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Changing risk preferences while taking financial decisions: an experimental approach

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Abstract

With respect to the concept of risk preferences the Neoclassical Capital Market Theory assumes stable and homogeneous ones. On the contrary, the Behavioral Finance Theory supposes variable and heterogeneous preferences. In the light of this conflict the research objective of the present paper is to determine the risk preferences of undergraduate students of the Autonomous University of Queretaro within the financial decision-making process using an experimental study design. Performing two simple experiments with a total of 146 participants the following main results were obtained: The majority of students clearly show heterogeneous risk preferences which were also adapted to varying decision situations – a result that clearly contradicts the position of the Neoclassical Theories. Based on the results of the study it is recommended to further strengthen the position of behavioral concepts in the areas of financial teaching and research in order to better understand the financial decision-making process on a capital market and enterprise level.

Keywords: Risk preferences, financial decision-making, behavioral finance theory, neoclassical capital market theory, experimental study.
JEL clasificación: C91, G11, G40, G41.

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Preferencias por el riesgo al tomar decisiones financieras: un experimento

Resumen

Con respecto al concepto de preferencias por el riesgo, la teoría neoclásica del mercado de capitales asume preferencias estables y homogéneas. Por el contrario, la teoría de finanzas conductuales supone preferencias variables y heterogéneas. Reflectando este conflicto, el objetivo de investigación del presente trabajo es: determinar las preferencias por el riesgo en el proceso de toma de decisiones financieras de los estudiantes de licenciatura de la Universidad Autónoma de Querétaro utilizando un diseño experimental. Realizando dos experimentos sencillos con un total de 146 participantes se obtuvieron los siguientes resultados principales: La mayoría de los estudiantes claramente muestran preferencias por el riesgo heterogéneas que también fueron adaptadas a diferentes situaciones de decisión un resultado que contradice la posición de la teoría neoclásica del mercado de capitales. Basándose en los resultados del estudio, se recomienda fortalecer aún más la posición de los conceptos de las finanzas conductuales en las áreas de enseñanza e investigación financiera con el fin de entender mejor el proceso de toma de decisiones financieras al nivel mercado de capitales y al nivel empresarial.

Palabras clave: preferencias por el riesgo, toma de decisiones financieras, finanzas conductuales, teoría neoclásica del mercado de capitales, estudio experimental.
Clasificación JEL: C91, G11, G40, G41.

1. Introduction

The most influential theory in financial teaching and research is still nowadays the Neoclassical Capital Market Theory which is responsible for major breakthroughs in finance beginning in the 1950s until the 1980s and beginning 1990s. Neoclassical theories such as the Modern Portfolio Theory, the Capital Asset Pricing Model and the Efficient Market Hypothesis have led

to astonishing advances in the field of finance which will never be forgotten or substituted. Nevertheless, unrealistic assumptions with respect to economic actors and markets have opened the door to a multifaceted critique on the neoclassical theories. Based on this critique and beginning in the 1980s a newer field of financial research developed which is called Behavioral Finance. The Behavioral Finance Theory is by far not a complete and universal theory, however, for certain financial phenomena it can offer a better theoretical approach than the neoclassical theories.

There exist fundamentally different assumptions which form the basis of both theories. Referring to the concept of risk preferences the Neoclassical Capital Market Theory assumes stable and equal risk preferences for all economic actors. On the other side, the Behavioral Finance Theory assumes risk preferences that could vary depending on different situations and individuals. In light of this conflict the present study formulates the following research objective: Determine the risk preferences of undergraduate students of the Autonomous University of Queretaro within the financial decision-making process using an experimental study design. In order to achieve the outlined research objective two experiments were carried out with a total sample of 146 undergraduate students of the areas economics and international commerce of the Autonomous University of Queretaro. Both experiments were designed to determine the risk preferences of the participants within simple decision-making problems which imply different financial outcomes (financial decision-making under risk).

The main results of the paper are as follows: Within both experiments there can be found different risk preferences across the sample of undergraduate students, i. e. some participants show a more pronounced tendency to risk-seeking behavior and some to risk aversion. Furthermore, individuals also adapt their risk preferences to the respective situation or decision problem, i. e. in different situations the same individual shows different risk preferences. Moreover, the majority of participants was not able to take a purely rational decision in one of the experiments. These results can be explained by several Behavioral Finance concepts and theories (e.g. Prospect Theory, Disposition Effect, Loss Aversion) and clearly contradict the assumptions of the Neoclassical Capital Market Theory.

The remainder of the paper is organized as follows: First of all, the section "Theoretical Background" presents some basic, theoretical fundamentals of the Neoclassical Capital Market Theory, the Behavioral Finance Theory and

risk preferences. The following part, "Methodology", explains the experimental design of the study. Subsequently, results are presented and discussed. Finally, the paper closes with some concluding remarks.

2. Theoretical background

2.1. Neoclassical capital market theory

Since the 1950s until today academic teaching as well as academic research in finance is strongly influenced –almost dominated during the 1960s to 1980s– by the Neoclassical Capital Market Theory. Because of their strict assumptions and their results expressed as perfect equilibrium states of financial markets these neoclassical theories can be defined as normative theories which model how markets should function under optimum conditions.

