Is there a pessimistic bias in individual beliefs ? Evidence from survey data[*]

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Abstract

The aim of this paper is to determine whether individuals exhibit a behavioral bias towards pessimism in their beliefs, in a lottery or more generally in an investment opportunities framework. For this purpose, we design a field survey on a sample of 1,540 individuals aiming at deriving a measure of pessimism from answers to hypothetical scenarios. In the context of our experiment, we observe that individuals are on average pessimistic. We analyze how pessimism is distributed among individuals, in particular in link with gender, age and income. We also analyze how our notion of pessimism is related to more general notions of pessimism already introduced in psychology. We finally estimate the possible impact of this pessimistic bias on the financial markets equilibrium risk premium.

1. Introduction

Commonly defined, optimism reflects an expectation that good things will happen, whereas pessimism reflects an expectation that bad things will happen.

Abel (2002) and Jouini-Napp (2006) show that the presence of a pessimistic bias in individual beliefs leads to a higher risk premium and a lower risk-free rate in financial markets equilibrium models. This effect is particularly interesting in light of the risk-premium and the risk-free rate puzzles. It remains to analyze to which extent individual beliefs exhibit such a pessimistic bias.

Previous work on the notion of pessimism/optimism that seems related to this issue includes empirical studies of economic forecasts as well as psychological surveys.

In the empirical studies of economic forecasts, the participants are analysts, economists from industry, government, banking, etc. and they provide forecasts on earnings, dividends or on GDP, consumption, etc. These studies have led to different results depending on the contexts even though the main conclusion is towards optimism. Fried and Givoly (1982), O'Brien (1988), Francis and Philbrick (1993), Kang et al. (1994) and Dreman and Berry (1995) provide evidence that analysts' forecasts on earnings are overly optimistic and the converse result is obtained about professional forecasts on GDP in Giordani and Söderlind (2005). However, as underlined by Schipper (1991), Mc Nichols and O'Brien (1997), Abarbanell and Lehavy (2001), Darrough and Russell (2002), professionals' forecasts may be biased by environmental factors.

In psychology, the notion of pessimism that has been considered so far is very general and based on the concept of pessimism as a negative conception of life. In order to measure personal pessimism, the questions asked in psychological surveys aim at evaluating the way the individuals perceive their future. Such a perception of one's future

2

takes into account how individuals might influence future events and involves feelings like self esteem or overconfidence. Standard psychology studies (e.g., Kahneman and Lovallo, 1993, Taylor and Brown, 1988) conclude to a significative level of optimism. Kahneman and Lovallo (1993) interpreted that overly optimistic forecasts result from the adoption of an inside view of the problem, which anchors predictions on plans of success rather than on past results, the so-called *insider bias*. With an insider view of the problem, risk is perceived as a challenge to be overcome by the exercice of skill.

One of the aims of the present paper is to analyze if the optimistic bias pertains if we get rid of the positive self evaluation and illusion of control biases as well as the environemental biases and consider investment-like situations on which the individual has no influence. More precisely we will focus on "judged" probabilities on events that have a direct impact on individual well being but that are exogenously given like in lotteries.

For this purpose, we shall design a survey, involving verbal expressions of beliefs concerning lotteries, that permits to provide an individual measure of pessimism in such a context. More precisely, we will measure in a very simple framework the "judged" probability that individuals assign to the outcomes of a lottery and we will look for systematic deviations from the objective probability in relation with the nature of the outcome. Pessimistic individuals are then those for which bad outcomes have a higher "judged" probability than the objective probability. We shall refer to this notion of pessimism as "pure-hazard introspective pessimism" (PHIP). "Introspective pessimism" refers to the fact that our approach is introspective and different from a choice-theoretic approach in the sense that we elicit individual beliefs through verbal expression and not through pairwise choices. Implicit in such an approach is the assumption that these beliefs result from a cognitive process. "Pure-hazard pessimism" refers to the fact

3

that we are interested in individual beliefs in the face of "pure hazard", represented by lotteries, and not in the face of events whose outcomes the individuals can influence. We shall analyze how pure-hazard introspective pessimism is distributed among individuals, in particular in link with age, gender, income. We shall also analyze how PHIP is related to other concepts of pessimism already introduced in psychology.

