
Prospect Theory: A Study of the Endowment Effect

Teoria dos Prospectos: Um Estudo do Efeito Dotação

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Abstract

Behavioral Finance is a recent field of study which contradicts the presupposition supported by Modern Finance that decision makers act rationally. Prospect Theory, developed by Kahneman and Tversky (1979), is presented as an alternative model to the Theory of Expected Utility in relation to the way people decide in face of possibilities of risk. According to Prospect Theory, people define gains and losses based on a given point of reference, which can be established on grounds of a given level of expected gain. This fact leads to the Endowment Effect - a behavioral trend investigated in this study – whereby investors are influenced by a portfolio which they have received as an inheritance or endowment. The reason this occurs is that individuals usually define their expectations of gain according to the future profitability of the portfolio received, and not according to the future profitability of the market. Using an investment simulation, the Endowment Effect was tested among 226 university students taking courses in the subject of capital markets. The results demonstrate that the students were influenced by the different initial portfolios, which were randomly assigned.

Key words: Prospect Theory, Endowment Effect, Risk.

Resumo

As Finanças Comportamentais são um recente campo de estudo que contradiz a pressuposição apoiada pelas Finanças Modernas de que os tomadores de decisão agem racionalmente. A Teoria dos Prospectos, desenvolvida por Kahneman e Tversky (1979), é apresentada como um modelo alternativo à Teoria da Utilidade Esperada em relação à maneira como as pessoas decidem face a possibilidades de risco. De acordo com a Teoria dos Prospectos, as pessoas definem as perdas e os ganhos com base em um determinado ponto de referência, o qual pode ser estabelecido também com base em um determinado nível de ganho esperado. Tal fato leva ao Efeito Dotação – uma tendência comportamental investigada neste estudo – em que os investidores são influenciados por um portfólio que receberam como herança ou doação. Isto ocorre porque os indivíduos normalmente definem suas expectativas de ganhos de acordo com a rentabilidade futura do portfólio recebido, e não de acordo com a rentabilidade futura do mercado. Usando uma simulação de investimento, o Efeito Dotação foi testado entre 226 estudantes universitários que faziam a disciplina “Mercados de Capitais”. Os resultados demonstraram que os estudantes eram influenciados pelos diferentes portfólios iniciais, os quais lhes foram aleatoriamente atribuídos.

Palavras-chave: Teoria dos Prospectos, Efeito Dotação, Risco.

1 Introduction

The environment in which the process of financial decision making takes place is often characterized by its high level of complexity and uncertainty. This unstable, complex scenario could end up influencing the investor, causing him to attribute value to his intuition to the detriment of the previously established rules, which are widely accepted by the market. As a result, investment decisions can be affected by cognitive illusions, which are the result of people's intuitive judgment (KAHNEMAN and HALL, 1998).

Within this context, Behavioral Finance combines concepts of Finance and Cognitive Psychology with the aim of understanding systematic implications involved in the psychological process of decision making in the financial market (OLSEN, *apud* BRABAZON, 2000). It is therefore considered opportune to carry out a study dedicated to the Endowment Effect.

Thaler (1980) identified the Endowment Effect – a tendency among people to demand a higher price when selling an object than the price they would be prepared to pay for it - based on an observation of the attachment of an economist colleague and wine-lover to some bottles of wine. Some years later, in 1984, Knetsch and Sinden managed to demonstrate the Endowment Effect in a laboratory through an experiment using lottery tickets.

One of the consequences generated by the Endowment Effect in the investor is that he retains, for a long period of time, a portfolio which he received ready made up. For example: an heir who receives an inheritance wholly invested in a specific share tends to keep this portfolio for a long time.

An experiment with an artificial financial market was conducted by Krahen, Rieck and Theissen (1997) among graduate students at the University of Giessen. In order to test the Endowment Effect, they distributed to half of the participants a portfolio comprised of investments in shares, and a cash investment to the other half. At the end, they observed that the participants who had received only shares had higher proportions of shares than those who had received only cash. As a result, they concluded that the initial portfolio influenced its final composition, and therefore accepted the hypothesis that the Endowment Effect influences the behavior of investors.

