



**Bureau
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(BETA)**
UMR 7522

Documents de travail

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EXPLAIN OVERCONFIDENCE AND RISK
TAKING?
A Field Experiment »**

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Document de Travail n° 2016 – 11

Février 2016

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DO SELF-THEORIES ON INTELLIGENCE EXPLAIN OVERCONFIDENCE AND RISK TAKING?

A Field Experiment¹

Bertrand KOEBEL², André SCHMITT³ and Sandrine SPAETER⁴

ABSTRACT

Self-theories deal with how an individual perceives some of her attributes such as intelligence. People endorse basically one of two theories: growth mindset people think that intelligence can be developed (incremental theory) whereas fixed mindset people believe that intelligence is a fixed trait (entity theory). These theories play an important role on motivation and achievement as shown by Carol Dweck's life-long research. They also impact self-assessment accuracy since fixed mindsets are much more imprecise in estimating their own ability. In behavioral economics, overconfidence is shown to play an important role in individual's preferences and choices. In this paper, we conducted a field experiment to investigate whether self-theories impact overconfidence. Early career Vietnamese executives pursuing an MBA were incentivized. Our sample of managers and professionals controls for a wide range of corporate and demographic variables. The main result of our paper is that self-theories impact overconfidence when taking into account income. As in previous studies, we also find that subjects exhibit significant absolute overconfidence. Gender does not have any impact on overconfidence. We also tested the relationships between self-theories and risk taking.

Keywords: self-theories; overconfidence; experiment; mindset; risk-taking.

JEL classification: C93, D81

I. INTRODUCTION

Traditional theoretical decision models in economics and finance have been revisited in order to take into account the individuals' psychological characteristics in their evaluation and decision process. Behavioral economics and behavioral finance borrow concepts and methodologies from psychology when attempting to explain the deviations from standard economic or finance models (expected utility, CAPM for instance). In particular, in financial decisions the principal reasons for deviation quoted in the literature are relative to mental accounting, heuristic simplification, peer effects, dispositional effects, self-deception, and overconfidence.

¹ We would like to thank two anonymous referees for their numerous and useful comments, Valentina Rotondi for assisting us in the experiments, and Mathieu Lefebvre for his valuable remarks on an earlier version. Participants at the 5th Annual Meeting of the French Experimental Economics Association in May 2014 in Besançon, at the annual *Journées de Microéconomie Appliquée* in June 2015 in Montpellier and at the Journées du BETA in Nancy in March 2015 are also acknowledged for comments.

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Overconfidence is a main trait that has been extensively studied in psychology research. Its manifestations include miscalibration, better-than-average effect, illusion of control and unrealistic optimism (Skala, 2008). Behavioral finance and economics have established that it has significant impacts on agents' decisions. For instance in finance, because of overconfidence, investors trade more frequently without an increase in wealth, invest in more risky assets and under diversify their portfolio (Barber, 1999 ; Barber and Odean, 2001).

What explains overconfidence? One main factor is the illusion of knowledge which refers to the tendency of people that accuracy increases with more information (Peterson and Pitz, 1988). Illusion of control can also explain it. People tend to overestimate their capacity to control events and even to believe that they influence uncontrollable events (Presson and Benassi, 1996). In our paper, we test an alternative explanation based on self-theories. We investigate whether overconfidence is impacted by the way people perceive their intelligence.

Our study draws on Carol Dweck's lifelong research on self-theories on intelligence (for an overview see Bandura and Dweck, 1981; Dweck and Legett, 1988; or Dweck and Molden, 2005). Self-theories⁵ deal with how people think about themselves and how these self-theories create their psychological worlds, shaping thoughts, feelings and behaviors. Self-theories can be measured on a wide range of attributes such as intelligence, personality or moral character. In our research, we will focus on one attribute which is intelligence.

Self-theories explain how people perceive intelligence. The question is not about the innate/cultural share of intelligence, but how people perceive their intelligence (Dweck, 2000):

1. Do people believe that their intelligence is a fixed trait? If so, people have developed a "fixed mindset" which reflects an "entity" theory.
2. Do people think that intelligence is a malleable quality that they can cultivate? If so, people have acquired a "growth mindset" and believe in an "incremental" theory.

While many studies show that people are poor at estimating their own abilities (read for instance Robins and John (1997)), Dweck (2008) has established that "it was those with the fixed-mindset who accounted for most of the inaccuracy". Indeed, people who believe that intelligence can be developed, take into account much more information and feedback, even if it is unflattering, to estimate their abilities. Conversely, fixed-mindsets have a predetermined idea about their intelligence. Any negative feedback is dismissed whereas positive feedback is perceived as a mere confirmation. All in all, we expect that growth mindsets have a less distorted view of their abilities and thus impact overconfidence.

We conducted an experiment in the two major cities of Vietnam: Hanoi and Ho Chi Minh City. All decisions and choices taken by young Vietnamese executives were financially incentivized. Our sample of managers and professionals controls for a wide range of corporate and demographic variables including income, marital status, sector of activity and years of experience. We administered a specific questionnaire to elicit individuals' degree of overconfidence. The objective was to link their degree of overconfidence to their perception of their type of mindset and to their risk-taking decisions.

Because this study is at the crossroads of two research areas, the general methodology can be divided in two main steps. First, we measure respondents' mindsets using a questionnaire on their implicit theories. Then we experimentally test for overconfidence. This combination determines the subjects' mindset and their level of overconfidence in order to test whether differences in implicit theories could explain differences in overconfidence levels.

⁵ In social psychology, researchers also call self-theories implicit theories.

Our main result is that self-theories impact overconfidence when we take into account income. We show that linearity in mindset is statistically rejected against this quadratic specification. Even though the distribution of overconfidence is less dispersed for growth mindsets than for fixed mindsets as we predicted, the difference is not significant. As in previous studies, we also find that subjects exhibit significant absolute overconfidence. However, gender does not have any impact on overconfidence but cultural differences may matter. Furthermore, self-theories have a significant impact on risk taking.

The paper is organized as follows. Section II presents self-theories and links them to overconfidence and risk-taking. Section III describes the experimental design. Descriptive statistics on the sample, on measures of mindsets and on levels of overconfidence are proposed in Section IV. In section V, we test and discuss the main hypotheses regarding the relationships between self-theories, overconfidence and also risk taking. Section VI concludes.

II. ABOUT SELF-THEORIES, OVERCONFIDENCE AND RISK TAKING

Self-theories on intelligence

“Self-theories are people’s beliefs about the fixedness or malleability of their personal qualities, such as their intelligence”⁶. If you believe that intelligence is a fixed trait and that you cannot do much to change it, you have a “fixed mindset” and endorse the “entity theory”. If you believe that intelligence is a malleable quality that can be developed through effort and learning, you have a “growth mindset” and endorse the “incremental theory”. In social psychology research, these categories are measured by asking questions like “You have a certain amount of intelligence, and you cannot really do much to change it”⁷. Empirical surveys found that 40% of people tend to endorse the incremental theory, 40% the entity theory and 20% are undecided.

Many papers have shown that self-theories on intelligence are at the root of many other factors including our motivation for learning, strategies that we implement after setbacks, effort perception and effects on attribution (for some early references see Legett and Dweck, 1986; Mueller and Dweck, 1997; Rhodewalt, 1994; Zhao, Dweck and Mueller, 1998). “Growth mindset” people are learning oriented rather than performance oriented, implement efficient strategies to overcome setbacks, attribute failure to lack of effort or inappropriate strategies and evaluate more precisely their strengths and weaknesses. In contrast, people with a “fixed mindset” try to validate their intelligence through their performance and are more easily diverted from learning, consider effort as negative, and see setbacks as a sign of lack of ability (Dweck and Molden, 2007).