There is a well-known debate between the intuitive approach, for which beliefs exist prior to the choice behavior and the choice theoretic approach for which beliefs exist only in so far as they are expressed in choice behavior. Without getting too much into the details of this debate, we choose an introspective approach which is based on the verbal expression of the beliefs[1] (Fox and Tversky, 1998, Karni, 1996) because it appears as more adapted to our study. Indeed, the choice-theoretic approach which is based on pairwise choices requires the embedding of beliefs in a broader model of human behavior, and we want to avoid the risk of confounding beliefs with other aspects of the decision making process. Moreover, note that in the choice-theoretic approach, the utility function as well as the beliefs, or more precisely the subjective probabilities, are theoretical constructs inferred from the decision maker's choice behavior. They do not necessarily exist in the mind of the decision maker, whose intuition is assumed to apply only to choices among alternative courses of action, and therefore do not correspond to a concept of individual "beliefs" and pessimism, which is the purpose of our study. We think that the verbal expression of beliefs is valuable, if applied to simple circumstances in which it is reasonable to expect truthful answers, which is the case for the questions

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[1]This does not mean that the verbally expressed individual beliefs are independent of any decision choice. As noted by Karni (1996), the two notions of individual beliefs, in the choice-theoretic approach and in the intuitive approach, are equivalent as soon as we consider that the utility function is state independent.

4

of our survey. Notice that a great number of empirical studies, aiming at eliciting some dose of pessimism/optimism in the forecasts of individuals in investment-like situations, also rely on the verbal expression of expectations.

Our data, based on a sample of 1,540 individuals, exhibit a significative level of PHIP. More precisely, the measure consists of asking people to imagine a situation where a fair coin will be tossed ten times. If a person can be thought to win or lose on each toss of the coin, the question is how many times (out of ten) does the person expect to win. The mean score we obtain is around 4. This means that in our simple lottery individuals have a higher (resp. lower) judged probability for bad (resp. good) events. It is interesting to notice that if there is no gain associated to the coin tossing, then the average answer is 5, as expected which would mean that the exhibited pessimistic bias can not be explained by a wrong elementary probability inference.

Our results are very different from the results obtained in psychology, with the usual notions of personal and general pessimism. However, we show that the pure-hazard introspective pessimism is positively correlated with the usual notions of pessimism in psychology, and more particularly with the notion of personal pessimism.

As far as the link between pure-hazard introspective pessimism and other demographic variables is concerned, we observe that in our survey women are more pessimistic than men. Besides, there is a strong link between PHIP and individual characteristics such as income, and age.

The paper is organized as follows. We start in Section 2 by presenting the survey instrument. Section 3 is devoted to the notion of "pure-hazard introspective pessimism" and we relate it to the different notions of pessimism and the different approaches previously adopted in the literature. Section 4 deals with the results, possible interpretations and an estimation of the possible impact of this pessimistic bias on the equilibrium risk

premium.

2. Survey instrument (data collection)

The survey was conducted face-to-face in the field by professional interviewers experienced for in-person surveys. These include both undergraduate and graduate students, as well as non-students under the management of senior field work supervisors and senior staff members. Interviewers are trained in general and project-specific interviewing techniques, such as maintaining objectivity, reading questions as written, and securing respondent cooperation. Interviewers were continuously monitored during data collection for quality assurance.

The sample consists of adults, between 22 and 55 randomly chosen and yielded 1,540 responses[2]. We chose a large enough sample size in order to run cross sectional analysis.

The questionnaire consists of essentially five parts[3].

In the first part, the participant is supposed to be offered the opportunity of entering a heads or tails game in one draw where he/she wins 10 Euros if heads occur. After the first two questions that deal with the willingness to participate in a game of chance and why (religious grounds, etc.), in the third question, the individuals are asked to reveal the maximum amount that they are willing to pay in order to participate. The aim of this question is to elicit the level of individual absolute risk aversion. The data issued from this question shall not be analyzed in the present paper.

In the second part, the participant is supposed to be offered the opportunity of entering a heads or tails game in ten draws. More precisely, the coin is being tossed

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[2]We obtained similar results on smaller samples (236 individuals) of undergraduate and graduate students in management and mathematics.

[3]The whole questionnaire is available upon request.

ten times; each time heads occurs, the participant is supposed to get 10 Euros. The participant is then asked for his/her own estimation, according to his/her experience and his/her luck, of the number of times heads will occur, i.e. how many times (out of ten) he/she thinks he/she is going to win (and get the ten Euros).

The third part deals with questions as in Barsky et al. (1997) permitting to elicit the level of individual relative risk aversion. The data shall not be analyzed in the present paper.

The fourth part deals with optimism/pessimism questions as in Wenglert and Rosen (2000). The aim of this part is to analyze the correlation between our PHIP with a standard measure of pessimism in psychology. It includes 16 items concerning personal events (*I will have a happy life, I will keep my best friends,...*) and 15 items concerning general events (*there will be a third world war, the unemployment rate shall fall, life expectancy shall increase*, etc.). For each item, individuals are asked about the importance granted to the considered event (between -10 and +10), as well as its "judged" probability of occurrence (between 0 and 100). For negatively formulated questions, the participants had sometimes trouble interpreting the question about the importance granted to the event, due to the negative scaling. The interviewer then split the question into two successive ones: 1) is this event positive or negative for you (do you wish that it happens) ? and 2) how important is it for you (give an answer between 0 and 10) ?

The fifth part deals with personal questions, such as gender, age, marital status, employment status, education and income.

