

THE DETERMINANTS OF RISK TOLERANCE: A BEHAVIOURAL ANALYSIS

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Abstract

The traditional perspective of financial theory suggests an implicit rationality on decision making. Historically, researches have revolved around demographic, social and economic heuristics, thus neglecting the emotional, cognitive and behavioral suppositions, related to financial decision making. In this sense, this study aims to evaluate which are the determining factors for risk tolerance. So, we carried out a survey on 815 individuals residing in Santa Maria, Julio de Castilhos and Cruz Alta, Brazil. Afterwards, we performed a CFA and, eventually, a regression analysis. Generally and consistently, the suppositions for rationality were refuted, though consistent to the Prospect Theory, validating the numerous studies that demonstrate the violation of the rationality suppositions. The heuristics which are traditionally used in order to determine the level of risk tolerance have not shown to be significant in this research. The cognitive, emotional and behavioral dimensions of decision making have shown to be significant.

Keywords: Risk, Risk Tolerance, Behavioral Finance

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1. Introduction

The premise that currently supports most of the modern economic and financial theory is based on the rationality held by the economical agents. This conceptual aspect suggests that all economical agents are completely rational and that they use all the available information in the best way possible. As a consequence, individuals will choose their optimal option that will in turn maximize their satisfaction (Mosca, 2009).

We can find in this context of rationality for financial decision the Expected Utility Theory (EUT) that was shaped by Von Neumann and Morgenstern (1944). EUT is an axiomatic theory that is based in the premise that the rational human being makes decisions by comparing the promised utility for each alternative (multiplying the expected utility for each option by the respective probability and choosing the highest value).

One of the main axioms in EUT is the one on rationality, which subsidizes the one on utility and

suggests that individuals will make their choices based in expected utility, so as to maximize their wealth. However, Allais (1953), as well as Edwards (1961), Quiggin (1982), Segal (1989), Quiggin and Wakker (1994), demonstrated that human beings often violate the rationality axiom, as suggested by EUT.

Among financial decisions, behavior facing risk is one of the central themes. Risk tolerance is a determining factor when it comes to choosing how to allocate assets and, as a consequence, it directly influences the creation of products and the definition of investment and funding strategies. In this context, several studies seek to identify factors that influence risk tolerance, but many questions are yet to be answered, especially regarding its determinants.

Several heuristics are used in order to determine the level of risk tolerance in individuals, which suppose a strong correlation between the demographical and social/economical characteristics. However, few studies demonstrate the influence of

the cognitive, behavioral and emotional dimensions on financial decision making.

Considering the importance of risk tolerance, the setback of financial theories that approach rationality, the discrepancy of results when compared to determining factors and the scarcity of studies that demonstrate the influence on cognitive, emotional and behavioral dimensions in risk tolerance, this research sought to answer the following question: *which are the determining factors in risk tolerance for financial decisions?*

2. Review

2.1 The traditional perspective on risk and the Expected Utility Theory

Risk, according to the traditional conception, is objective and of a quantitative nature. It is based in past information (occurrence of an event followed by a statistical evaluation) so as to make a decision in order to increase the safety of results. In this sense, risk definition, according to EUT, supposes that the investor evaluates the investment risk according to the change that it carries as far as wealth is concerned.

Ricciardi (2004) states that according to EUT, risk is analyzed by relating the expected return in terms of utility. Another relevant point to be highlighted is that EUT works with the concept that the investor is perfectly rational when making decisions, always preferring the alternative that presents a greater increase of his expected wealth.

Moore (1968) described it as objective risk: the word "risk" commonly denotes only future events where the probabilities for the alternative results are known. Probability is a measure for the relative frequency for an event and is strictly applicable to events that are repeated in nature. Thus, it shows distribution, and such observations can be analyzed and statistical inferences can be carried out. When there are a great number of observations available, the highest frequency observed, bias-free, gets closer to the objective risk, via the probability for the event to happen.