These mindsets are developed from our early education. Children are sensitive to their parents’ judgment and messages praising intelligence induce fixed-mindset while messages praising efforts induce growth mindsets. Because early education tends to be deeply ingrained, mindsets tend to be stable through time and are already set at an early age (Smiley and Dweck, 1994, for instance). This justifies that, in our study, self-theories are the explanatory variables and that endogeneity issues are circumvented.

⁶ Dweck and Molden (2007)

⁷ Read section 1 of appendix B for a sample of questions to measure self-theories.

All in all, self-theories lead to very different “meaning systems”. The learning orientation of growth mindsets translates in interpreting correctly sources of mistakes and implementing the right strategies to overcome them. Fixed mindsets tend to be much more inclined towards competence validation. For them, negative outcomes are attributed to a lack of competence and not a lack of effort or inadequate learning strategies. Hence, growth mindsets take into account most of the feedback whereas fixed mindsets base their judgment on a much narrower set of information.

Thus, self-insight grows out from self-theories. It is not surprising that fixed-mindsets are much more inaccurate when estimating others’ abilities and their own abilities (Butler, 2000). Self-assessment accuracy which depends on the individual’s self-theory endorsed might in turn induce different level of overconfidence. We expect fixed mindsets to have a higher distortion of their ability estimation than growth mindsets.

Overconfidence

In psychology, overconfidence has several extensions and interpretations: miscalibration and positive illusions are among the most studied ones. Miscalibration refers to the difference between the accuracy rate to a set of questions and an assigned probability of correct answers. Positive illusion can take the forms of the better-than average effect, which comes from an unrealistic positive of oneself compared to the others (Skala, 2008).⁸

Bernardo and Welsch (2001) focus on the overconfidence of firm-managers, while Camerer and Lovo (1999) consider the willingness to enter into competitive markets and overconfidence. The existence of overconfidence on financial markets and its impact on prices and corporate behaviors has been widely investigated, especially through experiments (Glazer and Weber, 2007; Biais et al. 2005; Odean and Barber, 2001). One important result is that overconfident investors trade more, although their portfolio does not perform better than others. Barber and Odean (2000) studied this issue by classifying portfolio performance of individual investors (households) according to portfolio turnover over a six-year period. Active portfolio management should be based on superior information gathering and interpretation to be successful. However, when taking into account transactions fees to compute the net return, the more passive the portfolio the better the return. Buy and hold strategies clearly outperform all active strategies. By referring to theoretical models that take into account overconfidence (as for instance Odean, 1999), Barber and Odean argue that excessive trade (or turnover) can be explained by this psychological bias. Nevertheless, the link between turnover and overconfidence is not tested in their study. Glaser and Weber (2007) have confirmed that active portfolio management is linked to overconfidence: an online questionnaire on investors’ level of confidence showed that more confident investors traded more without performing better.

When applied to economic or financial decisions, overconfidence refers usually to an overestimation of one’s knowledge and, thus, of our knowledge compared to the others’ knowledge. Indeed, “believing we know more than we truly know” and “believing we are better than others” are merged in the financial and economic literature, while psychologists keep the difference as a research topic (Skala, 2008).

⁸ Optimism is another form of positive illusion. Either it may come from a misrepresentation by the individual of how he believes he will perform (overconfidence), or it is an intrinsic characteristic of individuals’ preferences (optimism as opposed to pessimism). Both induce probability weighting: an optimistic individual may over-evaluate probabilities of high stakes.

In our paper, we provide two distinct measures of overconfidence as in Ifcher and Zarghamee (2014). Our measure of absolute overconfidence is computed as the difference between estimated correct answers and actual correct answers to a quiz. The measure of relative overconfidence we provide compares the subjects' performance to their subjective view of other subjects' performance. Hence, we provide simultaneously measures of miscalibration and better-than-average effect.

Risk taking

In this paper, we wanted to link individuals' overconfidence to their perception of their type of mindset and, if possible, to their risk-taking decisions. To do so, we also implemented lotteries choice in the vein of Holt and Laury (2001). Nevertheless, it is important to note that we do not elicit risk attitudes. We only focus on risk taking. Our aim is to obtain some additional information about simple decisions that they have to take in a two lotteries choice game. The risk attitude is not measured in this experiment, but risk-taking, overconfidence and mindset are.

Many papers deal with the link between overconfidence and risk taking in behavioral economics & finance (see for instance Odean 1999, Kent and al. 2001, Barber and Odean 2001, Statman and al. 2006, Glaser and Weber 2007). Several economic experiments were conducted in order not only to identify this bias but also to test whether it is more or less pronounced with regard to gender, experience or the professional variables (see Heath and Tversky (1991), Frascara (1999), Locke and Mann (2001), Christoffersen and Sarkissian (2002), Kirchler and Maciejovsky (2002)).

To our knowledge, no experiment in finance and economics has tested the potential link between over-confidence, risk-taking and people's mindset. In the meantime, psychological studies have shown that the way individuals perceive their mindset has a significant effect on their behavior.

III. EXPERIMENTAL DESIGN

The experiment took place in Vietnam, respectively in Ho Chi Minh City and in Hanoi in January 2014. All subjects have a full-time career.⁹ The experimental procedure was as follows. First, the experimenter distributed the instructions manual (enclosed in Appendix A). Subjects read the manual and the experimenter read it aloud as well and told subjects to ask any questions that would be helpful in clarifying the experimental procedure. Second, subjects read and signed the letter of consent. Third, sections 1 to 3 of the questionnaire/experiment were distributed. The first two sections measure the implicit theories and the risk taking attitudes of the subjects. Section 3 is a general knowledge trivia quiz with 20 questions. These 3 sections were collected after completion. Fourth, sections 4 and 5 of the questionnaire were handed over. Section 4 is a performance self-evaluation based on the quiz of section 3. This section provides measures of overconfidence. Section 5 collects demographic data. Fifth, lotteries were drawn to compute rewards from section 2 in front of all subjects. Sixth, subjects were paid according to their answers to sections 2, 3 and 4 of the questionnaire/experiment and they signed the certificates of payment.

Subjects

The experiment was conducted in Vietnam at the Centre Franco-Vietnamien de formation à la Gestion (CFVG) in Hanoi on January 11, 2014 and in Ho Chi Minh City on January 18, 2014. CFVG is a nonprofit business school operating in Vietnam since 1992. It was created by the Vietnamese

⁹ More details are given in the next section.

government and the French Ministry of Foreign Affairs and is operated by the Paris Chamber of Commerce and Industry (CCIP). It trains yearly about 600 students. They study on evenings and weekends and most have a full-time job.

All participants to our questionnaire/experiment attended the “financial markets” course in the second year of the MBA program. Prospective subjects were told that participation would yield an average profit of 250,000 VND (roughly 11.85 US\$), which is equivalent to 23.35 US \$ using the purchasing power parity exchange rate. 81 Asian students from the MBA program participated voluntarily to the experiment (80 were Vietnamese and one Indian)¹⁰. They are all part-time students and have a full-time career. The average years of professional experience is close to 6 years.