3. Pessimism

Before analyzing the answers to this survey, we will present the different concepts of pessimism considered in the literature and we will discuss our methodology in light of these different approaches.

In theoretical models, the notion of pessimism is related to the way a subjective distribution departs from subjective one. However, there are many ways to transform a given objective distribution into a subjective one and to define related concepts of pessimism. Common to all these notions[4] is the fact that an individual is said to be pessimistic if his subjective distribution is "less favourable" than the objective one, in the sense that it puts more (resp. less) weight on the bad (resp. good) states of the world. A typical example of a pessimistic individual is the one for which the subjective distribution of a given payoff is given by $\mathcal{N}\left(m, \sigma^2\right)$, whereas the objective distribution is given by $\mathcal{N}\left(M, \sigma^2\right)$ with $m < M$. More generally, all notions of pessimism have in common that a pessimistic transformation lowers the mean of the distribution under consideration.

From the empirical and experimental point of view, the concept of pessimism has been analyzed in relation with four different disciplinary fields : financial economics, accounting, psychology and decision theory.

In financial economics empirical studies, an individual is said to be pessimistic if

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[4]For instance, in the Subjective Expected Utility setting, Abel (2002) proposes to relate pessimism to First order Stochastic Dominance (FSD) and Jouini-Napp (2005b) propose to relate it to the Monotone Likelihood Ratio (MLR) dominance of Landsberger and Meilijson (1990), or to the central riskiness property of Gollier (1995, 1997). In Rank-Dependent Utility models, different notions of pessimism have been introduced, which correspond to a FSD shift (Chateauneuf et al., 2005), or to a MLR shift (Wakker, 2001).

his/her forecasts of given economic variables (like earnings, dividends, GDP, consumption, etc.) lie significantly below the true value. These studies focus on forecasts of "professionals" (the participants are analysts, economists from industry, government, banking, etc.) and have led to different results depending on the contexts. Fried and Givoly (1982), O'Brien (1988), Francis and Philbrick (1993), Kang et al. (1994) and Dreman and Berry (1995) provide evidence that analysts' forecasts on earnings are overly optimistic and the converse result is obtained about professional forecasts on GDP in Giordani and Söderlind (2005). However, as underlined by Schipper (1991), Mc Nichols and O'Brien (1997), Abarbanell and Lehavy (2001), Darrough and Russell (2002), professionals' forecasts may be biased by environmental factors[5].

Since our aim is to evaluate optimism/pessimism caused by human biases that might be typical of all economic agents, we have chosen to adopt a survey based on hypothetical scenarios in order to avoid environmental effects like the insider bias effect of analysts. Indeed, with hypothetical questions, environmental factors and incentives (e.g. unique to analysts) are absent and human psychological bias is more clearly evident.

In accounting, Affleck-Graves et al. (1990), Maines and Hand (1996), Calegari and Fargher (1997) and Gillette et al. (1999) designed experimental studies in order to identify possible sources of forecasts bias. Subjects are given, in varying contexts, a certain number of data on the EPS or dividends of a given asset and are asked to forecast the next EPS or the next dividends. The framework is compatible with our notion of pessimism as a transformation of a given distribution. However, the approach

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[5]For example, it has been advocated that many analysts are employed by brokerage firms, so forecast optimism is consistent with their incentives to promote the purchase of stock or maintain access to top executives at the firms they follow. More recently, the positive bias in analysts' forecasts have been associated with Kahneman and Lovallo's (1993) insider bias (e.g., Darrough and Russell, 2000).

and the aims of these different papers are quite different from ours. Indeed, these papers aim at measuring individuals' ability to forecast or at analyzing how individuals react to the release of information. Hence the adopted approach is not suitable in order to measure what we refer to as pessimism. These authors find that the forecasts exhibit significant positive bias and conclude that there is an optimism bias. But from our point of view and let aside the problem that the random variable to be forecasted is too complex, these data do not correspond to something owned by the participants, high values for the next EPS are neither "good" nor "bad" for the respondent, and henceforth the prediction errors can not be considered as a measure of the degree of optimism or pessimism. They only reflect the way individuals extrapolate future terms of a partially observed series of numbers.

For our purpose, the pessimism measure should lead to consider as optimistic individuals that overweight "good" states of the world and underweight "bad" states of the world. This means that one has to set up lotteries in which some states are identified as unambiguously good (resp. some others as unambiguously bad) and clearly correspond to good (resp. bad) outcomes for the individual.