In Brazil, despite the fact that studies related to Behavioral Finance are still in their infancy, some scientific articles have already been published in this area, such as: *Análise do sentimento de aversão à perda em finanças comportamentais e na teoria psicanalítica* (MARCON, GODOI, BARBOSA e PINTO, 2002); *Finanças comportamentais: aplicação no contexto brasileiro* (ALVES e TORRES, 2001); *As novas finanças e a teoria comportamental no contexto da tomada de decisão sobre investimentos* (CASTRO JÚNIOR e FAMÁ, 2002). However, as far as it is known, no study on the Endowment Effect has been carried out. Furthermore, there are no records that this cognitive illusion has already been studied using an investment simulation.

This study, through the use of an investment simulation, therefore proposes to

answer the following question: are investors affected by the cognitive illusion of the Endowment Effect?

It is hoped that the results of the investigation will give a clearer understanding of the decision-making process in the financial markets, thus contributing to the study of how individuals interpret information and act in order to make informed decisions relating to the management of their investments.

2 Literature Review

No precise definition is found in the literature regarding the exact point at which the study of finance departs from economics and accountancy and establishes itself as a particular area of study. For many academics, however, the beginning of finance is marked by the book *The Battle for Investment Survival*, by Gerald M. Loeb (1935). The first stream of study in finance – the traditional financial analysis – believes the market is not always correct since it recognizes the possibility of obtaining gains in the financial market at times when the investor discovers that he is wrong. This premise ratifies the possibility that the markets are subject to irrational behaviors.

From the meeting of traditional finances, at the beginning of the 1950s, emerged the Modern Theory of Finance, which questions the premise that diligent and careful investors could gain systematically more than the market average, and that the market often behaved in an irrational way (LOEB, 1935). According to this new theory, investors act rationally and the market is efficient.

Castro Júnior and Famá (2002) state that Modern Finance has raised concepts which view the investor as an economic, rational being adverse to risk, and who, to maximize his well-being, uses the expected utility curve.

The Utility Theory (BERNOULLI, 1738) defends the idea that rational people, when faced with uncertain scenarios, consider all the information available, process it objectively and respond to the new information based on a clearly defined set of preferences. Thus, rational investors, when making an investment, analyze the information available objectively, and the mistakes they make in forecasting the future are random and not the result of a tendency towards optimism or pessimism (BERNSTEIN, 1997).

Von Neumann (1928), and later Von Neumann and Morgenstern (1944), by means of an article which presented Game Theory, consolidated the idea of rational economic behavior and rationality in economic decision making – the markets cannot be predicted and neither can they behave irrationally.

The rationalist movement, born of the Economic Sciences, rapidly impacted the field of finance. At the beginning of the 1950s, Markowitz (1952) published the historic article “Portfolio Selection” in the “Journal of Finance”, which established the bases of the new finance. Markowitz states in it that the markets cannot be predicted; in other words, an individual investor cannot gain systematically more than the market

average.

Perfecting the theory of Modern Finance, Modigliani and Miller (1961) defend the irrelevance of the payment of dividends to share prices. According to the rationale of these authors, the payment of dividends is irrelevant to the overall wealth of the shareholders.

A few years later, Sharpe (1964), based on the premises that the investor is rational, adverse to risk and always seeking to maximize his well-being, formulated a model for assessing assets in conditions of risk: the CAPM (Capital Asset Pricing Model).

Fama (1970) formalized an efficient market more precisely. However, the notion of an efficient market had already been mentioned by Gibson (1989, *apud* SHILLER, 2000, p.162). Gibson clarified that when “the shares become publicly known in the open market, the value they acquire can be considered as the most intelligent judgment of them”.

Discussion on the efficiency of the markets is still one of the topics yet to be resolved in finance, along with the rationality of investors defended by Modern Finance (FAMA, 1970). Consequently, discussion concerning the rationality of decision makers is of primary importance for finance.