The Expected Utility Theory (EUT) is the main theory to process – a in a statistical manner – the problems regarding economical decision. It was initially launched by Von Neumann and Morgenstern (1944), although there is evidence, in the case of Baron (2008), e.g., that the first scientific work on EUT was developed by Daniel Bernoulli, in 1738, as an attempt to solve the Saint Petersburg Paradox.

Utility can be defined as "the level of satisfaction that somebody has when consuming a good or performing an activity". The terms "utility" or "preference" are frequently used in order to define the decision maker's attitude facing the choice. They basically refer to the relationship between alternatives, in which the decision maker prefers one instead of the other always choosing the one that

offers more "expected utility", as quoted by Pindyck and Rubinfeld (2005).

According to EUT, a rational individual always needs to have imperative preferences, i.e., one must never abstain from acting rationally. In this concept, a rationally acting individual must agree and act consistently to the presented axioms. Meanwhile, some evidence for inconsistencies was found in some of these axioms.

2.2 The cognitive and behavioral perspective on risk

The basic assumption of modern finance states that man is a rational being and a maximizer for expected utility. However, literature on markets' irrationality is fertile. The idea that markets could behave in an irrational manner was against the principles of expected utility.

However, according to Kahnemann and Riepe (1998), financial decisions are made in times of high complexity and great uncertainty. Often, the moment's emotional stress at the moment of financial decision is huge. This ambiance makes the investor trust intuition which often plays a crucial role in financial decisions. This is the context where the prejudices that push them away from rationality come up.

In this sense, discussion on human rationality and, as a consequence, the validity of EUT, has opened a new path for a new area in Finance that is currently being developed and called Behavioral Finance. This area is commonly defined as the application of Psychology to Finance, in an attempt to explain the financial decision of individuals.

For Behavioral Finance, decisions made according to a problem follow, in some cases, an identifiable pattern that can and should be contemplated by an economical and financial model. The field of Behavioral Finance is precisely the identification of how emotions and cognitive mistakes may influence the decision making process and of how such behavioral patterns can determine changes in the market.

2.2.1. Excessive confidence bias

Excessive confidence, or overrating personal skills, is maybe the behavioral bias that has a greater number of studies confirming its existence. For some researchers it gets to be the element with the strongest influence on the decision making process. It is vastly observed in individuals who imagine they own a decision making skill that is superior to the average population. Biass, Hilton, Mazurier and Pouget (2002) created an experimental market to study the influence of excessive confidence on the performance of investment portfolios. In this study, researchers demonstrate that, the more an individual suffers from excessive confidence, the worse the performance for

his investment portfolio is, when compared to other investors.

Pompian (2006) quotes that, in its most basic form, excessive confidence maybe summarized as unjustified faith in an intuitive reasoning, in judgments or cognitive skills. The concept of excessive confidence bias is based in the set of cognitive and psychological experiences that directly influence the decision making process, overestimating both the anticipating skills and the precision of the information that underlies them. Fallaciously, they tend to compare the amount of information to its quality, making an individual believe that the more information he has, the more prepared he will be, without even analyzing its validity.

Another perverted consequence of excessive confidence is the reluctance in assuming a mistake. This feeling of aversion to regret shapes another bias that is commonly studied in Behavioral Finance: cognitive dissonance.

2.2.2. Cognitive Dissonance

When a new piece of information starts conflict with pre-existent perceptions, individuals often feel a mental discomfort, which is a phenomenon known as cognitive dissonance. In Psychology, cognitions represent attitudes, emotions, beliefs and values, and cognitive dissonance corresponds to an unbalanced condition that takes place when contradictory cognitions collide. According to Pompain (2006), the concept of cognitive dissonance inscapes the answer of individuals when trying to harmonize cognitions and, thus, to relief their mental discomfort.

Pompain (2006) quotes that the difficulty to accept the mistake in a decision is perceived as a contestation of such decision and this becomes an emotional threat. Most people avoid dissonant situations or even ignore potentially relevant information so as to avoid psychological conflicts.

Scholars have identified different aspects of the cognitive dissonance and that participate in the decision making process: selective perception and selective decision making.