In psychology, the notion of pessimism is much more general than in the previously mentioned financial economics and accounting papers. A first set of measures, initiated by Youmans (1961), is based on the definition of optimism and pessimism as reflecting positive and negative outcome expectancies. In this spirit, one of the most popular measures is Scheier and Carver's (1985) Life Orientation Test (LOT)[6]. Typical questions include "*In uncertain times, I usually expect the best*" or "*If something can go wrong for me, it will*". Respondents are asked to rate the extent of their agreement with these items. In contrast to expectancy-based measures, attributional measures, like Peterson

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[6]as well as its derived versions (ELOT, Chang et al.,1997, LOT-R, Scheier et al., 1994)

et al.'s (1982) Attributional Style Questionnaire (ASQ) (see also Peterson and Villanova, 1988) provide a more indirect assessment of optimism and pessimism; for each event (e.g., "*you have been looking for a job unsuccessfully for some time*"), respondents are asked to write down one major cause for why that event occurred. Individuals who perceive that good things happen to them because of internal, stable and global factors are considered to have an optimistic explanatory style.

Wenglert and Rosen (2000) measured optimism through answers to questions about personal life (20 questions) as well as the world in general (20 questions). In each group of questions, half of the questions were associated to "good" (resp. "bad") events that might occur in the future. Participants are asked about the "judged" probability of occurrence and about a measure of the importance granted to the considered event. Typical questions are "*do you think that you will have a happy life ?*" or "*do you think there will be a third world war in the next thirty years ?*". The correlation between "judged" probability of occurrence and importance measures the level of optimism. Focusing on each group of questions, one obtains a measure of personal optimism as well as a measure of general optimism. The authors obtain an average level of personal optimism of 0.596 and an average level of general optimism of 0.336. They also obtain that women are more pessimistic than men.

This approach has the following advantages. It considers pessimism as an individual characteristics and the introduction of the questions on the importance granted to the event permits to measure it in a context that is directly related to the individual. Besides, it is interesting to be able to distinguish between personal and general pessimism. However, from our point of view, an important drawback of these psychological approaches is that they are not rigorously linked to the concept of pessimism in financial or economic theory, which, as seen above, is related to the transformation of an

11

objective distribution. Moreover, it seems that other feelings than optimism/pessimism interfere when one is to answer a question like "*do you think you will have a happy life ?*". Indeed, among others, self esteem, pride, etc. might bias the answer.

This is why we need an approach that leads to a *direct* measure of the level of optimism/pessimism and that does not involve other individual characteristics or feelings like overconfidence, self-esteem, loss aversion, risk aversion, regret, doubt, etc. Furthermore questions on lotteries, instead of life in general, seem to be more adapted to our purpose since our aim is to determine if pessimism affects investors beliefs and how in a financial or economic framework and lotteries are usually considered as a simple way to model financial investment opportunities.

Finally, even if we are not in the same theoretical framework, we have to mention experimental studies initiated by Tversky-Kahneman (1992)[7] in order to calibrate models of Prospect Theory and to determine the shape of the probability weighting function. They all agree on an inverse S-shaped probability weighting function, which means that it overweights unlikely (extreme) outcomes and underweights outcomes with a medium or large probability relative to the objective probability. To our knowledge, no clear-cut conclusion has been drawn regarding pessimism.

In order to get rid of these overweighting and underweighting effects and to focus on the concept of pessimism itself, we need a lottery with equiprobable outcomes.

To summarize, one would need a questionnaire based on a hypothetical lottery with equiprobable outcomes and for which some outcomes are identified as unambiguously good for the individual (resp. some others as unambiguously bad).

According to these constraints, we chose the following simple question "what is your

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[7] See also Camerer-Ho (1994), Wu-Gonzalez (1996) and Gonzalez-Wu (1999) in a parametric setting and Prelec (1998), Bleichrodt-Pinto (2000) and Abdellaoui (2000) in a nonparametric setting.

own estimation, according to your experience and your luck, of the number of times heads will occur, i.e. how many times (out of ten) do you think you are going to win (and get the ten Euros)?".

This question will permit to have a direct measure of the degree of pessimism/optimism of the individual in a financial gains context. The event "heads occurs" corresponds to a gain for the individual, it is therefore legitimate to consider it as a good event for the individual and the subjective probability associated to this event as a measure of the individual optimism. Such a measure of Pure-Hazard Introspective Pessimism can be directly estimated by the number of times $x_i \in \{0, ..., 10\}$ that the individual i thinks he is going to win (the subjective probability that the individual associates to the event "heads occurs" is then given by $\pi_i = \frac{x_i}{10}$). Indeed, a pessimistic individual shall be characterized by a value of x_i below the objective value of 5 and the distance to 5 measures the intensity of his PHIP ($o_i = \frac{x_i - 5}{5}$).

This simple lottery has also other advantages. First, in the simple context of a unique binary lottery, all decision theory models can be reduced to the choice of a given subjective probability and all concepts of pessimism (as well as all concepts of dominance) are equivalent. This means that we need not adopt a specific model nor a specific concept of pessimism in order to elicit the presence of pessimism in individual beliefs. Second, the introduction of the ten times procedure is intended to provide the individuals with a simple framework, helping them to reveal their subjective probability associated to the event "heads occurs". However, the framework is simple enough in order to maximize transparency and cognitive ease for the subjects. Therefore, divergence among agents cannot result from a divergent understanding of the framework. All agents should have the same understanding of the situation and their answers ought to differ only through different psychological evaluations of the probabilities. Besides, we

refer to real life experiences (heads or tails) and we do not define the lotteries by the explicit distribution of the payoffs, in order to let room for free interpretation.