In the 1950s an intense debate also began on the rationality of decision makers in the field of Psychology. At the time Markowitz wrote his article psychology was dominated by the behaviorist school. For behaviorists, all human behavior can be explained by the relationship between stimulus and response (SKINNER, 1957). According to Skinner (1957), decisions that are not taken in a rational way are punished taken in a rational way are punished with negative stimuli, which induce humans to use reason to make decisions.

Shortly afterwards, influential psychologists – Miller, Galanter and Pribram (1960), and Newell, Shaw and Simon (1957) -, not satisfied with the explanations of the traditional behaviorists for a series of human behaviors, and working within an environment in which the premise that human behavior can always be explained by a success of stimuli and responses was being harshly criticized, initiated a new field of study: Cognitive Psychology.

The decision-making process in humans is presented as one of the fields of study of Cognitive Psychology (STERNBERG, 2000). When studying it, the psychologists observed that, in certain situations, human beings violated principles of rationality when making decisions.

In view of this fact, Simon (1956) proposed an alternative model of rationality according to which humans used a decision-making strategy which he called “Satisfying”. Since humans normally have difficulty considering and assessing all the options involved in choice, they generally consider only some of the options in order to take the necessary decision. In the whole, human decision-making process, only in exceptional cases, is the best alternative sought; in most situations, humans act upon conditions of bounded

rationality.

Two cognitive psychologists, Amos Tversky and Daniel Kahneman, went beyond demonstrating the violation of the axioms of the theory of expected utility to create a descriptive model of the way humans make decisions (KAHNEMAN and TVERSKY, 1972, 1973; TVERSKY and KAHNEMAN, 1971, 1973, 1974, 1982).

Firstly, these psychologists observed that humans use heuristic rules – mental shortcuts or empirical rules to find the solution to a given problem – when making decisions. The use of heuristic rules can generate bias in the decision, i.e., systematic tendencies which violate the axioms of unbounded rationality.

A second factor generating decision biases was grouped under the name “Prospect Theory” (KAHNEMAN and TVERSKY, 1979). According to this theory, humans use two phases in the selection process: the first, to edit risky prospects; the second, to assess these prospects. The initial phase consists of a preliminary analysis of the probabilities offered in which such probabilities are often reduced to a simplified form. In the second phase, the edited probabilities are assessed and the probability with the highest value is selected.

The separation of decisions into two phases and, in particular, the use of the preliminary editing phase, which attempts to simplify the process, often leads to bias in the decision or systematic errors. However, the existence of systematic errors in the financial market is not compatible with Modern Finance.

The tendency of investors to commit systematic errors of assessment is called cognitive illusion. The aim of learning about cognitive illusion, and its influence in the decision-making process, is to be able to recognize the situations in which this particular error could arise (KAHNEMAN, SLOVIC and TVERSKY, 1982).

Nevertheless, despite all the advances in the study of decision making on the part of cognitive psychologists, the link between Economy and Cognitive Psychology was only made after a while by Richard Thaler, placing him at the vanguard of a group of academic economists who reacted to the flaws in rational behavior.

The article by Kahneman and Tversky (1979) in the field of Econometrics marks a milestone in linking the study of Psychology with Economics and Finance. Tversky, Kahneman and Thaler inaugurated a new field of study called “Behavioral Finance” (BERNSTEIN, 1997).

Behavioral Finance studies investors’ behavior, particularly in relation to the way they make decisions. It takes the view that investors do not always act rationally and are often affected by cognitive illusions that could be harmful to them. The identification and comprehension of cognitive illusions - as well as their effects and the means of avoiding these effects -, are the main objectives of this recent area of study in finance (NOFSINGER, 2001).

One of the discoveries arising from Prospect Theory (KAHNEMAN and TVERSKY, 1979) studied by Behavioral Finance is the so-called Endowment Effect,

whereby people often demand a much higher price for their assets (*willingness to accept* - WTA) than they would be prepared to pay for them (*willingness to pay*-WTP) (THALER, 1980).

People seem to give preference to their current situation when comparing it with a new one that they do not know well, even if the current one does not seem the most appropriate to them. This cognitive illusion, known as the Inheritance or Endowment Effect, could harm investors who own investment portfolios with poor prospects for future performance (THALER, 1980; KNETSH and SINDEN, 1984; KAHNEMAN, KNETSH and THALER, 1990).