Individuals who suffer from selective perception only register information that confirms the path chosen, thus producing an incomplete vision of reality and, as a consequence, imprecise. Since they are unable to objectively analyze the available evidence, they become more and more likely to make calculation and prejudiced mistakes in their future decisions.

On the other hand, selective decision making takes place when the commitment to the decision is high, thus forcing the individual to rationalize his actions in such a way that they do not enter a conflict with his decision, even when there is an exorbitant economical cost to it. Many studies show that individuals will subjectively and continuously

reinforce decisions or commitments made or taken in the past.

In order to weather the dissonance that comes from recognizing mistakes in the past, investors often associate their failures to external events opposite to assuming a bad decision. Naturally, people who lose the opportunity of learning from their past will be prone to new calculation mistakes, thus renewing the anxiety cycle, discomfort, dissonance and denial. Another bias that is associated to cognitive dissonance is the self-attribution bias.

2.2.3. Self-attribution bias

Self-attribution bias refers to the tendency individuals have to attribute their success to innate features, such as talent for anticipating or their own intelligence, although their failures are often attributed to external influences, such as bad luck. Pompian (2006) quotes that the self attribution bias is a cognitive phenomenon that makes individuals attribute their negative results to situational factors and their gains to innate factors of their own nature. This bias can be divided into analysis forms: *self-enhancing bias*, which represents how prone individuals are to claim an irrational degree of credit for their success; *self-protecting bias*, represents the corollary to the irrational denial of responsibility for failure.

The author concludes that the self-enhancing bias may be explained by a cognitive approach, because individuals are naturally more biased to credit their success rather than their failures, since they intend to have success, instead of failing. Self-protecting bias can be explained from an emotional point of view. Psychologists argue the human being's need to keep their self-esteem by instigating psychological protection, so as to decrease the psychological pain of assuming guilt for wrong decision.

The irrational attribution of success and failure can harm an investor in two primary ways. First, people who are not able to understand their own mistakes are, as a consequence, unable to learn from their own mistakes. Second, investors grant a disproportional credit to the positive results of their investments, making them excessively confident about their future decisions.

2.2.4. Excessive Optimism Bias

Investors may be excessively optimistic about markets, economy and the potential value increase of assets they have invested in. According to Pompian (2006), many investors believe a bad investment will not happen to them, but only to others. These neglects may harm the profitability of their investment portfolios, because individuals may not recognize the potential consequences of their investment decisions.

Daniel Kahneman and Daniel Lovallo describe the excessive optimism bias in a more technical way.

Researchers marked a tendency of investors to adopt an internal vision, with a clear personal involvement, instead of an external vision, without personal involvements. The external vision, not passionate, evaluates the current situation regarding results obtained in the past, relating and analyzing them in the most unbiased way possible. The process of external vision replaced by internal vision is the one that distinguishes excessive optimism, thus harming the rational decision and implying in predictions that are too “pink”, influenced by feelings that are related to present situations in a biased manner.

Pompian (2006), quotes that most investors are inclined towards an internal vision, influenced by their feelings. This approach, according to the author, is traditional and rooted, and it comes in an intuitive way. Since the path to think about an investment is complex, due to the need to analyze the available data and to pay special attention to unique or uncommon details, the perception of the need to gather stats about a case rarely comes up in an investor’s mind.

2.2.5. The fear of missing a gain opportunity

Mosca (2009) comments that the fear of missing a gain opportunity in a specific investment that others are participating in is a stronger motivator for the acquisition of a specific asset, when compared to the fear a financial loss, as long as most of his peers have made the same mistake. Such fear of being left out is the main fuel that drives the herd movements and, consequently, the forming of bubbles.

Research led by DeMarzo, Kremer and Keniel, Stanford and Duke Universities, confirm that most fear, not the loss itself, but the risk of seeing their investments having a worse performance when compared to other investors. These researchers demonstrate that individuals care first about the wealth – compared to other people or members of their community. So, for these authors, fear #1, regarding managing their property, is to be poor while other get richer.