Note that the respondents do not have monetary incentives when answering the questions, as is often the case in experiments. This can be seen as a drawback of our method of data collection; because respondents are not staking actual funds on the investment, there is no way to reliably assess whether their actual behaviour would mimic their answers. This applies equally well of course to all previous studies using survey questions involving thought experiments. Fortunately, however, there is evidence (see for instance Beattie and Loomes (1997) and Camerer and Hogarth (1999)) that for simple (choice) problems respondents do not need real incentives to reveal their preferences. Camerer and Hogarth (1999) present a theory describing when payments can be expected to make a large difference and when not. The main conclusion is that payments increase the effort that is made by the respondent. This can be highly relevant for complex or tedious tasks, but our respondents are only presented with a short and very simple questionnaire on lotteries. It does not seem that our respondents are bored or disinterested, so the need for increasing their effort by monetary incentives is only small. Finally, there is in our framework a specific problem linked to financial incentives. Indeed, since the focus of our study is the elicitation of individual beliefs, the reward should be related to the accuracy of the predictions. Now, either the participants are confronted with "real lotteries", which means that they truly receive the outcomes, but in this case, payments for correct forecasts could generate diversification behaviour: for instance, in our heads or tails setting, people expecting the best (heads will occur) will forecast the worst (tails) in order to win money in both cases (the good outcome if heads occurs and the reward for the correct forecast if tails occurs) even if they believe that heads will occur. The answers would then involve pessimism as well as risk aversion (or

14

utility curvature), and, as we have already underlined it, this is what we want to avoid. Another possibility would be to confront the participants with hypothetical scenarios and to only reward the question on their beliefs, but in such a situation, it is likely that participants would tend to focus on the rewarded task, which is the accuracy of the prediction and would tend to neglect the lottery itself so that the "good" outcome would not be felt as good anymore by the participants and, like in the experimental studies (Affleck-Graves et al. (1990) and others), the approach would not be suitable to elicit pessimism.

As mentioned in e.g. Hartog et al. (2002), there is a special problem linked to non-response and response with zero "judged" probability of winning. Indeed, zero "judged" probability of winning can truly reflect strong pessimism but it can also signal that the individual refuses, on ideological or religious grounds, to participate in the imaginary lottery. To avoid this problem, we have started our survey by asking the individuals whether they are willing to participate in a game of chance.

We also adopted in the survey an approach similar to Wenglert and Rosen (2000) in order to compare our results with previous ones obtained in the psychological literature.

4. The results, possible interpretations and applications

We are interested in the notion of PHIP itself (the distribution among individuals, the mean, standard deviation,...), in its links with other demographic variables, such as gender, income, age, etc. as well as in its links with other notions of pessimism already introduced in the psychological literature (personal, general).

4.1. Pure-Hazard Introspective Pessimism (PHIP)

Figure 1 illustrates the distribution of our measure of optimism among individuals.
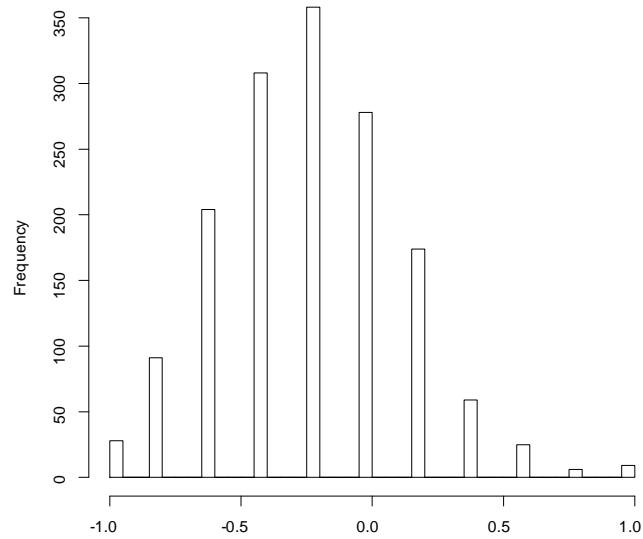

Figure 1: Distribution of PHIP

We can first observe that there is a great heterogeneity in the level of pessimism among agents.