Generally, the Neoclassical Capital Market Theory is based on the assumptions of perfect markets and the homo economicus model. Perfect markets can be characterized for example by the following aspects (Ho and Lee, 2004): non-existence of taxes, information costs and transaction costs, perfect information symmetry among market participants, homogeneous expectations of market participants as well as the non-existence of market entry barriers. The image of man as a purely "economic man" (*homo economicus*) implies the following characteristics (Morgan, 2006):

- opportunist behavior
- stable preferences
- access to perfect information
- rational decision-making process

Opportunist behavior implies a sole focus of the homo economicus on its own interests. Moreover, the economic man shows homogeneous and stable preferences for example referring to concepts as consumption and acceptance of risk. Concerning to these preferences Stigler and Becker (1977) argue that economists should assume that individual tastes are stable over time and identical across persons. The mentioned access to perfect information implies complete information free of costs. Finally, the economic man is characterized by a perfectly rational decision-making process. In economics in general rationality can be defined in terms of the Theory of Rational Expectations and

refers to the utility maximization of an economic actor (Von Neumann and Morgenstern, 1947; Bernoulli, 1738). "Rationality in financial markets implies that investors correctly use all available information in establishing security prices" (Brown, Harlow & Tinic, 1988, p. 355).

As revolutionary examples of the Neoclassical Capital Market Theories one can mention the Modern Portfolio Theory of Harry M. Markowitz (Nobel Prize Economics 1990), the Capital Asset Pricing Model of William F. Sharpe (Nobel Prize Economics 1990), John Lintner and Jan Mossin and the Efficient Market Hypothesis of Eugene F. Fama (Nobel Prize Economics 2013). Markowitz (1952) proves that an intelligent combination of different financial assets in a portfolio reduces the risk (standard deviation of expected returns) of an investor-an effect that is commonly known as diversification. Sharpe (1964), Lintner (1965) and Mossin (1966) independently developed the Capital Asset Pricing Model that identifies a simple linear relationship between risk and expected return in perfect capital markets as one of the most fundamental principles known in financial literature. Fama (1970) established the Efficient Market Hypothesis which transferred the homo economicus model and the Theory of Expected Utility to the capital market and defines this market as perfect (i.e. efficient) as a consequence of rationally acting investors.

Despite its undeniable importance and relevance as well its revolutionary influence on finance theory the Neoclassical Capital Market Theory has faced justified criticism from major scholars since decades (e.g. Black, 1986; Thaler, 2000; Akerlof and Shiller, 2009; Lo, 2017). One principal point of criticism rests on the already mentioned unrealistic suppositions (perfect markets, homo economicus) of neoclassical models. Hence, these theories simply cannot model and explain certain financial phenomena that occur in real capital markets like for example excess volatility (Shiller, 1981), erroneous reactions of investors to new information (De Bondt and Thaler, 1985) or asset price bubbles (Demmler, 2017). Furthermore, for example Thaler (2000) appeals to the economic and financial community to consider a more human and thus realistic image of man within its theories and models-a logical and groundbreaking idea that is taken into account within the financial research field of Behavioral Finance.

2.2. Behavioral Finance Theory

As already mentioned, as a response to the critique on the Neoclassical Capital Market Theory a new field of research evolved which is called Behavioral

Finance. According to De Bondt (2005, p. 207) behavioral finance can be defined as "the study of financial decision-making with the help of concepts borrowed from psychology". Furthermore, it can be interpreted as a descriptive theory as the Behavioral Finance Theory tries to explain the financial decision-making behavior of real economic actors, instead of modeling a desired optimum state of how markets should function or decisions should be taken (normative theories as for example Neoclassical Capital Market Theory). As an interdisciplinary financial research area the Behavioral Finance Theory has its origin in the Theory of Bounded Rationality of Nobel Prize Laureate Herbert A. Simon. Simon (1955, 1959) explains that human beings are not capable of always taking rational decisions due to their natural physical, mental and neural limitations. Hence, instead of optimization within the decision-making process a satisfying of utility is more realistic for the majority of situations.

As a consequence of non-rational influences, it makes sense to analyze further the real economic and financial decision-maker as well as its underlying decision-making process. Thus, instead of assuming a rational homo economicus with a perfect and systematic decision-making process, behavioral scientists try to enlighten the black box of human decision-making. A simple model of real, human decision-making can be seen in figure 1.

Fuente: elaboración propia.

Figure 1
Human decision-making process. Based on Rapp (2000)

As can be seen in figure 1, a simple human decision-making process contains three stages. The first part, information perception, refers to the process of acquisition of information. The second part, information processing, deals with the cognitive organization and analysis of the acquired information. Based on this analysis the stage of decision-making covers the formation of expectations. Here is the interface between expectations and the induced visible actions that are taken by the decision-maker (Demmler, 2017).

Each one of the outlined stages within the decision-making process is influenced by various behavioral anomalies which are the cause of systematic, irrational behavioral patterns shown by human individuals. According to Oehler (1992) these anomalies can be defined as mental, systematic and inter-subjectively correlated deviations of the behavioral patterns of a real decision-maker in comparison to the behavioral assumptions of the Theory of Rational Expectations. There exists a multitude of different behavioral anomalies. As examples one can mention selective attention (e.g. Duncan, 1984) for the stage of information perception, the representativeness heuristic for the stage of information processing (e.g. Grether, 1980) and the concept of overconfidence (e.g. Moore and Healy, 2008) as an anomaly within the decision-making stage. Furthermore and besides the mentioned individual anomalies, also group-interactive behavioral patterns as for example the aspect of herding (e.g. Banerjee, 1992) can influence individuals in their decision-making process and result in irrational behaviors.

In order to demonstrate the fundamental differences between the two outlined theories, Neoclassical Capital Market Theory and Behavioral Finance, figure 2 shows the basic assumptions of both theories.