Generally, people and companies follow the behavioral pattern of their peers because, by acting in such a way, they are fighting the risk that other might be investing in the next big winner, while they are out (MOSCA, 2009). There is, hence, a strong influence or pressure exerted by the observed or assumed behavior of our peers, where the final decision to allocate assets ends being determined by the perception of the evolution of wealth when compared to the other members of the group.

2.3. The emotional and social perspective on risk

Nofsinger (2005) quotes that finances have followed modern economy quite a lot, which seems to be seen as a branch of exact sciences. To that respect,

neoclassical finance theory tends to ignore the influence of social factors in the finance decision context, and a great part of the Traditional Finance is modeled in a Robinson Crusoe-like economy, i.e., isolated from the social system to which it belongs to. For the author, economy is not a physical system, but yet a complex system of human interactions.

Humor affects the way investors analyze judgments (Nofsinger, 2002). People in a good mood make more optimistic judgments than people in a bad mood. Being in a bad mood makes investors more critical; it helps them exercise a more detailed analysis. As an alternative, people in a good mood will tend to use less critical ways to process information. That aspect particularly affects relatively abstract decisions, about which people do not have complete or exact information. Naturally, this situation perfectly describes the investment context. According to the author, bad mood causes a more critical analysis of judgments and good mood tends to cause decisions taken without much analysis. So, investment decision making is directly influenced by the individual’s mood.

Nofsinger (2005) comments that conversation is important for stock market. Brokers interact with clients and other brokers. Analysts communicate with executives. Individual investors talk to their families, neighbors, colleagues and friends about investments. Shiller (1995) perform their research in institutions and on individual investors about their communication patterns. Authors conclude that the directing of interpersonal communications is very important in investments decisions. Hong, Kubik, and Stein (2005) analyze portfolio managers so as to test the premise that fund managers that work in the same city are more prone to exchanging investment ideas by word of mouth. Authors demonstrate that managers in the same city are more prone to exchange the same type of stocks and conclude that investments are consistent to the information that is being distributed by these interactions.

3. Method

This research was carried out with the inhabitants of Santa Maria, Julio de Castilhos and Cruz Alta (Brazil). A total of 815 questionnaires were applied. The main technique to define the determining factors for risk tolerance was the Exploratory Factorial Analysis. In order to answer the problem of this research “we used the multivariate technique, called multiple regression analysis.

Risk tolerance is a concept that has implications for individual investors, as well as managers in finance, or investment managers, for example. Droms and Strauss (2003) quotes that, for individual investors, risk tolerance will determine the adequate composition of assets in an optimized portfolio, as far as risk and return are concerned regarding each individual’s needs. The tool for collecting data was

adapted from Droms and Strauss (2003) so as to determine the level of the individuals' risk tolerance.

The tool for collecting data was adapted from Droms and Strauss (2003) so as to determine the level of the individuals' risk tolerance. In order to make this measure more quantitative, the participant was given the possibility of assigning a score (0-10), depending on how much he/she agreed with each one of the six questions. When assigning a zero score, the participant showed not to agree to the statement and when assigning ten, he/she utterly agreed. With the new scale, the sum of the values pointed out by the participants for each of the six questions could range

from zero (totally intolerant to risk) to sixty points (totally tolerant to risk).

4. RESULTS

In order to find the determining factors for risk tolerance, we initially performed a factorial analysis.

Adequacy and specificity tests performed on the sample were considered satisfactory, because the results from the Kaiser-Meyer-Olkin (KMO) equals 0,828 and the Bartlett's test showed a qui-square equal to 6.447,219 and significance equal to 0,000. Table 1 shows variance explained by factors with eigenvalues superior to 1.

Table 1. Extracted Factors and respective eigenvalues and explained variance

Factor	Eigenvalue	Explained variance	
		Percentual	Accumulated
1	5,913	25,709	25,709
2	2,221	9,655	35,364
3	1,972	8,574	43,938
4	1,371	5,96	49,898
5	1,339	5,82	55,718
6	1,177	5,116	60,834
7	1,047	4,553	65,387

Table 1 shows that the seven selected factors (with eigenvalues bigger than 1) explain, altogether, 65.39% of the data total variance, excluding other 16 factors that showed eigenvalues smaller than or equal

to 1. On Table 2 we show the factorial cargo on each of these seven factors, as well as the variables for each factor.