Measure of self- theories

Social psychologists have implemented many different questionnaires to scale implicit theories. Two main distinctions have been established: Self-theories vs. Other Theories, and Domain-specific vs. Domain-general Implicit Theories (Dweck, 2000). The “self” form is used to predict what respondents think about their own intelligence or personality. The “other” form asks them about people in general. As our goal is to link these theories to individual portfolio management behavior, the “self” form is appropriate.

Implicit theories measures can be domain-general (the “kind of person” theories) or can be applied to specific attributes like intelligence, personality or morality. Domain-general questionnaires are most appropriate when judgment or behavior are based on several attributes as for instance when studying stereotypes and their origins. Our purpose is to study the impact of mindset on overconfidence and on financial risk taking. Since intelligence can be defined as the ability to adapt to the environment and to process information adequately, we chose to measure implicit theories on intelligence. Besides, overconfidence comes from the illusion of knowledge and the illusion of control (Statman, Thorley and Vorkink, 2006; Nofsinger, 2011). Among other factors, investors’ confidence increases with the amount of information they receive.

The literature in psychology shows that fixed-entity people are much more sensitive to other’s judgement and hence more performance oriented (Stone (1998)). They are also less emotionally stable. For instance, they are much more depressed after a failure since they are more likely to see failure as a measure of the self (Zhao, Dweck, Mueller, 1998). In turn, there objectivity is more altered which induces a less precise evaluation of their own performance. Nevertheless, no study focuses on the direct, potential, relation between this misperception of their own capacity and overconfidence/lack of confidence. In this paper, we test this relationship in the frame of experimental economics. More precisely, we test the impact of mindset on overconfidence, thus causality and not merely correlation. The issue of endogeneity is discussed in the next section.

Questionnaires can include “entity” theory items as defined in the introduction (endorsed by fixed mindset people), “incremental” theory items (endorsed by growth mindset people) or a mixture of both. Although, previous research has shown that disagreement with entity theory is strongly correlated with agreement with incremental theory, including only incremental theory items can introduce some social desirability bias (Hong, Chiu, Dweck, Sacks, 1997); i.e, respondents who endorse entity theory are inclined to agree with incremental theory items. Thus, incremental theory

¹⁰ Only four students (among 85 students) could not take part in the experiment because of other commitments.

items must be carefully formulated and the questionnaire should include at least some entity theory items. We have chosen a mixed form with 3 incremental theory items and 3 fixed theory items gathered in section 1 of the questionnaire (cf. the instructions in the Appendix).

Subjects indicated the extent to which they agreed or disagreed with statements regarding self-theories on a rating scale including six ordered responses.

Measure of risk taking

In a second step of the experiment (section 2 of the instructions), we tested risk taking by subjects. In our experiment, risk taking is defined as the willingness to invest in a risky lottery while a sure lottery that permits the individual to earn the mean of the risky lottery for sure is available at the same time. The standard expected utility model applied to decision in risk predicts that all risk averse agents would choose the sure lottery since it has the same mean as the risky one. In our setting, almost all subjects chose at least one risky lottery. Nevertheless, since neither preferences nor risk attitudes are elicited we cannot form conclusions about the subjects' preferences (and we do not need to). Indeed, we do not elicit them. Instead we are interested in the frequency of investment in the risky lottery. In this experiment, all of the lotteries have a positive outcome and result in a net gain compared to their initial wealth.¹¹

Similar to Lauriola and Levin (2001), subjects had to choose sequentially between one sure lottery and a risky, binary, lottery with the same mean. All options were presented in pairs, which were ordered from the pair containing the most risky lottery to the one containing the least risky lottery. Lotteries being binary, the risk contained in them was measured by the variance. They were numbered from 1 (the most risky pair) to 5.

Through this section, subjects were financially incentivized. We decided to reward 10 subjects (over 81) who were randomly chosen.¹² We chose also randomly one of the five lotteries in front of all participants. Finally, the monetary gains displayed by a computer screen were distributed to them for the selected lottery according to the participants' choice of option A or option B.

To examine whether risk taking is influenced by self-theories, we construct a risk taking index (RTI) from answers to section 2 of the questionnaire. We chose to weight riskier choices more heavily. For each risky contract B, we attributed a coefficient reflecting the level of risk: if contract B of question 7, the riskiest contract, was chosen, we applied a coefficient 5. We applied a coefficient 4 for contract B of question 8 and so forth. A coefficient 0 was applied to choices of the riskless contract A. Hence, the risk taking indicator is defined as follows:

¹¹ We chose to work with positive lotteries for the sake of simplicity, the whole experience containing already several questionnaires. To work with losses and knowing that subjects cannot leave the lab with less money than they had when entering, the feeling of loss can be instigated by giving an initial positive wealth to the subjects and, then, by considering that some choices may induce a loss of part or whole of their initial wealth (as done in Beaud and Willinger (2015)). Nevertheless, the discussion is still open about the effective feeling of monetary losses perceived by the subjects. Non monetary losses can also be considered, as in Berns et al. (2009): in this paper, losses are concretized by painful ... electric shocks!

¹² Although each subject had a probability equal to 1/8 to be the rewarded subject, we think that the high amounts provided some stakes, the positivity of all possible stakes and the fact that subjects were professional managers and not students provide adequate incentives.

$$RTI = \sum_{i=7}^{11} (12 - i) * I_B(i) \quad (1)$$

Where $I_B(i)$ denotes the indicator function. It is equal to 1 if the subject chose contract B of question i and 0 otherwise. Hence the index of risk taking (RTI) can take any value from 0 to 15. Such an indicator permits us to keep in the sample the individuals who switched several times from the sure lottery to the risky one. Although it is considered as an irrational behavior in a standard expected utility model (which considers only objective probabilities), several switches may be a sign of subjective beliefs different from the effective probabilities. Knowing that we are interested in how people perceive themselves, it was important to keep all the subjects in the experiment. Note that less than 10% of the subjects switched several times, and, among them, they switched at most twice.

Measures of overconfidence

Overconfidence is measured through a two-step procedure.

First, subjects took part in a trivia quiz comprising 20 questions (section 3 of the instructions). All participants were paid for each answer that was exactly correct (no partial credit was given). Once this stage was completed, the experimenter collected responses from all first three sections.

Overconfidence is measured by two indices: the absolute overconfidence index (AOC) and the relative overconfidence index (ROC) as defined by Ifcher and Zarghamee (2014). The AOC index measures how the individual perceives her own performance without any comparison with others, while the ROC index measures how the individual evaluates her performance relative to the whole sample performance. Thus it may be that the individual be overconfident as measured by the AOC index but not overconfident from the ROC index, in particular if she overestimates the whole sample performance.

In our study, the subject's absolute overconfidence is measured through a set of four questions gathered in section 4 of the instructions. They were asked how well they think that they performed on the trivia quiz of section 3 by estimating how many questions they think they answered correctly. The difference between estimated correct answers and actual correct answers provides the measure of the AOC index.

Two questions contributed to elicit their relative level of overconfidence (ROC) as subjects were asked how well they performed compared to other participants both qualitatively and quantitatively. Relative overconfidence (ROC) is measured by question 3 of section 4 in which the subjects were asked: "Compared to the typical participant in this session, how many more or fewer questions do you think you answered correctly?" This estimation minus the actual difference between the subject's number of correct answers and the average of correct answers by the whole sample provides a proxy for relative overconfidence. For example, if a subject estimates that she answered 5 more "questions correctly than did the typical participant in this session" (see question 3 of section 4), and he actually answered correctly 12 questions compared to an average of 10 correct answers for the whole sample, her relative overconfidence (ROC) is 3.

The accuracy of the responses to the quantitative questions was financially rewarded for all subjects (see Appendix A for details).