Neoclassical capital market theory	Behavioral finance
• **Homogeneous investors** (realization of profitsas sole motive) • **Perfect information** (complete, simultaneous, correct, free of cost) • **Independient, rational behavior** (individual level, aggregate lavel) • **Elimination of individual mistakes on the market level** (law of large numbers) • **Stable and homogeneuos risk preferences** (mostly supposed risk aversion)	• **Heterogeneous investors** (numerous socio-dynamic motives) • **Imperfect information** (information asymmetry, costs of information) • **Dependent, irrational behavior** (systematic behavioral anomalies) • **Agregation of mistakes on the market level** (social imitation, social infection) • **Unstable and heterogeneous risk preferences** (changes because of situational and personal aspects)

Fuente: elaboración propia.

Figure 2
Assumptions of neoclassical capital market theory *vs*. Behavioral Finance. Based on rapp (2000)

As shown in figure 2 the Neoclassical Capital Market Theory assumes a homogeneous investor type (homo economicus) who takes independent and rational (utility maximizing) financial decisions. On the contrary, the Behavioral Finance Theory departs from a heterogeneous investor type. Hence, differences in aspects like age, sex, educational level, etc. are taken into account. Furthermore, these heterogeneous investors often take dependent and irrational decisions. With reference to the aspect of information, the neoclassical theories suppose perfect information which implies that every market participant has access to the complete amount of information without any cost. Also here, the position of the Behavioral Finance Theory is much closer to reality as information asymmetries as well as costs of information are considered.

As the Neoclassical Capital Market Theory supposes that (at least) the majority of investors act rationally, possible individual mistakes are eliminated on the market level and, hence, also the market functions perfectly. In the Theory of Behavioral Finance there exists explicitly the possibility of deficient markets as individual errors could be aggregated on the market level. Finally, the position of the Neoclassical Theory referring to risk preferences is a supposed stability of these preferences. Moreover, since investors are homogeneous also their risk preferences are homogeneous. The Behavioral Finance Theory, instead, assumes variable risk preferences across individuals and changing risk preferences due to situational factors. The theoretical background for this assumption of variable risk preferences can be found in the Prospect Theory of Kahneman and Tversky (1979) which is shown in figure 3.

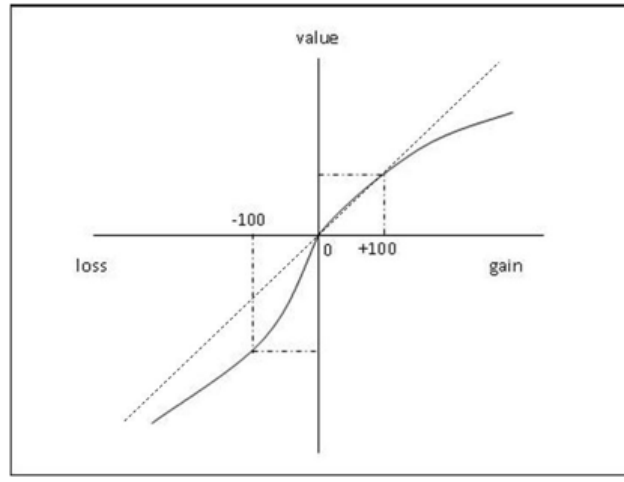

Figure 3
Value function of the prospect theory. Based on Kahneman and Tversky (1979).

Figure 3 shows the central piece of the Prospect Theory-an experimentally derived s-shaped value function (solid line in figure 3). According to Kahneman and Tversky (1979) the value function demonstrates subjective values of changes in wealth, expressed as gains and losses according to a reference point (0). Hence, for the example of a stock purchase, the purchase price is to be seen as the reference point. Depending on future price movements of the stock the investor would be either in the profit zone (in case of an incrementing market price) or in the loss zone (in case of a decrementing market price). Hence, the value function shows the value or importance that an investor assigns to changes of gains and losses.

The most interesting point of this value function is its s-shape. This means, that the value function is concave within the profit zone and convex within the loss zone-an aspect that implies decreasing marginal values of each additional unit of gain or loss (Kahneman and Tversky, 1979). Hence, for the profit zone one can conclude that the increase of value is much stronger if the investor increments the profit from + 10 to + 20 in comparison to + 1 010 to 1 020 (although in both cases the absolute increase is 10 $). Consequently, for the loss zone an investor gives much more importance to a loss, that increments from -10 to -20 instead

of -1 010 to -1 020 (although again the absolute differential in both situations is - 10 $).

Referring to risk preferences a concave value function in the profit zone implies risk aversion and a convex value function in the loss zone stands for risk-seeking behavior of the decision-maker. It should be reminded one more time that the value function of the Prospect Theory is the results of a series of experiments with real human beings and shows consequently that humans tend to vary their risk preferences depending on the simple criterion of gain or loss. This is a fundamentally different result than the supposed stable risk preferences in the Neoclassical Capital Market Theory (represented by the dashed line in figure 3).

It is thanks to the outlined Prospect Theory that anomalies or empirical phenomena like the disposition effect or the loss aversion are explicable. According to Shefrin and Statman (1985) the disposition effect is the "general disposition to sell winners too early and ride losers too long" (p. 777). Hence, investors tend to hold securities that are traded in the loss zone longer than securities in the profit zone. The explanation of this phenomenon can be found in the varying risk preferences of humans according to Prospect Theory. In case of an asset trading in the profit zone, the majority of investors tend to sell in order to realize the profit and like this demonstrate risk aversion in their investment decision. On the other hand, in case of an asset that currently trades in the loss zone, the majority of investors tends to hold on to the investment. This is done in the hope of future price increases that would eliminate the current losses. However, holding on to the asset implies that investors also accept the risk of further losses-an attitude that clearly reflects risk-seeking behavior. Shefrin and Statman (1985) explain the disposition effect with the emotions of pride (about a correct decision realized by the sale of an investment in the profit zone) and regret (about an erroneous decision that should be avoided by not-selling an investment in the loss zone).