Table 2. Factorial cargo obtained for each factor and respective variable

Variable	Factors						
	1	2	3	4	5	6	7
Enjoys a lot of luxury in life	0,77						
Enjoys owning things that impress people	0,74						
Better life if had many things that does not have now	0,73						
Would be much happier if could buy more things	0,65						
Upset if unable to buy all desired things	0,60						
Money means pleasure	0,50						
Afraid of losing an opportunity everyone takes		0,78					
Relieved because own mistake is the same as everyone else's		0,75					
Afraid of having worse results than others		0,71					
Make same decisions as most people		0,61					
Tranquility / peace			0,82				
Enthusiasm			0,79				
Happiness			0,75				
Able to identify the best moment to invest				0,79			
Gains are a direct result of his/her competence				0,78			
Instincts contribute for choosing investments				0,71			
Prefers spread payments even if total is more expensive					0,77		
Buys on spread payments instead of waiting to have money					0,71		
Finds it normal to get into debt so as to buy things					0,66		
Comments if there is loss						0,86	
Comments if there is profit						0,83	
Cognitive disonance							0,80
Losses are caused by invisible factors							0,79

All factors presented satisfactory factorial cargo (bigger or smaller than 0.50) and hence we kept them

for this study, such as suggested by Hair *et al.* (1998) – cargo greater than 0.30 is significant.

After estimating the factorial cargo, we named the factors. The first factor was called “materialism” for the interest in material goods and emotional association, whether by acquisition, or by the impossibility of acquiring such goods. Fournier and Richins (1991) quote that society nowadays lives an era of compulsive materialism. Authors have studied materialism in several different countries and concluded that the popular meaning of materialism involves notions of possessing or achieving the best, and wishing for wealth as an objective itself. For these authors, this notion is associated to objectives, such as the search for happiness, demonstration of social status, self-affirmation and feeling of superiority.

The second factor was called the “left out effect”, because a common way to simplify the decision making process is simply to follow the pack; to do what everyone else is doing. We have the innate necessity to act according to the other members of the group in which we are in. Mosca (2009) quotes that acting in such a way brings comfort and security, even because making a mistake along with others is less awkward.

Pompain (2006) quotes that when we act differently from our social group, our subconscious enters a conflict with pre-existent perceptions and individuals often feel a mental discomfort – a phenomenon known as cognitive dissonance. Cognitions, in Psychology, represent attitudes, emotions, beliefs and values, and cognitive dissonance is an unbalanced condition that takes place when contradictory cognitions cross. Psychologists conclude that individuals perform pseudo-rationalizations so as to synchronize their cognitions and keep their psychological stability. Thus, individuals modify their behaviors or cognitions in order to reach a new cognitive harmony. However, such changes are not always made in a rational way. Such pseudo-rationalizations can make individuals ignore potentially relevant information so as to avoid psychological conflicts, thus elevating their risk tolerance level.

The third factor was called “emotion”, because both the psychologists and the economists that analyzed the role of emotion in decision making realized that feelings and emotions that are unattached to the subject can affect decisions (Loewenstein, Weber, Hsee, & Welch, 2001). The term “unattached”, in this context, means that emotions are not related to the decision to be made. Nofsinger (2001) quotes that emotions interact with the evaluation’s cognitive process and end up leading to a

decision. Sometimes, emotional reactions diverge from reasoning and logic so as to determine the decision making process. In fact, the more complex and uncertain the situation is, the more emotions influence the decision (Forgas, 1995). Cavalheiro et al. (2011) quotes that financial decisions are complex and include uncertainty and can be influenced by feelings, emotions or mood. That is called misattribution bias, i.e., people generally let themselves being unduly influenced by feelings when making a financial decision.

