows graphically the evolution of the mutual fund investment as a function of the percentage over the stock market appreciation ($p_j$), distinguishing between the first part of the treatment with a 9% Treasury bond yield and the second part with a 21% return of the risk free asset. There is a positive relation between $p_j$ and investment in the mutual fund although, for higher $g_j$ values, the maximum investment is quickly reached in the first part of the treatment. One can easily observe the concave shape of the relation between the $p_j$ and investment in the fund. This phenomenon can also be observed in the second part of the treatment but only for higher values of $g_j$ due to the neutralizing effect of the higher secured yield of A (which makes investing in the fund much less attractive) over the structured product demand.

In Figure 4 we can also observe how the too good to be true effect is particularly stronger when the mutual fund is in a relatively better situation offering the investor a higher expectation of gain than the bond. As the guaranteed part of the fund increases its value relatively the effect grows stronger, particularly in the last 30 scenarios.

**Figure 4**

Guaranteed mutual fund investment in Treatment 1 according to percentage over stock market appreciation




### 3.3 Econometric analysis.

The graphical analysis in the previous section has shown two interesting changes in our subject's behavior when the scenarios are easier to compare: the "too good to be true" effect and the "trend" effect. In this section we will have analyze the statistical significance of these observations.

In order to obtain a more precise measure of the effects of the guaranteed part and the stock market revalorization premium on the demand for the mutual fund investment we construct a model using as independent variables those appearing in equations [1] and [2]. We have also introduced in the analysis the individual level of risk aversion estimated from our lottery tests, as it will shed some light regarding investor's behavior. Besides, we also employ as a variable the squared term of the percentage over the stock market appreciation ($p_j$) pursuing to show, if this quadratic effect is significant, the concavity of the demand of the mutual fund. This concavity must be big for the "too good to be true" effect to be significant.

According to the design of our experiment, the data obtained form a panel with 514 individual decisions for each one of 60 periods (287 in Treatment 1 and 227 in Treatment 2). Given that we have identified around 10%

investors with non robust answers to the risk aversion test, the respective observations are eliminated from our analysis.

Table 4 contains the main results we obtain by running a probit model for Treatment 1 in the first column, for Treatment 2 in the second column, and finally for the difference between the two treatments in column 3.

Starting with Treatment 1, all variables turn out to be highly significant and they all have the expected sign. For example, an increase of the return of option A (the bond) has a negative effect on the mutual fund demand, while a higher guarantee value option B (the fund) rises product´s demand. Also positively, but in a lower proportion, the percentage over the stock market revaluation positively affects the mutual fund demand. The negative coefficient of the squared term of the percentage over the stock market appreciation confirms our preliminary graphical analysis, which indicated a concave shape of the demand. This seems to be one of those behavioral features that do not fit with the Expected Utility Theory, and might be attributed to a cognitive bias, that we have called the too good to be true effect, in the spirit of those that Allais (1953) reflected in his famous experimental study.

When we turn to treatment two we see that all this effects are confirmed, only they are smaller with the exception of the effect of the guaranteed part of B.

In the third column we check for the significance of the differences between the two treatments and we obtain the the effect of the bond returns and of risk aversion is not different in both treatments. The positive effect of the guaranteed part of B is slightly greater in T2. And the most important differences between the two treatments, confirming our results statistically, are that the positive effect of the percentage on the stock market revaluation is significantly reduced to two thirds in Treatment 2 when the trend is not easily observed, and that the concavity of the demand function with respect to this percentage is also significantly halved, dramatically reducing the too good to be true effect.

**Table 4**
Probit Model with dependent variable Y
(Y=0 when investors choose the mutual fund, and Y=1 otherwise)

| | Treatment 1 | Treatment 2 | Difference (T2-T1) |
|---|---|---|---|
| guaranteed A ($r_j$) | -0.090*** | -0.085*** | 0.005 |
| | **(0.00)** | **(0.00)** | (0.124) |
| guaranteed B ($g_j$) | 0.091*** | 0.098*** | 0.007** |
| | **(0.00)** | **(0.00)** | **(0.041)** |
| percentage ($p_j$) | 0.043*** | 0.028*** | -0.013*** |
| | **(0.00)** | **(0.00)** | **(0.00)** |
| percentage$^2$ | -0.00022*** | -0.0001*** | 0.00012*** |
| | **(0.00)** | **(0.00)** | **(0.00)** |
| risk lover | 0.130*** | 0.08*** | -0.041 |
| | **(0.00)** | **(0.00)** | (0.103) |

The risk aversion test gave us a measure of investor's attitude facing a risky situation. Combining this data with the investment decision process, we find that in a scale from 1 to 12 of risk attitude (1 is very risk averse and 12 is highly risk lover), one additional level in this scale, that is, being more risk lover entails a higher probability to choose the risky option.

## 4. CONCLUSIONS

In this paper we experimentally analyze the demand for structured products; in particular we construct a guaranteed mutual fund that is offered to participant-investors versus a risk free bond investment. Our experimental design allowed us to control for the effect of several variables such as guarantees, premia, risk aversion, and the informational structure, obtaining that besides the expected rational behavior of participants, behavioral biases arise.

The first one is a "trend" effect which causes investors to value more positively a guaranteed investment fund when they observe an increasing trend in the expected returns, even if the realization of the returns of a given scenario is independent of the other scenarios. This illusion can only be fought with more financial literacy and insisting that past returns are not a guarantee of future returns.

The second observed effect is what we call the "too good to be true" effect which is a consequence of investors being able to compare more easily the different investment alternatives. The policy implication of this experimental finding would call for increasing the availability of categorized and ordered menus of directly comparable investments that the investors could use before placing their money. Simplifying the investors' information processing load could reduce the probability of them getting lured into dubious extremely high offer investments.

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