This result is consistent with Gillette et al. (1999) and other previous experimental studies, according to which there is some heterogeneity in subjective expectations, even though the individuals have access to the same public information (in our setting, the distribution of the random payments); this heterogeneity comes from a different sub-

jective processing of information. In Gillette et al. (1999), this different processing of information in a dynamic setting is linked to heuristics like the anchoring effect or the gambler's fallacy. In empirical studies on professional forecasts, it is linked, as we have underlined it, to the insider bias. In our context, the questionnaire has been designed in order to avoid all these effects and the pessimism seems then to be a primitive individual characteristics. It would be interesting to analyze the origin of such a behavioral pessimism through psychological studies.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Std Dev.
-1,000	-0,400	-0,200	-0,215	0,000	1,000	0,352

Table 1: Descriptive statistics of PHIP

For the considered sample of 1,540 individuals, the mean value for the measure of optimism is equal to -0.215 (Table 1). Equivalently, the mean value for the number of times the individual thinks he is going to win is equal to 3.925 or the mean subjective probability is equal to 0.3925. It is significant and quite striking to observe that when asked about how many times he/she is going to win at a heads or tails game in ten draws, an average individual does not answer 5 times as he/she should if thinking under the objective probability, but answers slightly less than 4 times. This means that, with our notion of pure-hazard introspective pessimism, the individuals in our sample are on average pessimistic. This result is in favour of the existence of a behavioral bias towards pessimism in individual beliefs. The same results have been obtained on a sample of undergraduate and graduate students in management and mathematics (236 individuals). Notice that when individuals are asked[8] about the number of times (out of ten) they think "heads" will occur without associated gains, the average answer is 5

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[8] The sample for this observation is different from the initial one and much smaller.

as expected and 90% of the answers are exactly 5. This would mean that our results are not related to numerical skills or to knowledge of elementary probability.

The result on the average level of pessimism is significantly different from empirical studies on analysts' earnings forecasts. However, as we have seen above, there are many convincing possible explanations to account for an optimism bias in earnings forecasts, specific to analysts (Schipper, 1991, Mc Nichols and O'Brien, 1997, Abarbanell and Lehavy, 2001, Darrough and Russell, 2002). Our result is nevertheless consistent with Giordani and Söderlind (2005), who do not deal with earnings but with variables for which the previous bias does not hold.

There is no evidence of pessimism in Affleck-Graves et al. (1990), Maines and Hand (1996), Calegari and Fargher (1997) and Gillette et al. (1999) but, as we have underlined it, this is not surprising since the experiments are not designed to measure optimism/pessimism in our sense. However, it is interesting to notice that in these experiments, the forecasts are more pessimistic in the market sessions where the agents hold the asset and receive the corresponding dividends than in the non-market sessions, which can be interpreted as reflecting some form of pessimism in our sense. Moreover, in Stevens and Williams (2003), it is shown that individuals systematically underreact to positive and negative information and that the underreaction is greater for positive information than negative information, which can also be interpreted as some form of pessimism. This is also confirmed by Taylor (1991), who finds that "negative information is weighted more heavily than positive information". Notice that such a behaviour could possibly account for the presence of some pure-hazard introspective pessimism in individual beliefs. In other words, pessimistic individuals in our survey would be those who put more weight on all the times they have lost at heads or tails than on the times they have won.
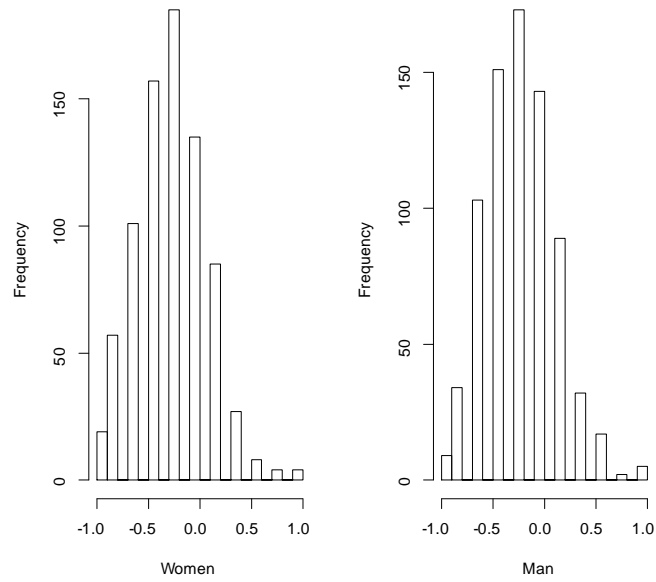
4.2. Cross-sectional analysis of PHIP

Figure 2: Distribution of PHIP by gender

Pessimism and gender. The average level of pessimism is equal to -0.237 (3.815) for women and -0.192 (4.04) for men, hence women in our sample and for our notion of pessimism, are more pessimistic than men. This is confirmed by a Wilcoxon test ($W = 2.8 \times 10^5$; $p\text{-}value = 1\% < 5\%$).