The fourth factor is called self-attribution bias via self-enhancement. Self-attribution bias is a cognitive phenomenon that makes an individual associate their negative results to situational factors and their gains to innate factors of their nature (Pompian, 2006). This bias can be divided into analysis forms: a) self-enhancing bias, that represents how prone individuals are to claim an irrational degree of credit to their success and b) self-protecting bias, representing the corollary effect to the irrational denial of responsibility for failure. The fifth factor is called “indebtedness”.

The sixth factor is called “talking about investments”. People learn from interacting with each other. The human-being observes other people’s behavior because he wants to interpret what they are thinking, but what he really likes is to take the most of the conversation’s social interaction. People talk about subjects that they are enthusiastic about, topics that they are interested in and even about what upsets them. Conversation is an important way to get information and detect emotional reactions, and this helps to make an opinion.

The last factor was called self-attribution bias by self-protection. Self-protection bias is taken as the attribution of personal failure to external influences, such as bad luck (Pompian, 2006). Self-protection bias can be explained from an emotional point of view, for the human need to keep self-esteem. This effect is connected to the difficulty humans have in recognizing their mistakes, because this recognition takes the individual to a level of unwanted psychological pain, directly influencing financial decisions.

In order to evaluate the liability of factors generated from the factorial analysis, we used Cronbach’s Alpha. According to Hair *et al.* (1998), *Cronbach’s alpha* should be bigger than 0.6 (because it is considered to be an exploratory factorial analysis). On Table 3, we show the variables that make up each factor and their respective results for *Cronbach’s alpha*.

Table 3. Variables and *Cronbach's alpha* for each factor

Factor	Variables	<i>Cronbach's alpha</i>
Materialisme	88, 86, 80, 84, 90 e 74	0,8282
Being left out effect	60, 59, 61 e 58	0,7911
Emotion	44, 45 e 43	0,7429
Self-enhancement	32, 34 e 35	0,7188
Indebtedement	87, 83 e 81	0,6487
Talk about investments	36 e 38	0,7584
Self-protection	31 e 33	0,4813

On Table 3 self-protection stands out with a *Cronbach's alpha* smaller to the one established by Hair *et al.* (1998) and, since it is no longer possible to exclude any variable because there are only two, we calculated the variables' average for each factor.

In order to check the influence of variables and factors on risk tolerance, we performed a multiple regression analysis. Risk tolerance was considered as an exogenous variable. Results of the chosen model, via stepwise, are shown on Table 4.

Table 4. Regressors, weights and coefficient significance of the OLS regression model in order to explain the exogenous variable – risk tolerance

Regressors	Coef.	std. deviation	t test	t test sig.	FIV
Emotion factor	0,698272	0,14154	4,9330	0,0000	1,2060
Being left out effect factor	0,397497	0,14311	2,7770	0,0056	1,5880
Cash-on.stock effect	0,295800	0,09810	3,0150	0,0026	1,2710
Cognitive disonance	0,399484	0,10626	3,7600	0,0002	1,2000
Self-protection	0,446919	0,10104	4,4230	0,0000	1,2710
Excessive confidence bias	0,509397	0,11599	4,3920	0,0000	1,4820
Risk as an opportunity	0,438070	0,10048	4,3600	0,0000	1,1650
Self-attribution factor	0,676986	0,13476	5,0240	0,0000	1,3940
Save before you spend	0,331377	0,10160	3,2620	0,0012	1,2640
Already incurred in cost	0,346609	0,09310	3,7230	0,0002	1,2540
Spending on expensive things	0,270591	0,10385	2,6060	0,0093	1,3700
Excessive confidence	0,210590	0,09934	2,1200	0,0343	1,2230
Excessive optimism	0,338406	0,13329	2,5390	0,0113	1,4080

The *Stepwise* model selected 13 regressors, 3 factors of which were used (emotion, self-attribution and being left out effect) and 10 variables. The determination coefficient (adjusted R^2) was 0.93. We can observe on Table 4 that all values for the t test were significant, as well as the ones for the f test (811,634 and sig. 000). The Akaike Information Criteria was equal to 5.713,168 and the Schwarz Criteria was equal to 5.774,309.