As already mentioned, another anomaly that can be analyzed by the Prospect Theory is loss aversion. According to this empirical phenomenon losses weigh about twice as much as gains of the same amount (Kahneman, Knetsch and Thaler, 1991). As can be seen in figure 3, a loss of -100 has an approximately twice as high negative impact on the value of the decision-maker than the increment of value caused by a profit of +100. In figure 3, this loss aversion is demonstrated by the steeper trend of the value function

in the loss area compared to its movement in the profit zone. Generally speaking, according to the concept of loss aversion investors seek to prevent losses and therefore avoid selling assets, which trade in the loss zone (Demmler, 2017).

2.3. Risk Preferences

As being central to the present study, the concept of risk preferences should be presented further in the following section. However, before explaining the concept of risk preferences, at first the term risk should be defined briefly. Risk can be defined differently as asymmetric and symmetric definitions exist. Asymmetric definitions, which represent the popular understanding of risk, solely take into account the adverse consequences of a specific risk. The *Oxford Dictionary* (2018) for example refers to risk as a situation involving exposure to danger. Thus, for instance in a financial context, risk is the possibility of financial loss. On the other hand, symmetric definitions do not define risk as a generally negative concept. For instance, the International Organization for Standardization (ISO, 2018) defines risk in its generic risk management standard ISO 31000 as the "effect of uncertainty on objectives" and "an effect is a deviation from the expected. It can be positive, negative or both, and can address, create or result in opportunities and threats". Also Besley and Brigham (2009) understand as a risk the probability of occurrence of a non-expected result. Hence, symmetric definitions, like the formerly mentioned one, combine the possible negative and positive consequences of risks.

Everyday human life and human decision-making are full of all kinds of different risks. Normally one refers to drug consumption, drunk driving or unprotected sex as "risky" behaviors or accidents and natural disasters as "risky" situations or events. In economics and finance risk is usually quantified by the variance in the probability distribution over possible outcomes (Fox and Tannenbaum, 2011).

Different persons react differently to risk in general or in situations that implicate risk –a concept that is known as risk preference. Generally, one can differentiate into three different categories of risk preferences or risk attitudes: risk-averse, risk-neutral and risk-seeking (Gitman and Zutter, 2012; Mylrea and Lattimore, 2010), figure 4. Out of an economic and financial perspective risk aversion implies that the decision-maker or investor prefers between two

alternatives with the same (expected) outcome the alternative with less risk. In order to accept a higher risk alternative it needs to offer an adequate additional return to this type of investor. This additional return, risk premium is seen as a compensation for the acceptance of the higher risk (Gitman and Zutter, 2012).

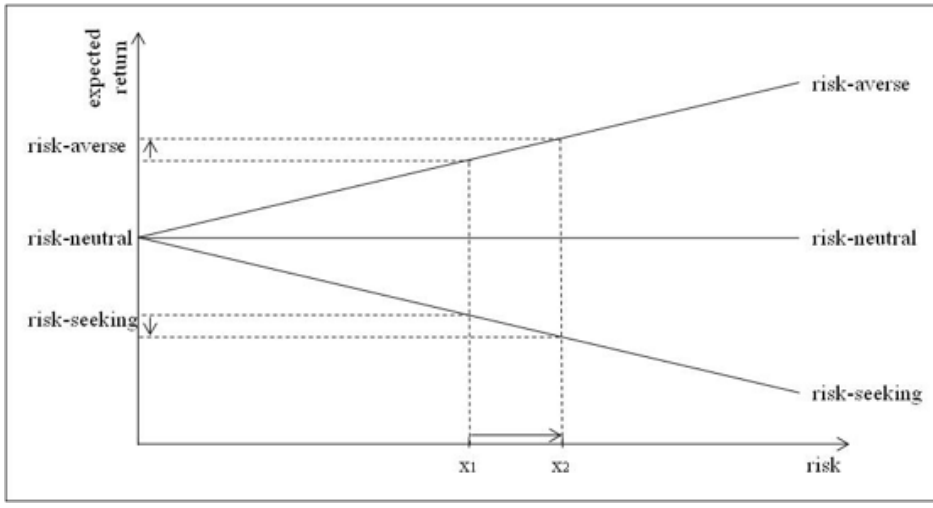

Figure 4
Relation between risk and expected return depending on varying risk preferences. Based on Gitman and Zutter (2012)

A risk-neutral economic decision-maker bases the investment decision on just one criterion which is the expected return. Hence, the dimension of risk is not important for this investor what results in the realization of the highest return alternative. The last risk preference is called risk-seeking. A risk-seeking investor prefers high risk alternatives and is willing to sacrifice part of the expected return in order to obtain the (probably small) chance to increment future return (Gitman and Zutter, 2012). Figure 4 shows the outlined relationship between risk and expected return for the three mentioned risk preferences.

As can be seen in figure 4 a risk-averse decision-maker demands an incremented expected return in order to accept the higher risk alternative (x_2) in comparison to the lower risk alternative (x_1). A risk-seeking investor, on

the contrary, prefers the high-risk alternative (x_2) and even accepts a reduction of the expected outcome. Finally, the risk-neutral decision-maker is indifferent between the two alternatives (x_1 and x_2). Another way to illustrate the three existing risk preferences can be seen in figure 5.