Pessimism and age. By sorting the individuals into age classes, and by computing the average value for our measure of pessimism for each class, we obtain the following

results, which show a decreasing relationship between optimism and age (Table 2). Spearman's and Kendall's tests confirm a decreasing relation, even though the Rhô and the Tau are small ($S = 6.7 \times 10^8$, $Rh\hat{o}=-0.08$, $p-value = 0.01$[9] and $Z = -3.6, Tau = -0.06$, $p-value = 10^{-4}$).

Age Band	$(0, 25]$	$(25, 30]$	$(30, 35]$	$(35, 40]$	$(40, 45]$	$(45, 50]$
Mean	-0,1497	-0,1919	-0,2280	-0,245	-0,227	-0,248
Median	-0,200	-0,200	-0,200	-0,200	-0,200	-0,200
Min.	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Max.	1,000	1,000	1,000	1,000	0,800	1,000
Std Dev.	0,395	0,362	0,359	0,328	0,324	0,331
N° of Obs.	191	372	292	289	230	166

Table 2: PHIP and age

Pessimism and income. As far as income is concerned, our initial sample is slightly modified (from 1,540 to 1,328 individuals) since some individuals refused to answer (74) and this data is missing for some others (138). We divide our sample of 1,328 individuals into 7 income classes leading to the following results.

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[9] The alternative hypotheses are such that Tau and Rhô are negative.

Income	≤ 200	$(200,400]$	$(400,600]$	$(600,800]$	$(800,1000]$	$(1000,1500]$	>1500
Mean	-0,295	-0,320	-0,233	-0,187	-0,231	-0,200	-0,207
Median	-0,200	-0,200	-0,200	-0,200	-0,200	-0,200	-0,200
Min.	-0,800	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Max.	0,400	0,400	0,800	1,000	0,600	0,800	1,000
Std Dev.	0,315	0,305	0,337	0,363	0,308	0,374	0,401
N$^{\circ}$ of Obs.	19	160	317	402	229	74	53

Table 3: PHIP and income

The Kruskall Wallis test indicates that these variables are linked ($KW = 14, df = 6$, $p-value = 3\%$). It seems on the means by class that there is an increasing relationship between pessimism and income.

It is interesting to notice that our measure of pessimism has the properties usually granted to risk aversion, i.e., it is greater for women than for men, it increases with age and decreases with income.

4.3. PHIP, personal pessimism and general pessimism

For our considered sample of 1,540 individuals, the respondents exhibit personal optimism and are almost neutral with respect to general events (Table 4). Wenglert and Rosen (2000), that deals with a sample of 183 individuals, also obtain personal optimism, with a level of 0.596, which is almost similar to ours. They also obtain, as we do, a level of general optimism (0.336) which is lower than the level of personal optimism (0.596). The difference with our results is that they obtain general optimism whereas
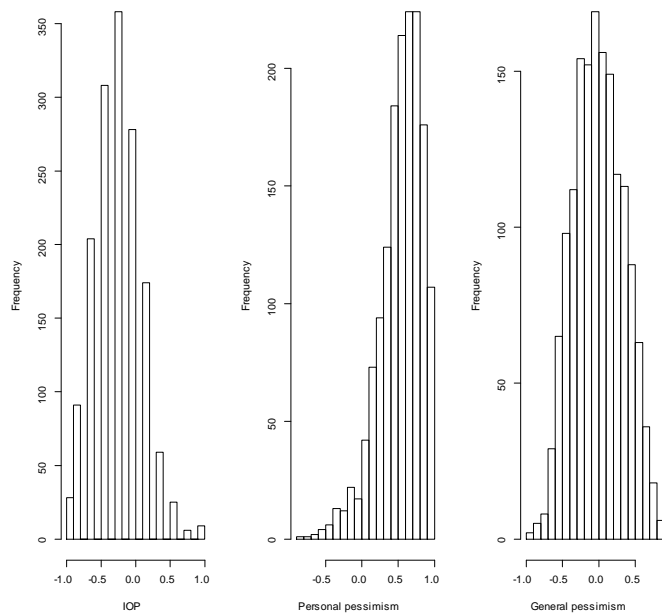
21

we obtain general neutrality.

Figure 3 : PHIP, personal pessimism and general pessimism.

	Min.	Max.	Mean	Std. Dev.
IOP	-1,000	1,000	-0,215	0,352
Personal Pessimism	-0,819	0,988	0,537	0,293
General Pessimism	-0,968	0,865	-0,004	0,342

Table 4: Descriptive statistics of PHIP, Personal Pessimism and General Pessimism

We have analyzed the link between the three different notions of pessimism, our notion of pessimism (PHIP) and the two standard notions of pesssimism in psychology (personal pessimism and general pessimism). The following Table shows that there is some increasing relationship between PHIP and personal pessimism as well as between personal and general pessimism.

	Kendall'sTau	Spearman's Rhô	Pearson Correlation
PHIP / Pers. Pessimism	$0,14^*$	$0,19^*$	$0,14^*$
PHIP / Gen. Pessimism	$-0,03$	$-0,04$	$0,03$
Pers. Pess. / Gen. Pess.	$0,11^*$	$0,17^*$	$0,21^*$

Table 5: Results of Kendall's, Spearman's and Pearson's tests. *: significatively different from 0.

