UNIVERSITÀ CATTOLICA del Sacro Cuore

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Abstract

Results of behavioral economics pose a strong challenge to mainstream finance theory conclusions. We discuss, theoretically and empirically, the connections of cognitive skills, biases and financial decisions using the Cognitive Reflection Test (Frederick, 2005). In particular, we have chosen overconfidence, risk aversion, bandwagon effect, time preference and money illusion, among the biases most discussed in the literature. The experiment we conducted confirmed a role of the cognitive skills in determining the decision mechanism of the investor although not neatly, especially for more complex biases, such as money illusion. Finally, we expose policy alternatives, focusing on the role of financial education to tackle cognitive biases in finance and monetary policy.

Keywords: cognitive biases, financial education, behavioral economics, CRT
JEL classification: G41

1. Introduction: finance theory and cognitive biases[*]

The mainstream theory of finance is based on the assumptions that markets are efficient and economic agents are rational, in the sense that they are always fully informed and are able to maximize their utility function based on the information they have (Fama, 1970). However, at least since the famous experiment (afterwards called "paradox") proposed by Maurice Allais in 1952 (Egidi, 2017), countless studies have shown that the mainstream approach fails to explain the actual behavior of investors.

Different lines of thought have been proposed as an alternative to the formalization of mainstream finance given by Markowitz, Fama and others. The most famous one, the *prospect theory* (Kahneman and Tversky, 1979) is now ubiquitous in discussions about financial markets. Behavioral economics (or behavioral finance) has proved that investment decisions, and the decision-making process in general, are strongly conditioned by psychological and social issues such as cognitive biases, emotional biases, imitative behavior, etc. The understanding of these aspects is paramount to suggest how to intervene to redress, or at least to reduce, the distortions affecting the markets. For instance, if data showed that cognitive biases are strongly age-related, so that a 20 years old investor is by far more prone to biases than a 50 years old one, for financial intermediaries would make sense to have young traders and analysts monitored by senior managers less affected by biases. If no such links emerge from the data, managers should be chosen only for their competence and ability, not for their age.

Behavioral explanations on how financial markets work are quite common nowadays, and behavioral finance is a vast area of research that already produced many ideas that became part of the financial regulation landscape, the use of nudge being probably the most famous (Thaler and Sunstein, 2008). A particular area that is rapidly growing tries to assess whether cognitive skills of an investor are important to explain his/her behavior. A more "intelligent" (in the sense that an IQ test can give to this term) investor is less prone or more prone to some biases? Does he/she behave differently? Data on this issue are very interesting for financial intermediaries as well as for regulators. In this work, we present data concerning an experiment we did, proposing a series of questions to subjects (on-line) to analyse whether cognitive skills are important as far as the role of cognitive biases are concerned. In practice, the idea was to see if biases are produced by the cognitive skills of the investors and, as such, can be tackled directing policy efforts to their source. The work is as follows. We first discuss the challenge posed by the behavioral finance to the mainstream finance theory. Then we discuss the connections of cognitive intelligence, biases and financial decisions with a particular focus on the role of the Cognitive Reflection Test proposed by Frederick. Thirdly, we debate links between this test and a series of biases (in particular overconfidence, risk aversion, bandwagon effect, time preference and money illusion) that we have selected because are among the most discussed in the literature. Afterwards, we introduce and discuss the main results of our experiment that confirm a role of the cognitive skills in determining the decision mechanism of the investor although not neatly, especially for more complex biases, such as money illusion. Finally, we discuss policy alternatives, especially focusing on the role of financial

[*] The views expressed by Lorenzo Esposito do not involve the responsibility of the Bank of Italy.

education to tackle cognitive biases in finance and monetary policy. In the appendix we put the questionnaire and all the data.

2. The tenets of the finance theory and the behavioral alternative

In the modern mainstream framework, a financial market is efficient if, at all times and in any condition, the assets price fully reflects the relevant information available so that no arbitrages are possible: competition ensures that the returns on the assets are at their normal levels. The role of an asset manager, who professionally selects specific assets using "fundamentals" or technical analysis, is therefore almost useless, because it is not possible to extract something interesting from the past ups and downs of the markets: the latter follow a random walk. Although many obstacles to perfect efficiency have been detected and discussed (transition costs, inside information, liquidity constraints and so on) these imperfections limit the perfect efficiency of the markets but the overall mechanism remains the same.

Among assumptions that are at the basis of the finance theory, many are connected to the preferences of the investors. Just to make two examples, preferences must be such that if A is preferred to B and B to C, then A is preferred to C (*transitivity*); moreover, if A is preferred to B when C is not available, then A must be preferred to B also when C is available (*independence of irrelevant alternatives*). These, and many other assumptions about preferences, are violated in behavioral finance tests as well as many other tenets of mainstream economics. For instance, it is easy to show that answers of the investors depend on how the question is posed (using frequencies instead of probabilities, giving some information first or in a given form, and so on). Consequences of these results are important for how markets work and how they should be regulated. The *caveat emptor* general principle is quite off the mark if it is sufficient to change the order of the information to obtain different behavior by the clients. Behavioral finance also discovered many anomalies that can easily shatter the efficiency market hypothesis. For instance, data show a "January effect", a seasonal phenomenon whereby the return on shares is higher in January than in the rest of the year (Rozeff and Kinney, 1976) and, similarly, a "weekend effect" (French 1980, and Kamara 1997), a "holiday effect" (Jacobs and Levi, 1988) and, even more surprisingly, a "good weather days effects" (Hirshleifer and Shumway, 2003).

As the philosophy of science, in particular with Kuhn (1962-2012), has observed, a theory cannot be set aside by an adverse fact but only by another theory that happens to explain also the adverse fact. The critiques of Allais were not sufficient to put the expected utility theory on the defensive, lacking a thorough alternative (Moscati, 2018, pp. 187 and following). Simon's bounded rationality could be considered such an alternative, but it was stopped by the rational expectations hypothesis that was conceived by Muth exactly as a counter-alternative to Simon's ideas (Simon, 1991-1996, pp. 290 and following). At the end, prospect theory (Tversky and Kahneman, 1979) was such an alternative. It was built as the expected utility theory, using probability functions, only with different features. Among the important aspects of this theory, a key part is played by *heuristics*: simple and immediate decision procedures that bypass rational computation in most real life situations. Examples of such heuristics are the disposition effect (Kahneman 2011), that explain when and how

subjects acquire information determining the tendency of investors to retain losing assets and selling winning ones, or the law of small numbers, where a small sample is identified as representative of the population from which it was extracted and is an aspect of the representativeness heuristics (Sharin and Chowdhury, 2017).

Cognitive biases are a particular set of heuristics that are unconsciously used to make judgments about unknown situations or situations that require too much analysis. In essence, these are mental automatisms, suboptimal but normally effective, used by individuals to take quick decisions. As Cunnigan (2013) observed, in making their own decisions, individuals use only a small subset of all the information available to them because using information is costly for the mind.