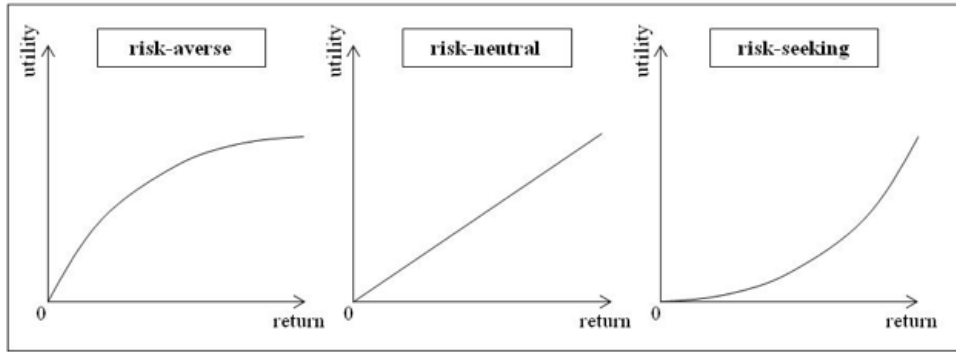

Figure 5
Relation between return and utility depending on varying risk preferences. Based on Bernard (1984)

According to figure 5 and already mentioned while presenting the Prospect Theory, a risk-averse decision-maker shows a concave utility function what implies a diminishing marginal utility for every additional unit of return. This is the case, as a risk-averse investor dislikes risk and for every additional unit of return an additional risk needs to be accepted. For a risk-neutral investor the concept of risk is not relevant and, hence, the utility function shows a constant marginal utility for every additional unit of return. A risk-seeking decision-maker perceives some kind of positive excitement while accepting higher risk alternatives. Thus, as already shown in the presentation of the Prospect Theory the utility function of this type of investor is convex and results in an incrementing marginal utility for every additional unit of return.

As already mentioned the postulate of the Neoclassical Capital Market Theory is the existence of stable and homogeneous risk preferences. Furthermore, in the majority of neoclassic models a constant risk aversion of the rational investors is assumed. The Behavioral Finance Theory, on the contrary, assumes heterogeneous investors with different and variable

risk preferences. Most state-of-the-art research studies reach the conclusion of rather variable than stable risk preferences. Some of these studies should be mentioned briefly in the following paragraphs.

As an empirical example of changing risk preferences of investors the disposition effect was already outlined. With reference to this effect for example Odean (1998) concludes in his empirical study of 10 000 US private investor trading accounts that the sale of a winner share is 50% more probable than the sale of a loser share. In another study about general risk preferences Beauchamp, Cesarini and Johannesson (2017) found in their population-based sample of 11 000 Swedish twins significant differences in risk preferences depending on the variables gender and IQ.

Also Conte, Levati and Nardi (2018) confirm gender differences in risk preferences, *i. e.* women are generally more risk-averse than men. Furthermore, they find in their experimental study that different emotional states impact human risk preferences. Conte, Levati and Nardi (2018) conclude that for example the positive emotion joviality and the negative emotions sadness, fear and anger tend to mitigate risk aversion.

Dohmen, Falk, Huffman and Sunde (2012) analyze survey data of 3 751 children and their parents living in Germany. They conclude that attitudes towards risk are transmitted within a formation process from parents to their children as well as that the children adapt to the prevailing attitudes of their local environment. In a physiological study Kandasamy *et al*. (2014) show that also the level of the stress hormone cortisol determines the risk preference of an individual. Higher levels of cortisol result in an increasing risk aversion. The authors link this result to the concept of financial crisis as the level of cortisol normally rises in prolonged periods of market volatility and uncertainty.

Finally, using a London Business School dataset of 2 041 managers and professionals Nicholson, Soane, Fenton-O'Creevy and Willman (2005) find that the risk propensity of an individual is strongly based on personality characteristics (e. g. sensation-seeking) and that risk propensity varies significantly across job types and business sectors.

3. Methodology

The research objective of the present paper is to determine the risk preferences of undergraduate students of the Autonomous University of Queretaro within

the financial decision-making process using an experimental study design. This research objective needs to be seen in the context of the already outlined theories –Neoclassical Capital Market Theories vs. Behavioral Finance.

Table 1
Participants of the experiments.[1] Elaborated by the author.

Group	Number of participants
Economics (1st semester)	40
Economics (3rd semester)	27
Economics (5th semester)	36
International commerce(1st semester)	43
Total	**146**

Fuente: elaborated by the author.

Using an experimental methodology, the present study tests the risk preference assumptions of both theories for a sample of 146 undergraduate students of economics and international commerce of the Autonomous University of Queretaro. The mentioned 146 students belong to the following five groups to which access was provided by university´s authorities, table 1.

In general, according to INEGI (2005) in an experiment an individual is intentionally exposed to the influence of a certain variable under controlled conditions with the objective to observe the impact of changes in the variable on the individual. Thus, experimental designs use the manipulation of variables and controlled tests to understand causal processes.

According to Falk and Heckman (2009) experimental studies are widely used in physical and life sciences. The general adoption of this method within most areas of social sciences has been much slower. However, during the last years and decades also in this field of research the work with experiments has increased, although Falk and Heckman (2009) still see a tremendous potential for further growth of the use of this method within

[1] Marginal differences of the size of the groups compared to table 2 or table 3 are due to very few students who arrived late to the experiment session or left early. However, this slight problem does not affect the overall results of the study.

social sciences. An opinion that is shared by Beauchamp, Cesarini and Johannesson (2017) especially for research studies in economics. Moreover, it needs to be stated that particularly in psychological research (as part of social sciences) the utilization of experiments as methodology of academic studies was and is quite common (Lo, 2004). As the Behavioral Finance Theory can be identified as a combination of financial and psychological concepts and theories, it seems adequate to choose an experimental research method for the present study.