Demographic characteristics

Section 5 of the questionnaire ends the experiment by collecting data on demographic and corporate characteristics: gender, marital status, age, home city, university degree, level of income, executive title, professional experience and business sector.

IV. DESCRIPTIVE STATISTICS

Subjects' characteristics

The age of the subjects' range from 24 to 36 years with an average age of 29. Nearly half of subjects are female (48%) and 31 subjects are married (38%).

Before joining CFVG, they graduated from universities with a bachelor degree which is a minimum requirement to enter the CFVG MBA program. Their college major ranges from medicine to HRM. However, most of them (65%) have completed either economics or management studies: economics (26%), finance (18%), general management (11%), marketing (6%) and HRM (4%). Engineer students represent the other important major (20%). Scientific students account for 11%.

The subjects occupy a wide range of positions within their companies : 10% are senior or top managers, 45% are middle managers, 40% are juniors and the remaining 5% are assistants. The high propensity of middle and top management positions considering the subjects' age can be explained by the recent history of Vietnam. The Đổi Mới policy, initiated in 1986, fosters economic reforms to support private enterprises. Combined with the lack of trained executives and a fast growing economy in the last two decades, the Vietnamese job market has offered many opportunities for fast career advancement.

The average monthly income is nearly 20,000,000 VND which converts into roughly 950 US \$ and represents sixfold the GDP per capita of Vietnam in 2013. The dispersion of income is very high reflecting differences of seniority and positions.

As the experience was conducted in two different locations, we tested also for demographic and professional differences between both cities. We do not find any statistically significant differences for most characteristics including sex, age, years of experience. The two sub-samples exhibit only a mild difference in terms of income. The average income is slightly higher in Ho Chi Minh City (p -value=0.09).

Mindsets statistics

We first checked the internal consistency of subjects' answers to the implicit theories items of section 1 of the questionnaire. If a subject strongly agreed with an incremental theory item (items 1, 3 and 5), he should also strongly disagree with an entity theory item (items 2, 4 and 6) and conversely. For the 6 items and the sample of 81 subjects, the estimate alpha of Cronbach is 0.81, indicating that subjects exhibit a high degree of internal consistency: high adherence to incremental theory (growth mindset) goes generally with a high rejection level of entity theory (fixed mindset) and conversely.

We use these answers to build an index M of mindsets for each subject. The index is the average of the 6 items ranging from 1 to 6 with $M=6$ corresponding to subjects endorsing very strongly the incremental theory (growth mindset) as opposed to index value $M=1$ for subjects endorsing strongly

the fixed mindset. The index mean is 4.28 and its standard deviation 0.90. This translates into an average high endorsement of incremental theories (those related to growth mindset). The first column of Table 1 displays the distribution of subjects with respect to their mindset index M. This result may find its roots in the composition of the population sample. Subjects are all young professionals, holding a master degree, and going back to university to study part-time to get an MBA. The program lasts two years and sets a challenging time schedule for all participants. They have to reconcile their professional, student and family commitments. Most of them self-finance their studies. All in all, students joining the program are usually highly motivated and believe in the benefits of training. Strong adherence to incremental theory might also be linked to cultural factors as the mandarin culture has deeply permeated the Vietnamese society.

Table 1: Descriptive statistics

	M	AOC	ROC	RTI	Income
Mean	4.28	1.38	0.28	8.32	4.25
Lower quartile	4.00	0.00	-1.44	5.00	3.00
Median	4.33	1.00	0.56	9.00	4.00
Upper quartile	5.00	3.00	2.56	12.00	6.00

Note: Income is a recoded interval variable. Intervals 3, 4 and 6 correspond respectively to a monthly income comprised between 10 and 15 million VND, 15 and 20 million VND, and 25 and 30 million VND. See Appendix C for a description of the 9 intervals.

Trivia quiz answers and overconfidence measures

The trivia quiz is inspired by Moore and Small's quiz (2007) (see Appendix B). We adapted it to Asian culture by including a few questions related to Asian geopolitics. Our purpose was to build-up a mildly difficult quiz in order to reach the highest variance of correct answers. Indeed, the mean of correct answers was 9.6 out of 20 with a standard deviation of 3.2.

On average, subjects overestimated their actual performance by 1.38 answers (see Table 1) which is highly significant (with a p-value of 10^{-6}). 64% predicted a higher score than the real one, 15% predicted it correctly and 21% underestimated their score. This result is in line with previous research (see for instance Ifcher and Zarghamee, 2014 ; Statman, Thorley and Vorkink, 2006). We investigated also the level of AOC with respect to demographic variables. Although men tend to overestimate more than women (1.55 vs 1.18), the difference is not statistically significant. Neither marital status nor professional position does exhibit any significant difference. However, the absolute overconfidence is strongly and positively correlated with income (p-value=0,035).

We found an average positive relative overconfidence (ROC) of 0.28 (see Table 1) which is not statistically significant (p-value=0.34). Despite this insignificance on average, it is worthwhile to study the impact of both AOC and ROC index on risk taking: Table 1 confirms that ROC is very dispersed over individuals.

Table 2: Correlation coefficients between variables

	M	AOC	ROC	RTI
AOC	0.04			
ROC	-0.08	0.50		
RTI	0.01	-0.24	-0.13	
Income	0.03	0.23	0.12	-0.04

Table 2 shows that ROC and AOC are highly correlated with a correlation coefficient of 0.5 (and an associated p-value of 10^{-6}). Subjects who overestimate their own performance do also overestimate their relative performance. On average AOC is significantly positive, but not ROC. This is due to the fact that the ROC index is a difference of differences and, thus, exhibits more randomness. This can also be interpreted as subjects overestimating the whole sample performance and believe that others did better than they actually did. Similar results were found by Ifcher and Zarghamee (2014). Table 2 shows that most other variables are not highly correlated with each other, which helps to avoid the burden of multicollinearity in the regression analysis below. Among all professional and demographic variables, income is the only one which has a significant correlation with overconfidence measures (p-value=0.035).

Finally, Figure 1 represents the histograms of absolute overconfidence (AOC) for people with low (fixed mindset) and high (growth mindset) M index. It provides valuable information about the distribution of AOC according to the individuals' mindsets. Indeed, the histogram of overconfidence for fixed mindsets is more dispersed than the one of growth mindsets as predicted in Section II.¹³ However a chi-squared test cannot reject the null hypothesis that both histograms are the same (at the 5% threshold).¹⁴

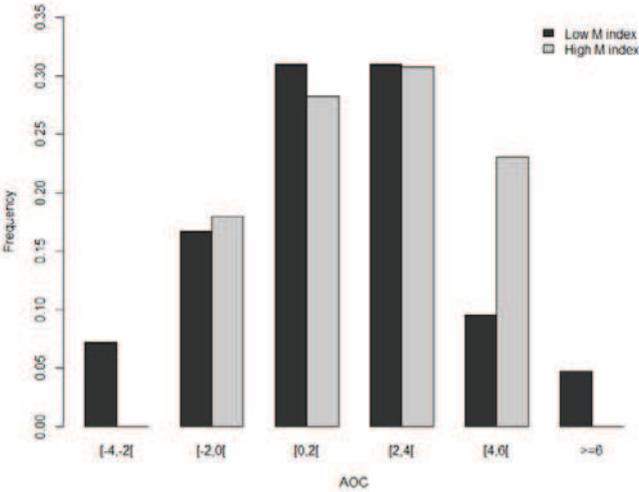


Figure 1: the histogram of AOC_n for low and high values of mindset

Hence, further investigation is provided in section V. We will test nonlinear models which take into account demographic and corporate variables.