A number of biases have been identified in the literature (Haselton et al., 2005); it seems that there are more than 150 of them. The research, to date, is still active but, despite the strong interest in the topic, an exact number is not predictable yet. In recent years, some authors have tried to group different biases in order to create categories (Ceschi, Sartori and Rubaltelli, 2012). Biases can coexist or act one against the other, depending on the choice the investor is doing. In this research, we analyse some of the most important and discussed of them.

3. Cognitive intelligence, biases and financial decisions: the role of CRT

What is intelligence is one of the most debated topic in psychological science (eds. Sternberg and Kaufman, 2011). Its complex and multifaceted nature defies any simplistic analysis. One of the oldest quarrel about intelligence is whether it has a genetic or cultural nature. Normally both factors are acknowledged for, but with different importance. Consequences of this debate can be huge also as far as economic policies are concerned. For instance, if a scholar believe that intelligence cannot change much with education, investment in mass education is sub-optimal vis à vis a careful picking of the best student for top schools. The same is true for financial decisions. If intelligence and cognitive skills cannot be cultivated, what is the point in financial education? However, before this issue, a preliminary research point is whether intelligence is relevant when we discuss how people take financial decisions.

If we start from the assumption, not at all obvious, that IQ test can approximate intelligence, empirical studies show numerous ways in how people with different cognitive abilities behave (Jensen, 1998) and these abilities also affect decision making (Lubinski and Humphreys, 1997). Normally, these characteristics were analyzed using standard IQ tests that, however, are difficult to administer and to study, therefore, in many contexts are difficult to use. For this reason, Frederick (2005) proposed a simple measure of cognitive abilities, the Cognitive Reflection Test (CRT), showing that the CRT turns out to be more significant, in terms of correlation between the test result and the observed behavior, compared to more complex personality tests, even if it is only made up of three questions. The test is able to distinguish individuals between the most impulsive and the most reflective, dividing the investors willing to use *system 1* and *system 2* in the famous Kahneman distinction. The system 1 corresponds to the intuitive sphere, and it is used to obtain immediate answers to a

problem facing the individual; on the contrary, the system 2 is connected to the reflective sphere, it is therefore more likely to be used for a motivated answer (Kahneman and Frederick, 2002). As the system 1 is the oldest, quickest and easiest to manage of the two, it is the choice by default of human beings and, sometimes, it is used badly, making decision on issues where system 2 would be a better choice.

CRT is able to assess when system 1 overstretches its competences, so to speak, and it has been widely used to this end (Oechssler et al., 2009, Toplak et al. 2011, Sleboda and Sokolowska, 2017). Despite some limitations, recent work suggests that the CRT test is still robust (Bialek and Pennycook, 2018). There are also many studies that use CRT to explain financial decisions (Da Silva et al., 2018, De Bortoli et al., 2019), how traders behave (Corgnet et al., 2016), or particular biases affecting financial decisions like the time preference (Ackert et al., 2020).

In this work, we use the CRT to appraise whether individuals with different cognitive abilities behave differently. In particular, we will use the CRT to investigate some biases that we think are fundamental to understand investment decisions. In the wake of Frederick's work, we will analyze time preference and risk aversion; moreover, we will discuss overconfidence, the bandwagon effect and the money illusion.

4. CRT and cognitive biases

The first interesting point to analyze is whether data show a connection between CRT and the personal characteristics of respondents. For instance if data showed that CRT results increase with the age, as if they were connected to some form of experience, this would be an interesting point to discuss financial markets. However, literature has detected no particular links excepted for gender: males have significantly higher scores on the CRT than females (Da Silva et al., 2018) and, not surprisingly, males are also more overconfident and trade more frequently (Booth and Katic, 2012, Gentile et al. 2016, Filbeck et al., 2017). This is connected to the fact that women are more risk averse than men (Ackert et al., 2020).

The second point is to deepen what is the direct connection between cognitive skills and investment decisions. Possible links are quite a few. For instance, Christelis et al. (2010) point out that, for investors with low cognitive skills, it is more difficult to gather and process information. The general interesting point here is that empirical studies show that the connections are based on the biases. Investors with different cognitive skills, as measured by CRT, are different as far as overconfidence, risk aversion, time preference and other biases are concerned (Korniotis and Kumar, 2011). The original Frederick's conclusions were similar. High score people (i.e. people that answer correctly to the CRT) are more patient, and, as far as risk aversion is concerned, confirming the prospect theory tenets, Frederick showed that low score people are more willing to participate to lotteries when losses are involved instead of gains (see also Oechssler et al., 2009). Before we analyse the results of the test, we sum up the discussion on the biases we delved vis à vis the cognitive skills.

Overconfidence has been defined the "mother of all biases" (Moore, 2018) and, in fact, it is met almost everywhere. Moore and Healy (2008) argue that it is a fundamental aspect of life, because, without overconfidence, no one would be involved in a dispute with someone else because the result would be known in advance, hence "Researchers have offered overconfidence as an explanation for wars, strikes, litigation, entrepreneurial failures, and stock market bubbles". As for finance, De Bondt (1998) has shown that this *hubris* is literally in every investor. Odean and Barber (2001) observed that overconfident investors has worse performance also because they trade too much (Glaser and Weber, 2007). There are also many researches on overconfidence and personal characteristics as gender or age. In particular, as we saw, normally women are less overconfident (Barber and Odean, 2001). Moreover, the age matters but not making people wiser. Gervais and Odean (2001) found that traders may learn to be overconfident not because they become better at trading but because they give credit of their success to overconfidence: "Overconfidence does not make traders wealthy, but the process of becoming wealthy *can* make traders overconfident". Merkle (2017) has corroborated the learning-to-be-overconfident hypothesis; Friehe and Pannenberg (2019) show that overconfidence increases with experience. Gentile et al. (2016), for the Italian market, confirm that "Older and wealthier individuals are more likely to be overconfident". However, as far as the connection with the CRT is concerned, Hoppe and Kusterer (2010) did not found any particular connection. Moore and Cain (2007) has shown that confidence in one's performance depends on the ease of the task being assigned, and that individuals tend to underestimate performance on simple tasks while overestimating more difficult ones. Christelis et al. (2010) noted that overconfident investors trade more often taking more financial risk "which implies a negative relation between cognitive skills and stockholding" with CRT "low group" underestimating financial risks.

The analysis of **risk aversion** is paramount in modern financial theory. In the traditional models, investors are normally risk neutral. Empirical studies show that individuals have a different attitude towards risk. For instance: "Although the vast majority of the survey participants are risk-averse according to our measure, a small proportion (4 percent) are either risk-neutral or risk-loving" (Guiso and Paiella, 2005). In particular, what would be interesting for us is if hints on connection between risk aversion and cognitive skills were to be found. Indeed, researchers found that people with high cognitive skills are more willing to take risks. Grinblatt et al. (2012) find it using IQ tests; Dohmen et al. (2010) connect this risk-seeking attitude with patience: "individuals with higher cognitive ability are significantly more willing to take risks in the lottery experiments and are significantly more patient".