On the other hand, the White test for heterocedasticity rejected the null hypothesis (Qui-square = 381,476245 with sig. 0,000), indicating the existence of heterocedascity, of a specification error, or both, although the FIV index suggests the inexistence of multicollinearity.

In order to correct the heterocedascity effect, we performed a new estimate for the parameters, now with variances and standard deviation with a corrected heterocedascity according to White (Gujarati, 1995).

Table 5. Regressors, weights and coefficients significance of the minimum square model with corrected heterocedascity in order to explain the exogenous variable – risk tolerance

Regressors	Coef.	std. deviation	T test	T test sig.	FIV
Emotion factor	0,949704	0,107794	8,8100	0,0000	1,1230
Being left out effect	0,459063	0,140252	3,2730	0,0011	1,5590
Cash on stock effect	0,253982	0,096049	2,6440	0,0083	1,2280
Cognitive disonance	0,386345	0,118740	3,2540	0,0012	1,1940
Self-protection	0,703214	0,097752	7,1940	0,0000	1,1870
Excessive confidence	0,492706	0,125111	3,9380	0,0001	1,4670
Risk as opportunity	0,459499	0,097596	4,7080	0,0000	1,1420
Self-attribution bias	0,751971	0,115600	6,5050	0,0000	1,3410
Save before you spend	0,358285	0,088313	4,0570	0,0001	1,1600
Already incurred in cost	0,360764	0,091277	3,9520	0,0001	1,2400
Spending on expensive things	0,276512	0,107104	2,5820	0,0100	1,3110

On Table 5 we can observe that all t test values were significant (the variables for “excessive optimism” and “excessive confidence bias” were excluded from the model because they were not significant at the t test).

The sample determination coefficient (adjusted R^2) was 0.3492. Although the sample determination coefficient had been inferior to the previous mode, the Akaike Information Criteria and the Schwartz Criteria were 3.380,183 and 3.431,918, respectively. All FIV indicators were close to one, indicating the absence of multicollinearity in this model.

The Qui-square test (0.651 and sig 0.72220), for residual normality (Doornik-Hansen test), accepted the null hypothesis for equal distribution of data with normal distribution.

5. Final considerations

The basis that supports most of the financial theories is founded upon the utter rationality of economical agents. This approach suggests that all economical agents are totally rational and use all available information in the best possible way. The heuristics used so as to determine the risk tolerance level of individuals and that suppose a strong correlation between demographic, social and economical features have not shown to be significant in this research. The cognitive and emotional dimension of the decision making process has shown to be significant.

Emotion and cognitive bias such as: self-attribution, excessive trust, cognitive dissonance, being left out effect, cash on stock effect and already incurred in costs have shown to be significant in this research, thus showing cognitive and emotional features during the decision making process, that are traditionally neglected in risk tolerance studies.

Considering that the regression estimated model attends to the basic presuppositions, it is possible to state that, for the selected sample, emotion have a direct and positive association to an individual’s risk tolerance. This association – that can be understood as the misattribution bias – validates Nofsinger (2001), who demonstrates that this bias generally makes people permeable to being influenced by feelings when making a financial decision. Via this result, it is

possible to conclude that people in a good mood make more optimistic judgments than people in a bad mood, and tend to use less critical ways to process information, thus elevating their tolerance level.

Humans show a natural tendency to follow the decisions made by the group. This behavioral effect can be observed by the “being left out effect”. The factor, in the selected sample, showed a positive association to risk tolerance, and it was possible to conclude that the bigger the effect, the bigger the risk tolerance is. This result contributes to what DeMarzo, Kremer and Keniel at Stanford and Duke Universities, suggest – they confirmed that most individuals do not fear loss itself, they are afraid of watching their applications having a worse performance than other investors. People and companies tend to follow their peers’ behavior, because when acting that way they are fighting the fear that other people may be investing in the next big investor, whereas others would be out. The “being left out effect” is potentially harming because it makes people assume more risks in their financial decisions and, hence, they would tend to neglect their ability to assume risks, which can lead to damage to their patrimony, by unduly exposing it to risk.