Risk Taking Index (RTI)

The RTI index is a normative measure ranging from 0 to 15 (see Equation (1)). Two agents may have a same RTI index, while having chosen different lotteries. What is important is the ranking of the RTI measures. The higher the RTI index of an individual, the higher her level of risk-taking in our experiment. Riskier lotteries (i.e. with higher variances) have higher weights in the RTI function. The

¹³ The empirical variances are respectively 6.7 for the low mindset indices and 4.1 for the high mindset indices.

average value of RTI was 8.3 with a high standard deviation of 4.53, showing that individuals are heterogeneous in terms of risk taking.

Let us recall that we are not concerned by risk attitudes, but by risk taking levels, in our experiment. Hence, we neither elicit risk preferences nor link risk attitude to mindset perception. Our principal aim is to link overconfidence with mindset perception. A secondary question relative to risk-taking, then, arises knowing that overconfidence is one important attribute of preferences that explain decisions in risky situations. It is worth noticing that Burks et al. (2009) and Dohmen et al. (2010) investigate the relationship between risk attitudes and cognitive skills. Defined as the ability of an individual to process information, to think, learn and remember, cognitive skills are shown to be related to the risk attitudes of agents among others attributes of their preferences.

V. IMPACT of SELF-THEORIES

Our aim is to study three explained variables y_j , where the subscript $j = \text{AOC, ROC, RTI}$, denotes respectively the Absolute Overconfidence index, the Relative Overconfidence index and the Risk Taking index. It requires specifying an adequate functional form, able to capture nonlinear interactions between explained and explanatory variables and at the same time ensuring a relative parsimony of parameters. These issues are widely discussed in the statistical literature (see Harrell (2001) for instance).

In order to avoid imposing too many *a priori* restrictions on our model, we consider a locally flexible specification corresponding to a second order Taylor-approximation of an unknown function of K explanatory variables. The specification is given by

$$y_{jn} = a_j + b_j'x_n + x_n'C_jx_n + u_{jn}, \quad j = \text{AOC, ROC, RTI}, \quad n=1,\dots,N. \quad (2)$$

The $(K \times 1)$ vector x_n comprises the explanatory variables. The parameters are given by a_j , the $(K \times 1)$ vector b_j and the $(K \times K)$ matrix C_j (which is symmetric and includes $K(K+1)/2$ free parameters). The random term u_{jn} satisfies $E[u_{jn}|x_n]=0$ and $V[u_{jn}|x_n] = \sigma_j^2$. A quadratic specification has the advantage of allowing the impact of income (for instance) to vary over the sample, and to be different for poorer and richer subjects.

In order to avoid overparameterization of the model, we require that the ratio of the number of observations to parameters, N/K , be higher than 10. Fortunately we can exclude some demographic variables: experience and the marital status can be excluded because they are strongly correlated with age in our sample. We exclude the sector of activity and the professional position for a similar reason: when we appropriately encode these categorical variables (for example, with a low code for a junior position and a high code for a senior one), they exhibit a strong correlation with income. It follows that only gender, age, income and mindset belong to the list of explanatory variables for our two overconfidence measures. As gender is a dichotomous variable (and so $x_g = x_g^2$), we can without loss of generality exclude it from the quadratic term $x_n'C_jx_n$ and include it only in the bilinear function part $b_j'x_n$. The range of the age variable is also quite limited and it is unlikely that nonlinear effects occur (or can be identified) with less than 12 years difference in age¹⁵, so we only include it in the linear term. We also include a dummy variable for the city in the specification. This leaves us with a

¹⁵ Recall that the participants' age ranges from 24 to 36 years.

total of $1+5+3=9$ parameters for overconfidence. For comparison, we also report the estimation results corresponding to the linear specification (obtained by imposing $C_j = 0$ in (2)). The estimation results are reported in Table 3.

Table 3: OLS parameter estimates

Model Type	AOC quadratic	AOC linear	ROC quadratic	ROC linear
Gender	0.31 (0.58)	0.06 (0.86)	-0.37 (0.57)	-0.58 (0.37)
Hanoi	-0.19 (0.73)	0.06 (0.92)	0.30 (0.64)	0.46 (0.47)
Age	-0.02 (0.86)	-0.03 (0.76)	-0.08 (0.53)	-0.08 (0.48)
M	5.09 (0.01)	0.11 (0.72)	3.34 (0.15)	-0.11 (0.74)
Income	1.80 (0.05)	0.28 (0.08)	1.57 (0.14)	0.24 (0.18)
M^2	-0.50 (0.04)	--	-0.32 (0.25)	--
Income^2	-0.03 (0.70)	--	-0.02 (0.76)	--
M x Income	-0.29 (0.05)	--	-0.25 (0.15)	--
H_0 : income is irrelevant	2.60 (0.059)		1.60 (0.20)	
H_0 : M is irrelevant	2.55 (0.063)		1.27 (0.29)	
H_0 : linearity in (M, Income)	2.54 (0.063)		1.08 (0.36)	
SSR	371.6	411.9	515.3	538.6
Adjusted R^2	0.057	-0.005	-0.012	-0.015

Notes: all regressions include an intercept (not reported). The p-value for the null hypothesis that the corresponding coefficient is equal to zero is indicated in parentheses.

Mindsets and overconfidence

Mindset is an exogenous characteristic of individuals. Indeed, the psychology literature has shown that fixed and growth mindsets are stable and longstanding beliefs (Dweck, 2000, p.24). It is developed during early education and can be changed temporarily only if the experimenter influences subjects by showing articles or films demonstrating the malleability of the brain (Hong, Chiu, Dweck and Lin, 1998 for instance). In our experiments, we do not influence subjects' beliefs. We just measure their self-theories to scale them on the mindset index. Hence, regressing overconfidence over mindset is the correct approach.

We first consider the regressions involving our two measures of overconfidence. Regarding AOC, the results of Table 3 (column 1) indicate that several coefficients are significant at the 5% threshold. The estimates of b_j of Equation (2) are either non-significant or positive, the second order terms are

either non-significant or negative. In particular, the estimated coefficients related to the Mindset index and to Income are significantly different from zero. We interpret them below.¹⁶

Demographic variables (gender, Hanoi and age) are non-significant. Indeed, our results indicate no gender difference in overconfidence level. This contrasts with Niederle and Vesterlund (2007)'s study on competitiveness. In their sample, men are substantially more overconfident than women which in turn partly explains their higher propensity to engage in tournaments. In their survey of experimental studies, Crozon and Gneezy (2009) conclude also that a gender effect exists. However, the most recent evidence seems to suggest that risk behavior is similar for men and women. Nelson (2015) carried out a meta-analysis based on 35 empirical works which includes those cited by Crozon and Gneezy (2009) and Charness and Gneezy (2012). Relying on the *magnitude* (measured by Cohen's *d*), she found a high degree of overlap between men and women distributions leading to a high degree of similarity. The conflicting results might be explained by cultural differences. For instance, in the cross-cultural study conducted by Gneezy, Leonard and List (2009), the authors showed that culture might play an important role. Men of the patriarchal Masai society enter much more in competition than women. In contrast, in the matrilineal Khasi society, more women than men choose to compete albeit not in a significant way. However, as the Vietnamese society is patriarchal (Nguyen The Anh (1996)), the explanation for the absence of gender difference in overconfidence levels lies rather on the political organization. Indeed, Zhang (2013) found similar results as ours for China. Among others, China and Vietnam share similar political organizations which promote high employment of women and gender equality.