This connect the issue of risk aversion with **time preference**. Frederick (2005) observed that high CRT group "was much more inclined to choose the later larger reward" but only for short horizon, while "for choices involving longer horizons…temporal preferences were weakly related or unrelated to CRT" as if for longer horizon the analysis of the participant was more based on careful appraisal, not on impulsive answers. However, Benjamin et al. (2013), although observed that risk aversion is less common among people with

high cognitive skills, also stated that "it is difficult, if not impossible, to establish the direction of causation between cognitive ability and time preference".

Bandwagon effect has been studied as a feature of financial market since the start of stock exchanges. It is sufficient to remind the importance of the beauty contest metaphor used by Keynes in the XII chapter of the *General Theory* (Esposito and Mastromatteo, 2020) or, even long before, the book on the madness of the crowd by McKay (1841) to confirm the long history for the discussion of this effect. Different studies have connected this effect with personal aspects of investors such as vanity or conformism (Kastanakis, 2010; Van Schalkwyk and Leigh, 2014). However, no connection with cognitive skills has been found (Toplak, et al., 2011), and also Grinblatt et al. (2012) conclude that "the herding variables do not interact significantly with IQ scores".

The last bias that we discuss is **money illusion**. This is the bias most directly connected to macroeconomic debates, because, if agents are affected by money illusion, conclusions on money neutrality do not hold anymore even in the short run. Not by chance, economists like Shiller and Akerlof have used this bias to reject the new classical macroeconomics conclusion starting with the "super-neutrality" (Akerlof and Shiller, 2010). Studies suggest that not only many people exhibit money illusion, but they also believe other have money illusion too, so they act accordingly (Fehr and Tyran, 2005). Money illusion is also connected to other biases such as the fact that individuals are more worried to avoid losses than to receive gains (Akerlof, 2002). Money illusion therefore can damage consumers because they do not perceive it (Favaretto and Masciandaro, 2015) and make their choices using the wrong budget constraint (Vincze, 2019). Overall, money illusion has "significant consequences on financial choices and portfolio composition" (Darriet et al., 2020) especially during deflation. However, as far as CRT is concerned, literature cannot find any link between money illusion and cognitive skills (Frederick, 2005).

Having discussed the biases we tested and their connection with the CRT, we present the results of the experiment, to see whether our data confirm what the literature has found on these topics.

5. Experimental design and results

We created a three sections questionnaire that we proposed in a link online; the first part is about the personal characteristics of the respondent (age, gender, education, profession); the second part is the CRT (hence is composed by three questions) and the third part proposes questions on the aforementioned cognitive biases (see the appendix for the questionnaire and all the data). We examined 300 subjects (171 female and 129 male) with an average age of 43 and that employed, on average, 16 minutes to fill the questionnaire. The breakdown of the answers is the following:

Table 1: Answers to CRT

Question	Correct	Intuitive	Other
Bat and ball	22.7%	64.0%	13.3%
Machines and widgets	45.3%	35.7%	19.0%
Lily pads in a lake	43.3%	40.0%	16.7%

Answers to the CRT allowed us to divide the subjects between a "high group" (at least 2 correct answers) and a "low group" (0 or 1 correct answers):

Table 2: Breakdown of respondents to CRT

Answers	Frequency	CRT group
0 correct	40.00%	
1 correct	24.00%	low
2 correct	20.67%	
3 correct	15.33%	high

The average score is 1.113. In Frederick (2005) the mean result of the CRT test was 1.24. Our average is low even vis à vis other studies (for instance, in Ackert et al., 2020, the average score is 1.60). As for the distribution of results, if we analyze in the original Frederick's studies, the cases that are the nearest in term of average result to ours, we have more extreme cases (more 0 and 3 correct answers). So our sample was more dispersed in term of cognitive skills (probably because, in the studies discussed by Frederick, respondents are more homogeneous in terms of their background and personal characteristics).

This is why, the first analysis we conducted was to verify a possible connection between personal characteristics and the CRT. Let's see the results[1]:

Table 3: Personal characteristics and CRT

Personal characteristics	P-value	
Profession	p = 0,09213	*
High school	p= 0,09731	*
Age	p = 0,00689	***
Degree	p = 0,0001	***
Gender	p= 0,00000001	***

(10%, ** 5%, *** 1% of significance)*

[1] For the classification in terms of jobs, age brackets and high school, see the appendix.

As we can see, age (younger participants have higher CRT results), having a degree and gender are the most significant. This confirms many works that show that men tend to give more correct answers to mathematical questions (Benbow and Stanley, 1980; Halpern, 1986; Hyde et al., 1990; Hedges and Nowell, 1995), and that, as Frederick suggested (2005), mistakes made by women are intuitive in nature. These data can also explain why the average CRT result of our test was low. In fact women in the high group are the 22.2% of the total women respondents, for the men the percentage is 54.3%.

Now we present the result of the biases under analysis. First, we put the results for overconfidence and risk aversion and we discuss the results:

Table 4: CRT with overconfidence and risk aversion

Question	Low Group	High Group	P-value	
Overconfidence				
Overconfident	30.20%(58)	27.78%(30)	0.8234	
Correct self-assessment	34.38%(66)	33.33%(36)		
Underconfident	35.42%(68)	38.89%(42)		
Risk Aversion (Positive Gamble)				
Risk-averse answer	65.62%(126)	66.67%(72)	0.8549	
Risk-seeking answer	34.38%(66)	33.33%(36)		
Risk Aversion (Negative Gamble)				
Risk-averse answer	56.25%(108)	68.52%(36)	0.0088	*
Risk-seeking answer	43.75%(84)	31.48%(34)	0.0088	*

(10%, ** 5%, *** 1% of significance)*

On overconfidence, we posed five questions: four about general issues and the last one asking participants to guess how many of the four previous questions they answered correctly (in the spirit of Hoppe and Kusterer, 2010). In this way, we were able to divide participants in three groups: "overconfident", "correct self-assessment" and "underconfident". Although low group emerges as more "overconfident", the result is not statistically significant.

As for risk aversion, we proposed two questions that embedded the bias on the positive and on the negative side to detect the asymmetry that behavioral economic found since, at least, the paradoxes of Allais and Ellsberg. When the question is posed in positive terms, the CRT is not able to identify if a risk-seeking attitude is connected to cognitive ability, while in the case of negative gamble, the results are statistically significant and the high group is more risk averse. Moreover, the respondents in the low group are more likely to be risk-seeking in the negative gamble situation, as Kahneman and Tversky suggested being the norm, although results are not significant. It is also interesting to point out that in the original data of Frederick (2005) only the

positive gamble gave significant results, with a by far more polarized results (low group 47% against 65,6% and high group with 75% against 66,7% of our experiment).

Now we pass to time preference and the bandwagon effect.