Moreover, three questions in the questionnaire on personal pessimism have attracted our attention : "you have no chance to win at a lottery game" (Q1), "you have no chance to be selected for a television game" (Q2) and "you will win one day at the promo sport[10]" (Q3), since intuitively, they should have a link with our notion of PHIP.

	Kendall	Spearman	Pearson Correlation
PHIP/Q1	$-0,23^*$	$-0,30^*$	$-0,30$
PHIP/Q2	$-0,21^*$	$-0,27^*$	$-0,27$
PHIP/Q3	$0,15^*$	$0,19^*$	$0,20$

Table 6: Link between PHIP, (Q1), (Q2), (Q3).

[10]The promosport is a game of chance dealing with sport results.

23

Table 6 shows that there is a decreasing relationship between (Q1) and PHIP as well as between (Q2) and PHIP, and an increasing relationship between (Q3) and PHIP, which seems natural. However these relations are not very strong.

4.4. Impact on the risk premium

In a continuous time CCAPM model with a subjective belief, it is easy to obtain an adapted CCAPM formula that clearly reflects the impact of the representative agent's pessimism (see Jouini-Napp, 2004). The difference between the level of the Market Price of Risk in the subjective belief setting and in the standard setting is precisely given by the level of pessimism of the representative agent measured by the deviation in mean, in units of standard deviation, of the aggregate wealth instantaneous growth rate. The presence of pessimism increases then the market price of risk and might contribute to giving explanations to the risk premium puzzle. The interpretation of this result is the following. The representative agent's pessimism leads him/her to underestimate the average rate of return of equity leaving unchanged his/her estimation of the risk free rate. Thus, the objective expectation of the MPR is greater than the representative agent's subjective expectation hence is greater than the standard MPR.

In our survey, we obtained that the average subjective probability of the "good state" is $\pi \approx 0.3925$. It is easy to see that for the considered lottery the deviation in mean, in units of standard deviation, of the expected gain is equal to -0.215. This implies that for an asset whose volatility is 15%, the (theoretical) equilibrium risk premium is increased by approximately 3.2% in the subjective beliefs setting compared to the standard setting. Implicit in our calibration is the idea that the individual cognitive bias, when facing a pure hazard situation, is characterized by the deviation in mean, in units of standard deviation, independently of the specific frameworks.

For a GDP growth volatility of around 1.5%, our level of pessimism is equivalent to an underestimation of the GDP growth level of approximately 0.32%. Giodarni and Söderlind (2005), for the 1982-2002 sample, obtain that professionals participating in the Survey of Professional Forecasters underestimate the GDP growth by 0.64% on average (which is greater than our 0.32%). Nevertheless,when they consider the period 1972-2002, the underestimation of the GDP is of 0.2% on average (which is lower than our 0.32%). Moreover, this implies that on the period 1972-1982, the forecasters have overestimated the GDP growth by 0.68% It seems therefore difficult to draw conclusions on the level of pessimism from such empirical studies, since the results are apparently highly dependent upon the considered period and the environmental factors.

Our results seem to show that there is a persistent behavioral pessimistic bias, which should not depend upon the environment and that this bias has a significant impact on the equilibrium risk premium.

5. Conclusion

In this paper, we have shown that there is a pessimistic behavioral bias in individual beliefs in a lottery context and we have denoted it by pure-hazard introspective pessimism (PHIP). The very simple lottery we adopted in the survey has permitted to show the presence of pessimism without having to refer to a specific decision-theoretical model. The concept of PHIP is different from the concepts of personal and general pessimism previously introduced in the psychology literature even if there is a significant link between all these concepts. We have obtained with our notion of pessimism that men are less pessimistic than women and that the level of pessimism increases with age and decreases with income.

When embedded in a capital markets equilibrium framework, pessimism has a direct impact on the equilibrium risk premium, as shown by Abel (2002) and Jouini-Napp (2004, 2005a). The survey we conducted permits to calibrate this impact.

It is a delicate question to identify the origin of the elicited pessimism. The observed pessimism might result from an individual learning process, where indiduals overestimate bad experiences (see Taylor, 1991). Another possible partial explanation might come from the fact that people are used, with casinos and national lotteries, to getting less than the theoretical average gain in pure hazard games, which leads them to systematically underestimate their probability of success. Finally, people seem to be regret averse in their choices (Joseph et al., 1996, Ritov, 1996). Regret avoidance may reflect a self deception mechanism designed to protect self esteem about decision making ability, i.e. a calculated avoidance of unpleasant future feelings. The elicited pessimism could be interpreted as defensive pessimism, an anticipatory strategy that involves setting defensively low expectations prior to entering a situation so as to defend against loss of self esteem in the event of failure.

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