Another possible explanation for the absence of gender difference lies in the fact that the sample of our study is composed only of managers or future managers. Several studies have shown that subpopulations of managerial men and women tend to behave similarly (for instance, Johnson and Powell (1994), Atkinson, Bird, Frye (2003)). They suggest that experience and selection might be the factors explaining similarity. Tanaka, Camerer and Nguyen (2010) who measured risk and time preferences of Vietnamese households did not find either gender difference for rural population in Vietnam. They conducted their experiments in villages, whereas participants of our study all worked in the two major cities in Vietnam and are earning substantially higher wages compared to a rural population. Despite this population difference, they also found that there are no significant effects of gender. An explanation suggested by Tanaka, Camerer and Nguyen (2010), for the existence of a gender effect in previous studies is that they omit explanatory variables like income and education which are correlated with gender. In our study, we control for income and education.

We test for the statistical validity of two other submodels (see the lower panel of Table 3). Omitting income as a regressor yields a model which is statistically rejected at the 6% threshold. Conversely, the omission of the mindset index from the regression is also rejected. In summary, we conclude on the basis of this empirical evidence that self-theories alone cannot explain the bulk of the level of overconfidence. Income has also a strong explanatory power and a high level of significance.

¹⁶ Column 2 in Table 3 presents the linear model in income and in mindset, which is statistically rejected against the more general formulation (column 1) at the 6% threshold. We note that the adjusted R^2 evaluated in the linear specification ($R^2 = 0.08$) is lower than in the quadratic one. This confirms that the linear model is not adequate, but also shows that the relative low R^2 obtained in the quadratic specification is not due to multicollinearity.

To further investigate our results, we evaluate the partial derivatives of AOC with respect to M and Income and construct the confidence intervals via the delta method in order to assess their sign and significance (see for instance Davidson and MacKinnon, 2004, for details on the delta method). The partial derivative with respect to M is given by $b_M + 2C_{MM}M_i + C_{MI}Income_i$, which is evaluated at the value of the estimated parameters and represented by the bold straight line on Figure 2 (evaluated at the median income level of 4). When this value is positive, the relationship between AOC and M is increasing (and decreasing otherwise). We also represent the 95% confidence interval for the hypothesis that the partial derivative is equal to zero by two dotted curves. It shows that the relation between overconfidence and the mindset index is significantly increasing (positive value of the slope) only for low levels of M (and incomes). This impact, however, decreases with M (and with income) and becomes insignificant when mindset increases.

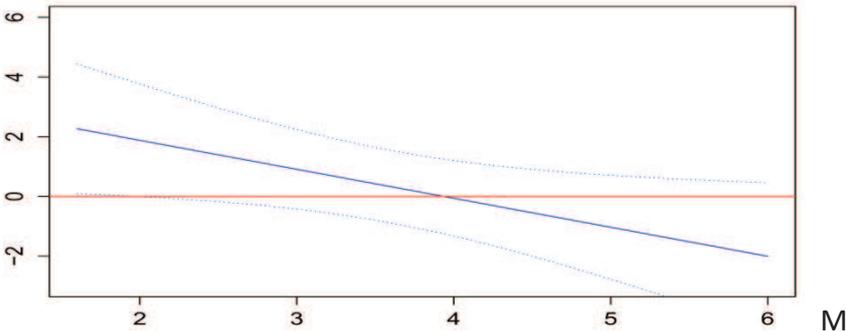


Figure 2: The marginal effect of M on AOC, for Income = 4

The group with a significant (positive) relationship between M and AOC comprises 10 individuals; they display a low level of overconfidence, with an average mindset and a lower than average income.

Hence, self-theories have a contrasted effect on the absolute level of overconfidence. When controlling for income, the level of overconfidence is sensitive to mindset only for strong fixed-mindset participants and for some highly growth mindset persons. Contrary to experiments conducted with students, our experiment controls for a high heterogeneity in the professionals' incomes. Indeed, in our sample, the growth mindset people are also those with the highest incomes, whereas fixed mindset persons are much less wealthy. The higher overconfidence of growth mindsets might be explained by successful careers since executives' income can progress very rapidly in Vietnam.

Zhao, Dweck, Mueller (1998) have shown that emotions may interfere when fixed-mindset people face challenges. After failure, they are much more vulnerable, which might also affect their objectivity. Note that our study tests the impact of mindset on overconfidence at one point of time. It would be interesting to test how overconfidence evolves in time for both fixed-mindset and growth mindset participants when participants receive feedback about their performance. Presumably, fixed mindset people's assessment of their own performance would be much more volatile and farthest from the true performance than for growth mindset people.¹⁷

¹⁷ A related strand of literature has dealt with predictors of students' success. Henderson and Dweck (1990), Hong, Chiu, Dweck and Lin (1998), among others, have shown that self-theories do better explain academic success than prior confidence.

Regarding *relative* overconfidence ROC (columns 3 and 4 of Table 3), estimated coefficients are statistically close to those obtained for AOC: yet none of the estimated coefficients for ROC is found to be individually significant at the 10% threshold, neither in the quadratic specification, nor in the linear one. As explained in Section III above, this may be related to the fact that ROC is defined as a difference between two variables and exhibits by construction more randomness than each separate random variable.

Risk taking

We now turn to investigate the determinants of risk taking. We consider the same specification (2) as before to which we add overconfidence in the list of explanatory variables entering the specification linearly. This increases the number of parameters to be estimated to 9. The RTI index is in turn regressed against AOC and mindset index by controlling for demographic and professional variables. Table 4 reports that income and the demographic variables have no (significant) explanatory power for risk taking: the specification test in the lower panel of Table 4 cannot reject this hypothesis.

Table 4: RTI parameter estimates

Model Type	RTI quadratic	RTI linear model
Gender	-0.47 (0.667)	-0.04 (0.972)
Age	-0.13 (0.530)	-0.08 (0.688)
M	-10.65 (0.008)	0.10 (0.856)
Income	-0.93 (0.604)	0.10 (0.752)
AOC	-0.30 (0.198)	-0.47 (0.039)
M ²	1.27 (0.007)	--
Income ²	-0.02 (0.875)	--
M x Income	0.28 (0.341)	--
H0: income is irrelevant	0.33 (0.802)	
H0: M is irrelevant	2.67 (0.054)	
H0: linearity in (M, Income)	2.66 (0.054)	
SSR	1392.5	1547.0
Adjusted R ²	0.059	-0.004

Notes: all regressions include an intercept (not reported). The p-value for the null hypothesis that the corresponding coefficient is equal to zero is indicated in parentheses.

In the quadratic specification AOC has an insignificant negative impact on RTI. On the contrary, the impact of mindset on RTI is significant. The relationship, however, is nonmonotonic and U-shaped and means that the relationship is heterogeneous over the sample. For low and high levels of M, individuals are more likely to choose more risky lotteries. This could be explained by the fact that persons with an average mindset assess their own intelligence cautiously. They may also be prudent when choosing risky lotteries, whereas persons having a more extreme viewpoint on their intelligence are less shy regarding risk taking.