Table 5: CRT with time preference and bandwagon effect

Question	Low Group	High Group	P-value	
Time preference				
3400€ now or 3800€ next month	51.04%(98)	66.67%(72)	0.0088	*
100€ now or 140€ next year	25.52%(49)	33.33%(36)	0.1495	
100€ now or 1100€ in 10 years	38.02%(73)	56.48%(61)	0.002	**
9€ now or 100€ in 10 years	30.73%(59)	46.30%(50)	0.0071	***
40€ subito or 1000€ in 10 years	54.17%(104)	71.30%(77)	0.0036	**
100€ now or 20€ each year for 7 year	35.42%(68)	33.33%(36)	0.7159	
400€ now or 100€ each year for 10 years	56.77%(109)	73.15%(79)	0.0049	**
1000€ now or 100€ each year for 25 years	42.71%(82)	46.30%(50)	0.5479	
Bandwagon Effect				
Bias-prone	43.23%(83)	47.22%(51)	0.5043	
Not prone to bias	56.77%(109)	52.78%(57)		
Bandwagon Effect II				
Bias-prone	42.19%(81)	44.44%(48)	0.2241	
Neutral	33.85%(65)	25%(27)		
Not prone to bias	23.96%(46)	30.56%(33)		

(10%, ** 5%, *** 1% of significance)*

To make the results for time preference comparable with previous analyses, we used the same questions of Frederick (2005). As it seems, result are similar but not quite the same. For the questions 1, 3 and 4, the result in term of significance is identical, but we find no significance in the question 2 while Frederick found no significance for questions 5 and 7. The general distribution of high and low group is nonetheless similar. Data show that, generally, the high group is more patient and has a lower discount rate.

The bandwagon effect has been studied with a question that aimed at analyzing how much participants are influenced by brands in their choices (completing sentences with a famous brand). We divided participants, first, between the ones that in both cases filled the spaces with the famous brand and the others, and then dividing them in three (further separating the participants who only filled the space once). Although data show that low group is less exposed to the bandwagon effect in both scenarios, results are not statistically significant.

Table 6: CRT and money illusion

Question	Low Group	High Group	P-value	Significance level
Money Illusion I				
Question no.25 (I kind)	82.81%(159)	91.67%(99)	0.03388	**
Question no.26 (I kind)	83.85%(161)	90.74%(98)	0.09555	***
Question no.27 (II kind)	63.54%(122)	64.81%(70)	0.82547	
Question no.28 (III kind)	46.88%(90)	43.52%(47)	0.57533	
Question no.29 (II kind)	30.73%(59)	37.96%(41)	0.20204	
Question no.30 (III kind)	38.54%(74)	37.96%(41)	0.92117	
Money Illusion II questions 25 and 26				
Bias-prone	6.25%(12)	2.78%(3)	0.04882	**
Neutral	20.83%(40)	12.04%(13)		
Not prone to bias	72.92%(140)	85.19%(92)		
Money Illusion II questions 27 and 28				
Bias-prone	30.21%(58)	30.56%(33)	0.18687	
Neutral	45.31%(87)	36.11%(39)		
Not prone to bias	24.48%(47)	33.33%(36)		
Money Illusion II questions 29 and 30				
Bias-prone	41.15%(79)	47.22%(51)	0.31725	
Neutral	32.29%(62)	24.07%(26)		
Not prone to bias	26.56%(51)	28.70%(31)		

The last bias for what we collected data in the experiment is money illusion. We used six questions: two about inflation appraisal, two about the economic situation vis à vis inflation, and two about the fairness of the inflation outcome. We used two approaches to aggregate the results. First, we considered every answer alone; in this case, high group gives more frequently the right question, although only in the first one the result is statistically significant. The answers about the economic situation and fairness are more similar because they are not linked to cognitive abilities but to broader ideas about economy and inflation. In the second approach, we give one point for each right answer, thus dividing participants in three brackets: 2 right answers, 1 right answers, 0 right answers for the three dimensions of money illusion we studied. Once again, differences are significant only in the first dimension, showing that high group is less prone to money illusion when this bias is directly linked to cognitive abilities.

All in all, it seems that when subjects are asked to highlight the best scenario, those with higher cognitive abilities are able to think more in real terms and to identify the worst. On the contrary, when emotions are brought into play, the differences between the two CRT groups are reduced and, in the last situation, where a subjective appraisal is required, the outcome is reversed.

Before passing to some policy conclusion, we sum up the results. A first interesting aspect is that our data confirm that gender is important vis à vis cognitive skills but so are also age and education; therefore, the ability to use his/her mind to understand a financial situation can be trained and improved. A second aspect is that overconfidence and bandwagon are too complex as cognitive biases to be detected with simple questions. They are not only part of the cognitive characteristics of a subject but interact with market conditions. This explains why even if biases are permanent, financial market have cycles and trends. A financial bubble cannot be explained only as a consequence of a biased perception of risks by investors but biases allow the bubble to inflate. Overconfidence and herd behavior are two of the main fuels of a bubble. Overall, loss aversion of the investors can be highly pro-cyclical and this put the discussion of cognitive skills into perspective. A pure behavioral analysis of the market is unilateral. For instance, in the 50s, the era of financial repression, banks and financial markets were stable and financial crises were absent. And yet, the brain of the human beings was not very different from 1929 or 2008. Therefore, it is possible to tame biases, the problem is that to tame biases authorities have also to tame financial profits, and this could be politically impractical.

As for the other biases we analyzed, time preference and money illusion both connect with the ability to discount future monetary outcomes. Our results seem to show that, when subjects are asked to highlight the best scenario, those with higher cognitive abilities are able to think more in real terms. However, when emotions are brought into play, the differences between the CRT groups are reduced, and when a subjective evaluation is required, the situation is reversed. Are the "cognitive impulsive" group, as Frederick call it, less able to wait for a higher reward? The point may be impulsiveness more than a low capability of separating real from nominal prices.

6. Policy discussion: how to tackle cognitive biases in finance and monetary policy

The first three biases we discussed (overconfidence, loss aversion and bandwagon) are particularly important in finance. They influence how investors decide and, then, the dynamic of financial markets. Our data show that cognitive abilities seem to influence the choices of investors although results are patchy and these elements interact with others. For instance, there are enormous differences in stockholding among nations. Can these differences be connected to cognitive abilities? Of course, it would be unilateral to the extreme to track national characteristics of financial portfolios to IQ: "[data] suggests that country effects are potentially quite important in explaining stockholding decisions of European investors" (Christelis et al., 2010). There are many factors. For instance, pension funds are relatively new in Italy, where, on the contrary, public debt has been high at least since the 80s. These elements have had a big impact on the composition of Italian households' financial assets: less stocks, more government bond. It would not be interesting to use biases to explain such dynamics, but if we concentrate on how fragile market configurations can rapidly develop, we can see cognitive biases at work, like drawing conclusions from few cases, being overconfident, or when things are worsening, increasing risk-seeking attitudes to regain what has been lost. Overall, cognitive biases act as a pro-cyclical drive, that must be tackled by financial regulation.