Empirical international literature demonstrates that, after having profit or loss, people feel inclined to assuming greater risks. People who gamble call it “cash in stock” and, after making some money, amateurs do not consider it their money. Regression showed that, for the selected sample, the increase of this effect is associated to an increase of risk tolerance which could generate an increase in markets negotiations, since investors could believe that they would be risking something that does not belong to them.

The Cognitive Dissonance variable has shown to be directly and positively associated to risk tolerance. This result can be understood as human nature – to dissociate the acknowledgement of guilt for one’s mistakes in decisions made by individuals. Assuming guilt for one’s own negative results is to assume that the wrong decisions were made and that generates a mental discomfort that in turn leads to psychological pain. In order to balance or even avoid such discomfort, it is easier to associate negative results in

decisions to external aspects. It was possible to observe in this research that, for the selected sample, the lack of acknowledgement was directly and positively associated to a greater risk tolerance level. This result tends to be harming, since when avoiding acknowledgement for one's mistakes, one cannot learn from those mistakes, which can lead to the same mistakes and recurrent negative results in their investments portfolios.

The misattribution bias shows two sides: self-enhancement and self-protection. Self-protection has a similar origin to the previous variable, since one avoids the association between the error's guilt and the decision-maker. The basic difference is that the mistake is associated to unpredictable circumstances, which would decrease the psychological pain coming from making the wrong decision. This variable showed to be positively associated to risk; so, we can conclude that, for the selected sample, a greater effect is associated to a greater risk tolerance and - just like in the previous effect - assuming new risks without even learning from previous mistakes could lead to persistent negative results.

The self-attribution bias showed a positive relation to risk tolerance, thus indicating that the bigger the effect of this bias, the bigger the risk tolerance is. This bias might be the most harming one, because it makes individuals believe they have a superior capacity than they really have. This belief leads to a greater level of self-confidence, less attention to details and, as demonstrated in our research, a greater risk tolerance, which is particularly concerning, because it could lead to wrong decision when allocating assets.

The excessive confidence bias showed a significant and positive relationship to risk tolerance in this research. This result validates Nofsinger (2001) demonstrating that individuals who show excessive confidence underestimate the risk they are taking. Underestimating risks can lead to choices that carry an unwanted risk level, thus not considering the capacity one has to take them, as well as a possible psychological pain of seeing that the obtained results are inferior to what was expected. This bias should, preferably have minimal influence when managing wealth, because of the loss coming from potentially biased decisions.

Materialism, due to the need for consuming expensive objects, has shown to be positively and significantly associated to risk tolerance. Empirical literature demonstrates that the popular meaning of materialism involves notions of owning or achieving the best. Damage associated to this factor takes place when one loses track of the objective for which one is taking a risk. Taking a risk exclusively for the wish of a new standard of wealth, without parameters or final objective may make individuals assume more and more risks without realizing the potential damage associated to their decisions. On the other hand, aversion to debts, for the need to save before you

spend, has shown to be positively related to risk tolerance; this fact, along with other quoted variables, may also be harmful by restricting opportunities for investments.

According to traditional economical theories, people should consider present and future costs and benefits when making a decision, not considering past costs. However, we have the natural tendency to avoid this dissociation, especially when there is a need to acknowledge mistakes in the past. This bias has shown to be associated to risk tolerance, that can generate unwanted results while investing time and assets that have consistently shown to be harmful. The decision to keep assets with loss has shown to be a natural protection against the pain associated to acknowledging wrong decisions, but it is inconsistent with the assets' wealth.

When looking for the answer to the research problem, it was possible to observe that the financial decision is influenced by biases that positively influence risk tolerance. Perhaps the most significant message to take from this research can be interpreted by the need of self-knowledge, in order to minimize such effects when making a financial decision, or as to avoid potentially harmful risks, for not answering the capacity to take risks.

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