Nevertheless, note that the relationship between both variables is insignificant for average levels of mindset. This can be seen, in particular, for the class 4 of Income. It is depicted on Figure 3 representing the partial derivative of (1) with respect to M, together with the 95% confidence interval (the dotted blue curves). Zero is included in the confidence interval for M between 3.2 and 4.2, and represents the range of mindset for which the relationship between RTI and mindset is insignificant.¹⁸

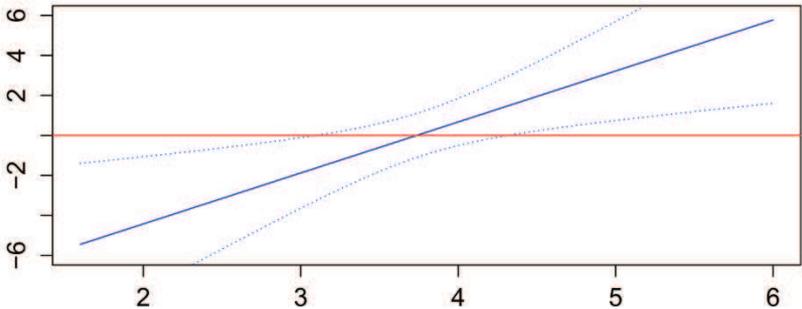


Figure 3: The marginal effect of M on RTI, for Income =4

As a last result, in our sample, there is no difference in risk taking between men and women. Our conclusion contrasts with Eckel and Grossman (2002)’s finding and with Barber and Odean (2001)’s one but is in line with the most recent studies showing high similarity across gender (Nelson, 2015).

VI. CONCLUSION

We conducted a field experiment to analyze how individuals self-theories impacts their overconfidence and their risk taking (not risk attitudes). Following Dweck (2000), two self-theories are at stake: people have developed a “fixed mindset”, when they believe that their intelligence is a fixed trait. In contrast, people who believe that intelligence is a malleable quality which can be improved have acquired a “growth mindset”.

¹⁸ We have also investigated the disaggregate data on each of the 5 lotteries explicitly and estimated a logit model for the choice decision between the risk-free and risky lotteries. The results are similar to those obtained for the aggregate risk index: mindset was the only significant explanatory variable for the risk taking decision. No further coefficient was significantly different from zero.

Our 81 subjects were Vietnamese (80) or Indian (1) studying in the MBA programme at the CFVG (Centre Franco-Vietnamien de formation à la Gestion) in Ho Chi Minh City and in Hanoi in January 2014, all of them having a full time job.

As in previous studies, we found that subjects exhibit absolute overconfidence. The main result of our paper is that self-theories have a significant impact on the level of overconfidence. However, they alone cannot explain the bulk of overconfidence. Income also has a strong explanatory power. Since the subjects who endorsed the growth mindset have also the highest income, successful careers might explain why they also exhibit higher overconfidence levels.

The second main result of our study deals with the significant impact of mindset on risk taking. Precisely, our risk taking index is higher for low and high levels of mindset and lower for average levels of mindset. Most probably, people who have a firm idea about the origins of their intelligence, either innate or malleable, readily take more risk.

A third result of our experiment is that gender does not have any impact on overconfidence nor risk-taking behavior, contrary to what is usually obtained in experiments conducted in Western societies. This adds further support to the impact of nurture and social conditions on differences of gender overconfidence in line with the study by Gneezy, Leonard and List (2009) and the most recent research which suggests that men and women have similar risk preferences (Nelson (2015)).

This paper is, to our knowledge, the first attempt to explain the impact of self-theories on overconfidence. This impact is significant even though it also depends on income. We believe that this research deserves further investigation in two directions. First, a dynamic setting should be introduced to measure the evolution of risk taking and overconfidence through time. We suspect that growth mindset subjects to be more sensitive to negative outcomes. Second, the relationship between mindset and risk taking needs further investigation either by enlarging the sample and/or by using also alternative measures of individual risk taking like multi-item questionnaires (see for instance Dohmen, Falk, Huffman, Schlupp and Wagner (2011)) as suggested by Lonnqvist, Verkasalo, Walkowitz and Wichardt (2014). And finally, biases other than overconfidence could be tested. The disposition bias which explains the tendency to sell winning stocks too early and to keep losing stocks too long, is a good candidate. Indeed, this bias is explained by pride seeking and regret aversion, two traits more prevalent among “fixed” mindset people.

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APPENDIX A: INSTRUCTION MANUAL

Instructions for the financial experiment conducted in Hanoi on January 11, 2014 (and Ho Chi Minh City on January 18, 2014) at CFVG premises

You have accepted to participate to a scientific experiment which objective is to determine psychological factors explaining risk behaviour.

You will receive a participation fee of 30,000 VND and supplementary rewards depending on the accuracy of your answers.

The experiment consists in responding to a questionnaire with 5 sections. In order to validate scientifically your participation, **you need to answer all questions** (except for the trivia quiz if you do not know the answer). Furthermore, you cannot carry any electronic devices (computer, phone,...) during the experiment. **You only need a pen** to write down your answers. Any communication with other participants is forbidden. If you have any question, please refer to the experimenter.

Hereafter, we describe the different steps of the experiment design:

Step 1: reading of the instructions. The experimenter will read aloud and explain the instructions

Step 2: you read and sign the informed consent form

Step 3: you answer the questions of the 5 sections of the questionnaire.

Step 4: Lotteries will be drawn in front of all participants to determine how much you won

Step 5: you will receive your payment. You will be paid in VND. For procedures reasons, the certificates of payment are in French and the amounts are expressed in Euros. The exchange rate used for the certificate is 1 € = 28,841 VND, CFVG official rate in January 2014.

The experiment lasts approximately 45 minutes.

Note: **Answers to the questionnaire will remain confidential.** However, we need to identify you (name and surname) to proceed with payment.

Section 1 of the questionnaire:

The questionnaire in this section has been designed to investigate ideas about intelligence (What you think intelligence is about). There are no right or wrong answers. We are interested in your ideas.

Using the scale provided, you will indicate the extent to which you agree or disagree with each of the statements by putting a cross in the space next to each statement that corresponds to your opinion.

Section 2 of the questionnaire:

Everyday decisions involve some element of uncertainty. In this section, we ask you to make such decisions under hypothetical conditions. In particular, you will be asked to make a series of choices between alternative options. Only one option can be chosen. The options will be presented in pairs as in the following example:

Option A	Option B
<p data-bbox="459 562 475 584">□</p> <p data-bbox="331 696 608 719">100 chances out of 100</p> <p data-bbox="344 831 595 853">TO GAIN 100,000 VND</p>	<p data-bbox="1171 562 1187 584">□</p> <p data-bbox="882 629 1398 651">25 chances out of 100 to gain 400,000 VND</p> <p data-bbox="882 763 1334 786">75 chances out of 100 to gain nothing</p>

One of the options (**Option A** in the example), if chosen, allows you to gain (or lose) a given amount of money for sure (e.g., 100,000 VND), since it provides 100 chances out of 100 for that monetary outcome. The alternative option (**Option B** in the example), if chosen, allows you to gain (or lose) an uncertain amount of money proportional to the risk it involves (e.g., 25 chances out of 100 to gain 400,000 VND and 75 chances out of 100 to gain nothing).

IMPORTANT

Note that the economic analysis of the alternatives above reveals that the two options (e.g. A and B) have the same worth. This is because the *potential* consequences of **Option B** (e.g., 25% of 400,000 VND + 75% of **nothing** = 100,000 VND) are worth as much as the *certain* consequences of **Option A** (e.g., 100% of 100,000 VND = 100,000 VND).

As a result, neither decision can be made on the basis of arithmetic calculations, nor can right or wrong answers be made from an economic point of view.