Let's take the example of the house mortgage market. It has been a major fuel for financial bubbles in the last decades (McArthur and Edelman, 2017). Banks lend using the value of the house as collateral, but lending is in itself a factor in the house price increase, creating a speculative spiral. To reduce the pro-cyclicality of the market, regulators can introduce rules on the LTV as also proposed by international institutions[2]. Besides the usual financial regulation, what authorities and government can do to reduce the markets' vagaries? The main tool developed in the last decade has been financial education. It has been observed that "individuals with low levels of financial literacy are less likely to have invested in the stock market and thus are less likely to report losses in wealth. Yet, individuals with low financial literacy are more likely to sell their assets which lost in value (realize losses)" (Bucher-Koenen and Ziegelmeyer, 2011).

However, for all its importance, financial education has been considered not making the difference. For instance, Corgnet et al. (2018) observe that "financial literacy does not significantly affect trader performance when we include relevant control variables in the analysis such as CRT, IQ or personality traits". Similar observations are made in De Meza et al. (2008). Fernandes et al. (2014) found that "interventions to improve financial literacy explain only 0.1% of the variance in financial behaviors studied, with weaker effects in low-income samples". It is interesting to observe that "experimental evidence supporting the key role of cognitive ability in financial literacy acquisition" (Muñoz-Murillo et al., 2020). This means that the effectiveness of financial literacy is *mediated* by cognitive abilities and this is an important issue to assess how financial education can work. The same is true for biases that can reduce the positive role of financial education: "The traditional approach may however give poor results if cognitive biases are not taken into account. Education and information may in fact accentuate some behavioral fallacies, such as overconfidence, optimism and illusion of control" (Linciano, 2010). Biases and financial illiteracy interact through cognitive skills.

Given that situation, what can the regulators do? The general idea is that the plans for financial education should also aim at making investors aware of their biases: "investor education programmes may be beneficial not only directly, i.e. by raising financial capabilities, but also indirectly, i.e. by enhancing people awareness of their financial capability and by hindering overconfident behaviors and behavioral biases" (Gentile et al., 2016). A wide study of OECD-IOSCO (2018) proposed *debiasing strategies* to improve the effects of financial education. Research has found two of these strategies. The first one is through incentives (for instance, at the end of a financial education seminar, a test is distributed and the best respondent is given a prize). The second one is changing the choice context (the most famous example of this is the Thaler's nudge). Is it possible to combine cognitive skills with the nudge, for instance creating different default choices for the low group and the high group.

[2] The Loan to Value (LTV) is a key indicator used by banks to assess the affordability of a house for the borrower. After 2008, it has been part of the macroprudential regulatory framework proposed by the IMF and the FSB to stabilize the house market (Arslan and Upper, 2017).

The idea of adding a cognitive profiling to the usual financial profiling (as the one that is mandatory in the MIFID II framework) seems interesting. Regulators and the financial industry could work on some test (like the CRT) that is quick and effective to have a better understanding of how helping the customers. This is not only an issue of asset allocation but of who takes the decisions. If the cognitive test shows that the client has very low cognitive capabilities, it would be better, for him/her, to largely delegate to a professional advisor the asset allocation (Grinblatt et al., 2011).

Strategies to improve cognitive skills, for instance reducing the impulse to answer instinctively without a careful analysis of the issue, can work. However, this is only a first set of biases. The other set is made by emotional biases. As Filbeck et al. (2017) observe: "The general rule is that cognitive errors can be mitigated by educating investors, while the emotional biased cannot mitigated only accommodated". Emotional biases are smartly exploited by firms, included financial firms, for marketing purposes. This means that supervisory authorities should strictly monitor the strategies used by banks and other intermediaries to sell their products. Of the biases we analyzed, this is particularly important for overconfidence and the bandwagon effect. A marketing campaign can be based on eliciting overconfidence in clients ("You are very competent! This is why you deserve this product!") as well as imitative behavior ("Everybody is buying this! What are you waiting for!") and this can have a great effect on customers. Also the incentives of financial advisors and other key players in the financial product distribution should be shaped to prevent advantages coming from exploiting emotional biases.

The other two biases we analyzed, time preference and money illusion, have obvious connections with financial markets but have also many links with the macroeconomic situation and the framework of economic policy. The core issue is how economic agents are able to measure the value of time and of money. The problem here is not that they are inconsistent or irrational in their preferences, although it also happens, as experiments show, the point is that, for a number of reason, they do not measure correctly the effect of time and the change in the actual value of money. This can explain a very old fact in the labor market: unions and workers always resist nominal wage cuts but are a lot less able to detect a post factum cut of real wages via inflation. Of course, this holds true for small change in prices (say, 3-5% a year), because when inflation is strong, its effect are obvious and countermeasures are taken (like automatic increase in wages and so on).

It is difficult to discuss, in this scenario, how authorities may act to reduce the effects of these biases. First of all, money illusion gives policymaker more space to intervene because money is no more neutral and an active policy can be useful. The point is that inflation can be a strong factor in redistributing income and wealth, therefore policymakers should intervene to avoid that money illusion is used for allowing a hidden wealth and income redistribution. In the last two decades, inflation, at least in OECD countries, has been so low that this could have be seen a minor issue. However, it is difficult to grasp how prices will move after the pandemic, therefore the role of money illusion and inflation can return to be important in the next period.

To be effective, monetary policy should anchor inflation rate expectations to the target chosen by public authorities (Mehrotra and Yetman, 2014) and this also requires to intervene on the people awareness of the actual value of money, i.e. on the people time preference and money illusion, but there are no tools to act on this. Financial education can help people to realize the difference between nominal and real price (or rates) only to a certain point. Education in general has been seen as increasing patience and the real appraisal of the passing of time (Park, 2019) but, again, only up to a point. Given that the issue here is how labor market works, the solution can only come from there. The growth of social and economic inequality was an important ingredient in the build-up of the 2008 economic and financial crisis: "Widening income inequality is the defining challenge of our time. In advanced economies, the gap between the rich and poor is at its highest level in decades" (Dabla-Norris et al., 2015). Pandemic has worsened the situation with a strong wealth polarization (Ferreira, 2021). For years, the standard solution to improve the efficiency of the labor market has been considered deregulation, that has contributed to increasing inequality: "the erosion of labor market institutions is associated with the rise of income inequality [and]… the decline in unionization is related to the rise of top income shares and less redistribution" (Jaumotte and Osorio Bruiton, 2015). Inequality, in its turn, produced financial instability on a world scale (Mastromatteo and Esposito, 2016; Stropoli, 2021). These reforms have been a bad strategy for world economy. As Wolf has recently observed: "Structural policy is a still more complex issue. Too often, this is just a synonym for market liberalisation. But financial liberalisation has surely increased inequality and financial instability. So, good structural reform would almost certainly seek to constrain finance. Similarly, in labor markets with significant monopsonies, labor market deregulation might well be bad for employment and inequality. Moreover, rising inequality is almost certainly a factor in creating the structurally weak demand that explains the declining real interest rates and soaring indebtedness characteristic of our era of "secular stagnation". For all these reasons, the structural reforms we should be thinking about are more difficult than conventional wisdom imagines" (Wolf, 2021). Therefore, if it is true that inflation can redistribute income and wealth, also epochs of low inflation can experience such an outcome using deregulation and structural reforms. Another economic policy road is needed.