Both experiments that are carried out in the current study are designed to determine the risk preferences of the participants within simple decision-making problems which imply different financial outcomes. Furthermore, Experiment 1 also offers the possibility to determine whether or not the participants of this experiment are capable to take purely rational decisions. Experiment 1 is based on Kahneman and Tversky (1979). The two following simple decision problems were presented separately via power point to the respective groups. The experimenter read the respective problem aloud and afterwards each participant had to decide individually between the different alternatives and express her/his opinion by a hand signal. At this moment the experimenter counted how many individuals opted for the different alternatives. The two decision problems of the first experiment are:

Decision Problem 1 (profit zone):

Alternative A: Gain 3 000 with a probability of 100%

Alternative B: Gain 4 000 with a probability of 80% and 0 with a probability of 20 %

Decision Problem 2 (loss zone):

Alternative A: Lose 3 000 with a probability of 100%

Alternative B: Lose 4 000 with a probability of 80% and 0 with a probability of 20%

It should be highlighted that the two outlined decision problems of Experiment 1 show the same absolute monetary changes of wealth as well as the same probability distributions. The only difference is that Decision Problem 1 refers to the profit zone and Decision Problem 2 to the loss zone.

Experiment 2 is designed as a two-round coin toss. First of all, the experimenter separated the respective groups into two equally sized sub-groups and assigned to the first sub-group "heads" and to the second sub-group

"tails". The coin used in the experiment was a normal, unbiased one that offers a fair game. Before playing the first round, it was explained to the participants that, *a*) in case of winning they will receive a profit of 1 000 and *b*) in case of losing they will suffer a loss of -1 000. Subsequently, the first round was played and consequently 50% of the participants showed a profit of 1 000 and the other 50% a loss of -1000. Now, all of the participants were offered to play a second round of the game with the same conditions (gain of 1 000 in case of winning and loss of -1 000 in case of losing). Hence, on the one side the first round winners faced the decision problem to –either play and risk their first round profit with the possible outcomes (50% *vs* 50%) of a total win of + 2 000 or 0 after the second round –or simply not to play. One the other side, the first round losers had to take the decision – either to play the second round with the possible outcomes of -2 000 (50%) or 0 (50%) –or simply not to play.

Before tossing the coin for the second time the experimenter asked the participants about who wanted to play again. Each participant had to decide individually and express her/his decision by a hand signal. At this moment the experimenter counted how many individuals of each sub-group opted for playing the second round of the coin toss. As for the experimenter the formerly mentioned information was the central one, the participants who continued to play were allowed to freely choose between "heads" or "tails" in this second round of the game.

Due to limited resources with respect to time, personnel and money the outlined experiments were applied in a group instead of an individual manner. Nevertheless, the experimenter paid very close attention to not permit any communication or interaction between the participants in order to assure an individual decision-making process in the best possible manner. Furthermore, the experiments were carried out with imaginary monetary incentives what was communicated openly to the participants at any time.

4. Results

4.1. Experiment 1

Table 2 presents the results of Experiment 1. In the first column on the left side one can find the different groups of undergraduate students which participated in the experiment. The column "results" is divided into the

already mentioned two decision problems (profit zone and loss zone) with two decision alternatives (A or B) for each decision problem.

Table 2
Results of experiment 1

Group	Results			
	Profit zone		Loss zone	
	A	B	A	B
Economics (1st semester	24	15	15	25
Economics (3rd semester)	17	8	8	17
Economics (5th semester)	22	14	18	18
International commerce (1st semester)	26	15	4	37
Total	89	52	45	97
	141		142	

Elaborated by the author.

Referring to the first decision problem (profit zone) the participants should decide between a certain profit of 3 000 (Alternative A) and the gamble (Alternative B) with two possible outcomes -80% probability of a profit of 4 000 and 20% probability of cero profit. As can be seen in table 2 within every group the majority of participants opted for the certain profit instead of the gamble alternative. The clearest result in favor of Alternative A can be found in the group of Economics 3rd semester as 17 out of 25 students (68%) opted for the certain profit. The less pronounced result in favor of Alternative A shows the group Economics 5th semester where 61.11% of the participants chose the first alternative. In total, 89 of the 141 students that participated in the first decision problem of Experiment 1 opted for the safe Alternative A (63.12%) and just 52 participants (36.88%) opted for the gamble alternative.

A different picture can be found for the second decision problem (loss zone) where the participants had to decide between a sure loss of -3 000 (Alternative A) and a gamble alternative (Alternative B) with two possible outcomes -80% probability of a loss of -4 000 and 20% probability of cero loss. table 2 shows that in 3 of the 4 groups (Economics 1st semester,

Economics 3rd semester and International Commerce 1st semester) there is a strong tendency towards the gamble alternative. The most pronounced result in favor of Alternative 2 can be found in the group International Commerce 1st semester where 90.24% (37 of 41) of the participants opted for the risky alternative. A different result shows the group Economics 5th semester as in this group 50% of the participants chose Alternative A and the other 50% Alternative B. In total, regarding the second decision problem of Experiment 1 68.31% (97 of 142) opted for the risky Alternative B and just 31.69% (45 of 142) for the safe Alternative A.