You are asked to answer in a subjective way according to your personal preferences or attitudes. Since no objective decision can be made, some people prefer the certain alternative (**Option A** in the example), while other people prefer the uncertain option (**Option B** in the example).

Once all participants have completed their questionnaire, 5 participants will be chosen randomly. The monetary gains displayed will be handed over to you for the selected lottery.

Section 3 of the questionnaire:

You will have to answer **20 trivia questions** about geography, history and general knowledge. You will be paid 10,000 VND for each answer that was exactly correct (no partial credit is given).

Section 4 of the questionnaire:

You are evaluated on your performance on the trivia quiz (Section 3). For instance, if you say that you answered 12 questions correctly in section 3 and, after we checked your answers, 12 responses are indeed correct, your evaluation of your own performance is perfect, and you will be paid 100,000 VND. If the margin error is one or two you will be paid 60,000 VND.

In this section, you will also be asked on your performance compared to other participants.

Section 5 of the questionnaire:

This section deals with demographic questions. For the purpose of our study, we need to know whether you are a male or a woman, the sector you are working for, your level of experience and so on

APPENDIX B: FIRST PART OF THE QUESTIONNAIRE (SECTIONS 1 TO 3)

This Appendix reproduces section 1 of the questionnaire. This is a measure of our implicit theories.

SECTION 1

The questionnaire in this section has been designed to investigate ideas about intelligence. There are no right or wrong answers. We are interested in your ideas.

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by putting a cross in the space next to each statement that corresponds to your opinion.

1. You have a certain amount of intelligence, and you cannot really do much to change it.

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

2. No matter who you are, you can significantly change your level of intelligence.

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

3. To be honest, you can't really change how intelligent you are.

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

4. You can always substantially change how intelligent you are

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

5. You can learn new things, but you can't really change your basic intelligence.

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

6. You can change even your basic intelligence level considerably.

Strongly agree	Agree	Mostly agree	Mostly disagree	Disagree	Strongly disagree

Section 2 of the questionnaire is adapted from Lauriola, Levin (2001) to measure subjects' attitude toward risk.

SECTION 2

In this section, we assess how you make decisions in situation involving chance or risk. Each problem is separate from all others. The monetary gains displayed will be handed over to you for the selected lottery if you are among the 5 randomly chosen students of your intake.

7. Which contract would you choose?

CONTRACT A

100 chances out of 100 to
Gain 100,000 VND

CONTRACT B

5 chances out of 100 to gain 2,000,000 VND
95 chances out of 100 to gain nothing

8. Which contract would you choose?

CONTRACT A

100 chances out of 100 to
gain 100,000 VND

CONTRACT B

25 chances out of 100 to gain 400,000 VND
75 chances out of 100 to gain nothing

9. Which contract would you choose?

CONTRACT A

100 chances out of 100 to
gain 100,000 VND

CONTRACT B

50 chances out of 100 to gain 200,000 VND
50 chances out of 100 to gain nothing

10. Which contract would you choose?

CONTRACT A

100 chances out of 100 to
gain 100,000 VND

CONTRACT B

75 chances out of 100 to gain 133,000 VND
25 chances out of 100 to gain nothing

11. Which contract would you choose?

CONTRACT A

100 chances out of 100 to
gain 100,000 VND

CONTRACT B

95 chances out of 100 to gain 105,300 VND
5 chances out of 100 to gain nothing

Section 3 reproduces the set of trivia questions. Each correct answer was rewarded 20,000 VND (except for the tiebreaker question).

SECTION 3: TRIVIA QUIZ

Answer the following questions. You will be paid 10,000 VND for each answer that was exactly correct (no partial credit is given)

1. Berlin is the capital of what country?
2. What is the capital of Azerbaijan?
3. How many weeks are there in one year?
4. How many nanoseconds are there in a second?
5. What is the name of the largest country in the world?
6. What is the name of the largest country in South America?
7. How many meters are there in a kilometer?
8. How many kilometers are there in a marathon?
9. What is the name of the prophet of the Islamic faith, born in the city of Mecca in the year 571?
10. Who is the current president of the People's Republic of China?
11. Who is the German Chancellor of Germany?
12. Which British band sang "Hey Jude"?
13. The Coliseum is located in which city?
14. Who wrote "Hamlet"?
15. In what European country is Dutch spoken?
16. How many countries were members of the Asean (Association of Southeast Asian Nations as of January 2014)?
17. The Roman god of war gives his name to the "Red Planet," the fourth planet from the Sun in our solar system. What is his name?
18. When did Christopher Columbus discover America?
19. Baghdad is the capital of what country?
20. Who ruled France before François Hollande?

Tiebreaker: Which grade do you expect to earn in the "financial markets course" (from 0 to 20)?

APPENDIX C: SECOND PART OF THE QUESTIONNAIRE (SECTIONS 4 AND 5)

This Appendix reproduces sections 4 and 5 of the questionnaire. This part of the questionnaire is handed over to participants after the experimenter has collected answers to sections 1 to 3.

SECTION 4: QUIZZ CHECK

You are evaluated on your performance on the trivia quiz (Section 3) by answering four questions.

- If your answer to question 1 is correct, you will receive 100,000 VND, and 60,000 VND (20,000VND) if your answer is within 2 (4) of the correct answer. For instance, if you think that you answered 12 questions correctly out of 20 for question 1, but in reality (after we checked answers) you answered 10 questions correctly, the difference is 2 and you earn 60,000 VND.
- If your answer to question 3 is correct, you will receive 100,000 VND, and 60,000 VND (20,000VND) if your answer is within 1 (2) of the correct answer.

1. How many of the 20 questions in Section 3 do you think you answered correctly?

2. How well do you think you did in Section 3? Possible responses range from 1, "Very poor," to 7, "Very well"

Very Poor	Poor	Quite poor	Average	Quite well	Well	Very well

3. Section 3 had 20 questions. Compared to the typical participant in this session, how many more or fewer questions do you think you answered correctly? (In other words, compare how many of the 20 questions in Section 3 you think the typical participant answered correctly to your answer to question #1 above).

"I think that I answered more / fewer (circle one) questions correctly than did the typical participant in this session."

4. In terms of correct answers in Section 3, how do you think you performed relative to all the other participants in this session? Possible responses range from 1, "Well below average," to 7, "Well above average"

Well below average	Below average	A bit below average	Average	A bit above average	Above average	Well above average

SECTION 5:

Finally, we would be grateful for some informations about yourself:

1. Are you a male or a female?

- Male Female

2. Are you married or single?

- Married Single

3. What is your age?

Years

4. Are you a full time student or have a professional activity?

- Full time student professional activity

5. Are you an exchange student

- Yes No

6. What is your major before joining CFVG (undergraduate degree)?

- Finance
 Marketing
 Economics
 General Management
 Engineer
 Mathematics
 Sciences
 Other : please specify :

7. For how many years have you been working?

years

8. What is your current position?

- Senior/top manager
 Middle manager
 Junior
 Other:

9. In which field are you working?

- Finance/banking/insurance
 Marketing/sales
 Industry
 Teaching
 Government
 Others : specify :

10. What is your monthly level of income?

- No professional activity outside CFVG (no income)
 Less than 10,000,000 VND
 From 10,000,000 VND to 15,000,000 VND
 From 15,000,000 VND to 20,000,000 VND
 From 20,000,000 VND to 25,000,000 VND
 From 25,000,000 VND to 30,000,000 VND
 From 30,000,000 VND to 40,000,000 VND
 From 40,000,000 VND to 50,000,000 VND
 More than 50,000,000 VND