7. Conclusions: limits to market efficiency, limits to behavioral finance-based policies

2007-2008 financial crisis has forced a rethinking of the assumptions behind the models used to describe financial markets. One of the reasons why market efficiency is not a viable hypothesis is that investors are not rational in their decisions neither consistent in their preferences. Behavioral economics has developed as an alternative to traditional finance theory, and it is now acknowledged as a standard explanation for economic choices that could not fit into the mainstream explanations.

Scholars have discovered a series of cognitive and emotional biases, that have been used to explain market anomalies. They are different in their functioning and, up to now, there is not a theory that can connect them structurally as it was made for chemical elements with the periodic table. A particular strand of behavioral economics has analyzed whether the cognitive ability of an individual is important in his/her decisions, included financial decisions. Do intelligent persons invest better or take in general better decisions? This could

seem a trivial issue (after all, what is the point in being intelligent if, when you choose, you are mistaken as anybody else?), but the point is not an abstract conception of intelligence but the style of decision making, the two *systems* that Kahneman, Tversky, Frederick and others have studied. There are individuals that tend to rely almost always on the more instinctual, immediate line of actions suggested by their mind. This decision making strategy served us well for ages, for instance in a natural environment when an immediate decision must be taken to run away from a predator or towards a prey. But when deciding how to invest their money, human beings should rely on more elaborated strategies. Often they don't.

The situation is made worse by the fact that, on financial markets, we do not have only or mainly individual investors deciding atomically on their asset allocation. Just like and even more than in a natural habitat, we have complex strategies and complex organizations in action. Cognitive and emotional biases are not lost to firms and financial firms in particular. On the contrary, they are used any moment as marketing tools. When a consumer approaches a bank branch or speaks with a financial advisor, cognitive biases are consciously used against the client to sell products, for instance pressing him/her to choose rapidly. This was so also a century ago because smart seller of cars or dresses learned to take into account clients' biases to make more profits. But now, these aspects are carefully studied and taken into account in the firms' marketing strategies. Therefore, the situation is tilted against consumers. This is the reason why financial regulation works to try to rebalance the situation, helping the consumers to take the right decision when they contact a bank, an asset manager or an insurance company. The problem is to understand what the right decision is, given that clients do not know the answer, neither anybody else does.

In this situation, campaigns of financial educations have become a prominent tool in the arsenal of regulators to help consumers. Although important, we have seen that financial education has many limits. Besides the limits we have discussed, there is a key point that financial education cannot solve. If markets are inefficient, if investors are not able to make the right decisions for themselves, the role of private financial markets is somewhat weakened. After all, economically, investors are left free to allocate their wealth as they please, not because it is "morally" right, but because it is considered efficient in terms of growth and income distribution. If this is not so, where it is right to put limits to public intervention? As it is supposed that the Treasury or the central bank are not prone to emotional biases or to a low IQ, why not hand them all the savings to decide for an unbiased allocation? A completely centralized solution would be considered extreme even by the more ardent behavioral economics supporter, but the point is that, theoretically speaking, biases make the whole discussion on markets efficiency very uncertain and tricky. This is why even expert of psychological aspects of economics are afraid of behavioral economics conclusions (Berg and Gigerenzer, 2017). In synthesis, the main message that the debate on biases conveys to economists is that empirical results matter: we cannot rely only on abstract mathematical models and econometric analysis to understand the reality of financial markets.

From this conclusion stems an even more important message: to understand financial markets and world economy, we need different perspectives and theoretical strands, starting from historical and psychological

analyses. The same behavioral economics is made of different traditions: behaviorism, cognitive sciences, neuro-sciences, dynamic phycology and so on. This pluralism is vital both for the academy and for policymakers to effectively explain and intervene on the markets.

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Appendix

1. The questionnaire

Part I – Personal data

1. Date of Birth
2. Gender
3. High school
4. Degree
5. Profession

Part II. The CRT Test

6. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?
7. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
8. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Part III. Behavioral Finance Test

9. What is the distance between the Earth and the Sun in astronomical units?
□ 587 □ 1 □ 4553 □ 14

10. How many inhabitants does the Saarland (land) have?
□ 2.132.000 □ 1.670.000 □ 1.037.000 □ 890.000

11. In what year did Albert Einstein died?
□ 1955 □ 1947 □ 1961 □ 1938

12. Which metropolitan area has the largest number of inhabitants?
□ Shanghai □ Istanbul □ Los Angeles □ Moscow

13. How many of the previous four questions do you think you answered correctly?

***

14. Your choice: (A) 100 € for sure, or (B) a 50% chance of 300 € and a 50% chance of getting 0?

15. Your choice: (A) Lose 100 € for sure, or (B) a 50% chance of paying 300 € and a 50% chance of paying 0?

16. Your choice: (A) 3.400 € this month or (B) 3.800 € next month?

17. Your choice: (A) 100 € now or (B) 140 € next year?

18. Your choice: (A) 100 € now or (B) 1,100 € in ten years?

19. Your choice: (A) 9 € now or (B) 100 € in ten years?

20. Your choice: (A) 40 € now or (B) 1,000 € in ten years?

21. Your choice: (A) 100 € now or (B) 20 € each year for 7 years?

22. Your choice: (A) 400 € now or (B) 100 € each year for 10 years?

23. Your choice: (A) 1,000 € now or (B) 100 € each year for 25 years?

***

24. This is the new iPhone 12 and iPhone 12 Pro (in the questionnaire there was a pic attached), all VIPs have already bought it. Complete the following words with the missing letter: (1) _ O D A (2) F A M _(in Italian)

***

25. Suppose you have neither savings nor debt and that you spend your monthly wage of 1,600 € (i.e. you do not save, neither borrow). Two scenarios are possible: (A) prices remain the same and you get a 2% wage increase (it goes from € 1,600 to € 1,632); (B) there is 4% inflation and you get a 5% wage increase (it goes from € 1,600 to € 1,680). Which scenario do you think is the best?