Another interesting aspect that can be found in table 2 is that according to the outlined results the majority of participants of Experiment 1 took a decision that is not in line with the rationality postulate known from the Theory of Rational Expectations. According to this theory, economic actors (defined as homo economicus) should always decide for the alternative that maximizes their (expected) utility. Calculating the expected profits (EP) of the two decision problems one reaches the following results:

Decision problem 1 (profit zone):

Alternative A: EPA = 3 000 · 1 = 3 000

Alternative B: EPB = 4 000 · 0.8 + 0 · 0.2 = 3 200

Decision problem 2 (loss zone):

Alternative A: EPA = (- 3 000) · 1 = - 3 000

Alternative B: EPB = (- 4 000) · 0.8 + 0 ·0.2 = - 3 200

Hence, the rational (correct) decision within Decision problem 1 is Alternative B as this alternative presents a higher expected profit (3 200) in comparison to Alternative A (EPA = 3 000). The rational decision within problem 2 is Alternative A with a more favorable expected loss of - 3 000 in comparison to the higher expected loss of Alternative B (EPB = - 3 200). Nevertheless, as shown in table 2, a total of 63.12% of all the participants in the first decision problem and 68.31% in the second decision problem took a non-rational (“incorrect”) decision.

4.2. Experiment 2

Table 3
Results of experiment 2

Group	Result			
	Roun 1		Round 2	
	Heads	Tails	Heads	Tails
Economics (1st semester	19	20	12	8
Economics (3rd semester)	14	13	9	7
Economics (5th semester)	18	18	13	15
International commerce (1st semester)	22	21	15	19
Total	73	72	49	49
	145		98	

Source: elaborated by the author.

Table 3 presents the results of experiment 2. As was already outlined, within the experiment 2 the undergraduate students participated in a coin toss game of two rounds. Within each round they could win or lose 1 000 depending on the outcome of the coin toss. Although the participation of the students in the first round was mandatory, their participation in the second round was voluntary. Objective of this experiment was to see how many students prefer to play a second round depending on their outcome of the first round.

In the column on the left-hand side, table 3 shows once again the four different groups of undergraduate students that participated in Experiment 2. The "Result"-column is divided firstly into the two rounds of the coin toss game ("Round 1" and "Round 2"). Secondly, each round is divided in two outcome alternatives ("Heads" and "Tails"). Furthermore, within "Round 1" one can see four cells highlighted in grey which represent the alternative which won in the first round of the coin toss game. Hence, for example in the group of Economics 1st semester the first round of the coin toss game resulted in "Tails" and for the group of International Commerce 1st semester the result was "Heads". Within the two outcome alternatives below "Round 2" one can just see the number of students who decided to

participate in this second round. At this point, it is not highlighted which of the two outcome alternatives won within the second round as this is not important according to the design of experiment 2.

As can be seen in table 3, for the totality of 145 undergraduate students that played the first round of the coin toss game just 98 students (67.59%) decided to participate in the second round. More interesting, however, is to analyze the decision for every individual group to play or not to play the second round of the game depending on the outcome of the first round. As an example the results of the group Economics 5th semester should be presented. At the beginning of the coin toss game the totality of 36 students was divided into two groups of 18 students each. The first coin toss resulted in "Heads" –hence 18 students realized an (imaginary) gain of 1 000 and the other 18 participants an (imaginary) loss of -1 000. Of the first round winner group 13 students decided to play the second round of the game with the possible outcomes of a total profit of 2 000 or 0 after round 2. Of the 18 students who lost in round 1, 15 decided to play another round with the possible total outcomes of -2 000 or 0 after playing round 2.

Thus, in the group Economics 5th semester a portion of 83.33% (15 out of 18) of the first round loser group and a portion of 72.22% (13 out of 18) of the first round winner group wanted to play a second round. It can be seen that the portion of the loser group is considerably higher than the portion of the winner group. As it is shown in table 4, the other three groups show similar results.

Table 4

Percentage of students willing to play a second round of experiment 2

Group	% of winnwrs playing second raund	%of losers playing second round
Economics (1st semester	40.00	63.16
Economics (3rd semester)	53.85	64.29
Economics (5th semester)	72.22	83.33
International commerce (1st semester)	68.18	90.48
Total	**58.90**	**76.39**

Source: elaborated by the author.

As can be seen for every of the four groups applies the rule that the percentage of the first round losers who want to play the second round of the coin toss game is higher than the percentage of the first round winners who decide to play again. The clearest result is reported for the group Economics 1st semester as the differential between losers and winners is highest with 23.16% (63.16 -40.00 = 23.16%). This means that 63.16% of the students of this group who lost in the first round wanted to play a second round with the preferred outcome of eliminating their first round loss. In comparison, just 40% of the first round winners wanted to continue and like this risk their first round gain. Taking into account all four groups who participated in the experiment 2, a significantly higher 76.39% of first round losers in comparison to just 58.90% of first round winners wanted to join a second round of the coin toss game.

4.3. Discussion

In section 2 of the present paper ("Theoretical Background") the two pillars in finance were presented –the Neoclassical Capital Market Theory and the Behavioral Finance Theory. It was also outlined that with respect to the concept of risk preferences the former assumes stable and homogeneous preferences and the latter variable and heterogeneous ones. The results of experiment 1 and experiment 2 of the present study clearly strengthen the position of the Behavioral Finance Theory. The risk preferences of the sample of 146 undergraduate students of the Autonomous University of Queretaro can be characterized as rather variable and heterogeneous instead of stable and homogeneous.

The results of Experiment 1 show that within the two outlined simple financial decision problems some participants decided with a risk-averse preference and others with a risk-seeking one. Hence, not all of the students show the same risk preference for both of the decision problems what should have been expected according to the Neoclassical Theory. However, in reality risk preferences are heterogeneous. In Decision Problem 1 63.12% of all students opted for the safe alternative A and 36.88% for the risky alternative B. In Decision Problem 2 31.69% choose the secure loss (alternative A) and 68.31% the gamble (alternative B). Hence, the majority of participants acts with a risk-averse preference in the profit zone and with a risk-seeking attitude in the loss zone.