26. Suppose year inflation has been 5%. The company where Thomas works has had a profit increase of 5% (year on year), and decides to increase the salaries of all its employees by 5%. Thomas's salary thus increases from € 1,120 to € 1,176. Do you think Thomas thinks his financial situation is:
□ More favorable □ Unchanged □ Less favorable □ I don't know

27. In relation to the previous question, in your opinion the situation of Thomas and of the other employees is:
□ Fair □ Unfair □ It depends □I don't know

28. All prices in the economy fell this year by 5%. The company where Thomas works has had a profit decrease of 5% (year on year), and decides to reduce the salaries of all its employees by 5%. Thomas's salary thus falls from € 1,120 to € 1,064. Do you think that Thomas thinks his financial situation is:
□ More favorable □ Unchanged □ Less favorable □ I don't know

29. In relation to the previous question, in your opinion the situation of Thomas and of the other employees is:
□ Fair □ Unfair □ It depends □I don't know

2. Data on the questionnaire

Personal characteristics

Table 1A – Profession

Observations	**Low Group**	**High Group**	**Total**
Accountant-financial clerk	14	12	**26**
Ordinary clerk	126	57	**183**
Self-employed professional	13	13	**26**
Manual worker	8	3	**11**
Retired	10	3	**13**
Student	21	20	**41**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Accountant-financial clerk	16,64	9,36	**26**
Ordinary clerk	117,12	65,88	**183**
Self-employed professional	16,64	9,36	**26**
Manual worker	7,04	3,96	**11**
Retired	8,32	4,68	**13**
Student	26,24	14,76	**41**
Total	**192**	**108**	**300**

χ^2	**Low Group**	**High Group**	**Total**
Accountant-financial clerk	0.41885	0.74462	1.16347
Ordinary clerk	0.67328	1.19694	1.87022
Self-employed professional	0.79625	1.41556	2.21181
Manual worker	0.13091	0.23273	0.36364
Retired	0.33923	0.60308	0.94231
Student	1.04640	1.86027	2.90667
χ^2 Value			**9.45812**
P-value			**0.09213**

Table 2A – At work/not at work

Observed frequencies	**Low Group**	**High Group**	**Total**
With a job	158	84	**242**
Not working	34	24	**58**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
With a job	154.88	87.12	**242**
Not working	37.12	20.88	**58**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
With a job	0.06285	0.11174	0.17459
Not working	0.26224	0.46621	0.72845
$\chi 2$ Value			**0.90304**
P-value			**0.34197**

Table 3A – High school

Observed frequencies	**Low Group**	**High Group**	**Total**
Professional Institute	22	6	**28**
Technical High School	73	34	**107**
Lyceum	91	66	**157**
Did not go	6	2	**8**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Professional Institute	17.92	10.08	**28**
Technical High School	68.48	38.52	**107**
Lyceum	100.48	56.52	**157**
Did not go	5.12	2.88	**8**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
Professional Institute	0.92893	1.65143	2.58036
Technical High School	0.29834	0.53038	0.82872
Lyceum	0.89441	1.59006	2.48447

Did not go	0.15125	0.26889	0.42014
$\chi 2$ Value			**6.31369**
P-value			**0.09213**

Table 4A – Age

Observed frequencies	**Low Group**	**High Group**	**Total**
1941 – 1960	27	8	**35**
1961 – 1970	59	21	**80**
1971 – 1980	44	24	**68**
1981 – 1990	18	10	**28**
1991 - 2002	44	45	**89**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
1941 – 1960	22.4	12.6	**35**
1961 – 1970	51.2	28.8	**80**
1971 – 1980	43.52	24.48	**68**
1981 – 1990	17.92	10.08	**28**
1991 - 2002	56.96	32.04	**89**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
1941 – 1960	0.94464	1.67937	2.62401
1961 – 1970	1.18828	2.11250	3.30078
1971 – 1980	0.00529	0.00941	0.01470
1981 – 1990	0.00036	0.00063	0.00099
1991 - 2002	2.94876	5.24225	8.19101
$\chi 2$ Value			**14.13149**
P-value			**0.00689**

Table 5A – Degree

Observed frequencies	**Low Group**	**High Group**	**Total**
Yes	69	64	**133**
No	123	44	**167**
Total	**192**	**108**	**300**

Expected frequencies	Low Group	High Group	Total
Yes	85.12	47.88	**133**
No	106.88	60.12	**167**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
Yes	3.05280	5.42720	8.48
No	2.43127	4.32226	6.75353
$\chi 2$ Value			**15.23353**
P-value			**0.00010**

Table 6A – Gender

Observed frequencies	Low Group	High Group	Total
F	133	38	**171**
M	59	70	**129**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
F	109.44	61.56	**171**
M	82.56	46.44	**129**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
F	5.07194	9.01679	14.08873
M	6.72328	11.95249	18.67577
$\chi 2$ Value			**32.7645**
P-value			**0.00000001**

Cognitive biases

Table 7A- Overconfidence

Observed frequencies	**Low Group**	**High Group**	**Total**
Overconfidence	58	30	**88**
Correct self-assessment	66	36	**102**
Underconfidence	68	42	**110**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Overconfidence	56.32	31.68	**88**
Correct self-assessment	65.28	36.72	**102**
Underconfidence	70.4	39.6	**110**
Total	**192**	**108**	**300**
$\chi 2$	**Low Group**	**High Group**	**Total**
Overconfidence	0.05011	0.08909	0.1392
Correct self-assessment	0.00794	0.01412	0.02206
Underconfidence	0.08182	0.14545	0.22727
$\chi 2$ Value			**0.38853**
P-value			**0.82344**

Table 8A- Risk Aversion (Positive Gamble)

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	126	72	**198**
Answer B	66	36	**102**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	126.72	71.28	**198**
Answer B	65.28	36.72	**102**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.00409	0.00727	0.01136
Answer B	0.00794	0.01412	0.02206
$\chi 2$ Value			**0.03342**

P-value			**0.85494**

Table 9A- Risk Aversion (Negative Gamble)

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	108	74	**182**
Answer B	84	34	**118**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	116.48	65.52	**182**
Answer B	75.52	42.48	**118**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.61736	1.09753	1.71490
Answer B	0.95220	1.69281	2.64501
χ2 Value			**4.35991**
P-value			**0.03679**

Table 10A - Time Preference I

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	94	36	**130**
Answer B	98	72	**170**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	83.2	46.8	**130**
Answer B	108.8	61.2	**108**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	1.40192	2.49231	3.89423
Answer B	1.07206	1.90588	2.97794
χ2 Value			**6.87217**
P-value			**0.00875**

Table 11A - Time Preference II

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	143	72	**215**
Answer B	49	36	**85**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	137.6	77.4	**215**
Answer B	54.4	30.6	**85**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.21192	0.37674	0.58866
Answer B	0.53603	0.95294	1.48897
χ2 Value			**2.07763**
P-value			**0.14947**

Table 12A - Time Preference III

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	119	47	**166**
Answer B	73	61	**134**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	106.24	59.76	**166**
Answer B	85.76	48.24	**134**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	1.53255	2.72452	4.25707
Answer B	1.89853	3.37516	5.27369
χ2 Value			**9.53076**
P-value			**0.00202**

Table 13A - Time Preference IV

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	133	58	**191**

Answer B	59	50	**109**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	122.24	68.76	**191**
Answer B	69.76	39.24	**109**
Total	**192**	**108**	**300**

χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.94713	1.68379	2.63092
Answer B	1.65966	2.95050	4.61016
χ2 Value			**7.24108**
P-value			**0.00713**