Furthermore, risk preferences in Experiment 1 seem to be variable depending on situational factors (decision about a potential profit vs. decision about a potential loss) what is also contrary to the position of the neoclassical approach. If the assumption of stable risk preferences in the Neoclassical Capital Market Theory was true, the results should show equal percentages of participants choosing the safe and the risky alternative in both decision problems. However, for example in the group International Commerce 1st semester in Decision Problem 1 26 participants act risk-averse and 15 in a risk-seeking manner. In Decision Problem 2 one can find just 4 students with risk aversion and 37 with risk-seeking behavior. Hence, clearly (at least) some participants changed their risk preference from one situation to another. A result which is also obtained for all of the other analyzed groups.

Moreover, Experiment 1 also offered the opportunity to evaluate if participants decided in a rational manner or not. The obtained result contradicts the assumption of the Neoclassical Theory of an economic man who always maximizes expected profits. Taking the expected profit as a criterion in Decision Problem 1 63.12% and in Decision Problem 2 68.31% of all the participants choose the "wrong" alternative and so take a non-rational decision.

The results of Experiment 2 lead to similar conclusions. Risk preferences shown in this experiment are not homogeneous. If they were, all participants should have wanted to play (or not to play) the second round of the coin toss game. However, in total numbers 98 of 145 participants prefer to play a second round and like this decide in a risk-seeking manner. But 47 of a total of 145 do not want to continue playing and like this show risk aversion. Clearly a result of heterogeneous preferences as assumed in the Behavioral Finance Theory.

Hence, risk preferences presented in Experiment 2 neither are homogeneous across the participants, nor stable across different situations. The latter conclusion can be drawn from the fact that the decision situation influenced the portion of participants willing to play a second round. This portion was significantly higher for the group of first round losers (76.39%) in comparison to the group of first round winners (58.90%). Hence, losing in the first round resulted in a higher percentage of risk-seeking students than winning in the first round.

As already mentioned the results of both experiments are more in line with the assumptions of the Behavioral Finance Theory and thus, can be explained much better by concepts of this research area. The tendency –of

more pronounced risk aversion within decisions that implicate a potential profit and more pronounced risk-seeking behaviors within decisions about potential losses –is a central conclusion of Kahneman and Tversky (1979) presented by the value function of their Prospect Theory.

Furthermore, the results may show evidence of the existence of the disposition effect and the loss aversion. With reference to the disposition effect most individuals in experiment 1 possibly want to realize an emotion of pride and so decide for Alternative A in decision problem 1. On the other side, in decision problem 2 the majority decides for Alternative B probably to avoid the emotion of regret about a decision that resulted in a loss. With regard to the concept of loss aversion within experiment 1 (decision problem 2) and experiment 2 (group of first round losers) one can find plenty of participants who are willing to risk a higher loss in order to obtain the chance of not losing at all.

5. Concluding remarks

The research objective of the present paper is to determine the risk preferences of undergraduate students of the Autonomous University of Queretaro within the financial decision-making process using an experimental study design. This research objective was chosen in the context of an existing conflict between two theoretical pillars of financial research –the Neoclassical Capital Market Theory and the Behavioral Finance Theory.

Although both theories are based on opposite assumptions, they coexist side by side and should not be seen as substitutes. Beginning in the 1950s to the 1980s neoclassical theories have reached ground breaking advances in the field of finance. However, they seem to fail in the explanation of empirical anomalies of the financial markets such as asset price bubbles or excess volatility. Taking into account psychological concepts and theories, the study of Behavioral Finance offers new and sometimes better approaches to these kinds of phenomena.

While the Neoclassical Capital Market Theory assumes stable and homogeneous risk preferences, the Behavioral Finance Theory believes in variable and heterogeneous ones. Hence, based on an ideal image of man (homo economicus or economic man) the neoclassical approach assumes that every economic actor has the same and constant preference for risk in its financial decision-making process. Seemingly more realistic (but much more complex) the Behavioral Finance hypothesizes risk preferences that are variable depending on personal and situational factors.

The present study exercises two experiments with a total of 146 undergraduate students of the areas of economics and international commerce of the Autonomous University of Querétaro. The experiments are designed to determine the risk preferences of the participants within simple decision-making problems which imply different financial outcomes. Hence, using an experimental methodology, the present study tests the risk preference assumptions of both theories –Neoclassical Capital Market Theory and Behavioral Finance Theory.

The obtained results of the present study are clearly more in favor of the Behavioral Finance Theory. Within the two realized experiments the participants show different risk preferences what implies that some individuals present a clear tendency towards risk aversion and others to risk-seeking behavior. This is a result that clearly contradicts the assumption of homogeneous risk preferences postulated in neoclassical approaches. Furthermore, participants also change their risk preferences between different decision situations. This means, the majority of participants acts rather risk-averse in situations that show potential profits and rather risk-seeking in case of potential losses. Once again a result in contrast to the constant risk preferences assumed in the Neoclassical Capital Market Theory. Moreover, in one experiment the majority of students was not able to decide in a rational manner what also negates the ideal of an economic, profit-maximizing man acting in neoclassical theories.

The implications of the results of the present study are as follows: It is highly recommended to further strengthen the position of behavioral finance concepts in the areas of financial teaching and research. One important disadvantage of actual study programs in finance of many Mexican universities is a deficient or not existent consideration of the Behavioral Finance Theory. The current study shows that for a comprehensive understanding of contemporary finance it is vital to teach in a theoretical and practical manner both of the outlined theories –Neoclassical Capital Market Theory and Behavioral Finance. Solely by transmitting this mentioned comprehensive understanding of finance, future financial researchers as well as financial decision makers of the economic sectors are adequately prepared.

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