Table 14A - Time Preference V

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	88	31	**119**
Answer B	104	77	**181**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	76.16	42.84	**119**
Answer B	115.84	65.16	**181**
Total	**192**	**108**	**300**

χ^2	**Low Group**	**High Group**	**Total**
Answer A	1.84067	3.27231	5.11298
Answer B	1.21017	2.15141	3.36158
χ2 Value			**8.47456**
P-value			**0.0036**

Table 15A - Time Preference VI

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	124	72	**196**
Answer B	68	36	**104**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	125.44	70.56	**196**
Answer B	66.56	37.44	**104**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.01653	0.02939	0.04592
Answer B	0.03115	0.05538	0.08653
χ2 Value			**0.13245**
P-value			**0.71589**

Table 16A - Time Preference VII

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	83	29	**112**
Answer B	109	79	**188**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	71.68	40.32	**112**
Answer B	120.32	67.68	**188**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Answer A	1.78770	3.17813	4.96583
Answer B	1.06501	1.89336	2.95837
χ2 Value			**7.9242**
P-value			**0.00488**

Table 17A - Time Preference VIII

Observed frequencies	**Low Group**	**High Group**	**Total**
Answer A	110	58	**168**
Answer B	82	50	**132**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Answer A	107.52	60.48	**168**

Answer B	84.48	47.52	**132**
Total	**192**	**108**	**300**

χ^2	**Low Group**	**High Group**	**Total**
Answer A	0.05720	0.10169	0.15889
Answer B	0.07280	0.12943	0.20223
χ2 Value			**0.36112**
P-value			**0.547882**

Table 18A - Bandwagon Effect I

Observed frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	83	51	**134**
Not Subject to bias	109	57	**166**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	85.76	48.24	**134**
Not Subject to bias	106.24	59.76	**166**
Total	**192**	**108**	**300**

χ^2	**Low Group**	**High Group**	**Total**
Subject to bias	0.08882	0.15791	0.24673
Not Subject to bias	0.07170	0.12747	0.19917
χ2 Value			**0.4459**
P-value			**0.504285**

Table 19A - Bandwagon Effect II

Observed frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	81	48	**129**
Neutral	65	27	**92**
Not Subject to bias	46	33	**79**
Total	**192**	**108**	**300**

Expected frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	82.56	46.44	**129**
Neutral	58.88	33.12	**92**
Not Subject to bias	50.56	28.44	**79**

Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Subject to bias	0.02948	0.05240	0.08188
Neutral	0.63611	1.13087	1.76698
Not Subject to bias	0.41127	0.73114	1.14241
χ2 Value			**2.99127**
P-value			**0.22411**

Table 20A - Money Illusion I

Observed frequencies	**Low Group**	**High Group**	**Total**
Correct answer	159	99	**258**
Incorrect answer	33	9	**42**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	165.12	92.88	**258**
Incorrect answer	26.88	15.12	**42**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Correct answer	0.22683	0.40326	0.63009
Incorrect answer	1.39339	2.47714	3.87053
χ2 Value			**4.50062**
P-value			**0.033883**

Table 21A - Money Illusion II

Observed frequencies	**Low Group**	**High Group**	**Total**
Correct answer	161	98	**259**
Incorrect answer	31	10	**41**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	165.76	93.24	**259**
Incorrect answer	26.24	14.76	**41**
Total	**192**	**108**	**300**

χ^2	Low Group	High Group	Total
Correct answer	0.13669	0.24300	0.37969
Incorrect answer	0.86348	1.53507	2.39855
χ2 Value			**2.77824**
P-value			**0.09555**

Table 22A - Money Illusion III

Observed frequencies	**Low Group**	**High Group**	**Total**
Correct answer	122	70	**192**
Incorrect answer	70	38	**108**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	122.88	69.12	**192**
Incorrect answer	69.12	38.88	**108**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Correct answer	0.00630	0.01120	0.0175
Incorrect answer	0.01120	0.01992	0.03112
χ2 Value			**0.04862**
P-value			**0.825469**

Table 23A - Money Illusion IV

Observed frequencies	Low Group	High Group	**Total**
Correct answer	90	47	**137**
Incorrect answer	102	61	**163**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	87.68	49.32	**137**
Incorrect answer	104.32	58.68	**163**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Correct answer	0.06139	0.10913	0.17052

Incorrect answer	0.05160	0.09172	0.14332
χ2 Value			**0.31384**
P-value			**0.575334**

Table 24A - Money Illusion V

Observed frequencies	Low Group	High Group	**Total**
Correct answer	59	41	**100**
Incorrect answer	133	67	**200**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	64	36	**100**
Incorrect answer	128	72	**200**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Correct answer	0.39063	0.69444	1.08507
Incorrect answer	0.19531	0.34722	0.54253
χ2 Value			**1.6276**
P-value			**0.202034**

Table 25A - Money Illusion VI

Observed frequencies	**Low Group**	**High Group**	**Total**
Correct answer	74	41	**115**
Incorrect answer	118	67	**185**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Correct answer	73.6	41.4	**115**
Incorrect answer	118.4	66.6	**185**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Correct answer	0.00217	0.00386	0.00603
Incorrect answer	0.00135	0.00240	0.00375
χ2 Value			**0.00978**
P-value			**0.921173**

Table 26A - Money Illusion VII

Observed frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	12	3	**15**
Neutral	40	13	**53**
Non Subject to bias	140	92	**232**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	9.6	5.4	**232**
Neutral	33.92	19.08	**53**
Non Subject to bias	148.48	83.52	**15**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Subject to bias	0.6	1.06667	1.66667
Neutral	1.08981	1.93744	3.02725
Non Subject to bias	0.48431	0.86100	1.34531
χ2 Value			**6.03923**
P-value			**0.0488201**

Table 27A - Money Illusion VIII

Observed frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	58	33	**91**
Neutral	87	39	**126**
Non Subject to bias	47	36	**83**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	58.24	32.76	**91**
Neutral	80.64	45.36	**126**
Non Subject to bias	53.12	29.88	**83**
Total	**192**	**108**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Subject to bias	0.00099	0.00176	0.00275
Neutral	0.50161	0.89175	1.39336

Non Subject to bias	0.70509	1.25349	1.95858
χ2 Value			**3.35469**
P-value			**0.186869**

Table 28A - Money Illusion IX

Observed frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	79	51	**130**
Neutral	62	26	**88**
Non Subject to bias	51	31	**82**
Total	**192**	**108**	**300**
Expected frequencies	**Low Group**	**High Group**	**Total**
Subject to bias	83.2	46.8	**130**
Neutral	56.32	31.68	**88**
Non Subject to bias	52.48	29.52	**82**
Total	**192**	**192**	**300**
χ^2	**Low Group**	**High Group**	**Total**
Subject to bias	0.21202	0.37692	0.58894
Neutral	0.57284	1.01838	1.59122
Non Subject to bias	0.04174	0.07420	0.11594
χ2 Value			**2.2961**
P-value			**0.317254**

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