Often, the goods received as an endowment are classified as separate parts of the assets and, as a result, end up being managed differently from the rest. Investors seem to believe that since they were not the ones who invested that part of the assets received as an endowment, they do not have any responsibility over its future performance. According to Nofsinger (2001), even when an investor has no emotional attachment to a given inheritance, he still tends not to break up the assets received.

As a result, being aware of the cognitive illusions to which investors are subject and making themselves aware of this fact, it is vitally important to improve the process of allocating the investments. In view of this, the evidence raised by Prospect Theory (KAHNEMAN and TVERSKY, 1979), whereby investors are affected by the cognitive illusion of the Endowment Effect, was tested using an investment simulation.

3 Methodology

To achieve the research objectives, the data required were collected by means of a computer program which simulates the market for private investors. In order to achieve the goal of this study, it was necessary to expose the participants in the investigation – university students without prior experience in the financial market – to situations in which the Endowment Effect could be tested.

In the simulation, the participants were given responsibility for managing a portfolio of investments over a period of five hypothetical years. Each investor's decision was equivalent to a three-month period of the market.

The computer program was fed with real data of the capital market, based on the real prices of shares traded on the Bovespa Stock Exchange, collected during the period January 1997-December 2001. The participants, however, were not told about the period of data collection. Also, the names of the companies were replaced by fictitious names.

The students were placed in an environment which was very similar to that of a small investor using the Bovespa Home Broker system. The difference was that there was no interaction between offer and demand to influence the prices – both the selling price and the buying price were determined by the system.

3.1 The investment options

In the model, the investors had the opportunity to choose from 31 options for investing their assets. These options were: 28 different shares, a flat, a land lot and cash.

In order to guide the investor, basic information was given about each share in the system, including: basic indicators, a brief description of the company, a system of recommendations based on market consensus, positive and negative points, and news relating to the average market movement.

The information system was designed in such a way that it did not interfere significantly in the decisions of the participants; in the case of possible interference, the researchers sought to move in the opposite direction to possible corroboration with the hypothesis of the Endowment Effect to be tested.

3.2 The simulation

To begin the simulation, the participants drew lots for the portfolio with which they would start the simulation. Four initial portfolios were created, all different, which would have significant different variations during the simulation. Portfolio 1 consisted of 93.3% real estate and 6.6% cash. Portfolios 2 and 3 were wholly invested in shares and portfolio 4 contained only cash. The shares comprising portfolio 2 performed below average, while those comprising portfolio 3 had a much higher performance than the other shares available for investment in the simulation.

Before the first round, each participant was able to buy and sell all the assets of his choice in such a way that his portfolio could be recomposed without transaction costs, with the assets which he judged most appropriate. In the simulation, there were no transaction costs since the methodological interest of the simulation was that the participants could deal freely. Also, there were no taxes on profits to avoid interference from profits or losses in the decision to sell.

In this simulation, there was no difference between the buying and the selling prices, which were identical and were shown to all participants at all times; this was done to ensure that a possible endowment effect would not be influenced by the difference between the WTP and the WTA.

3.3 Hypothesis investigated

According to the Theory of Expected Utility, investors do not have any “emotional” attachment to their current portfolio of investments. A rational investor evaluates all the investment options, regardless of whether or not they form part of his investment portfolio. Prospect Theory disagrees with this point of view since it states that investors tend to exhibit a strong attachment to the *status quo*, which makes people demand a much higher price for their assets than the value they would be prepared to

pay for them: a cognitive illusion known as *Inheritance* or *Endowment Effect*.

In order to verify whether the investors would be affected by the Endowment Effect, different initial portfolios were distributed in order to discover whether these would influence the profitability and final composition of the participants' portfolios.

In view of this, this research proposed to investigate the following hypothesis: are decision makers affected by the cognitive illusion of the Endowment Effect? – does the managers' initial portfolio influence the final profitability of their investments?

To prove this hypothesis, there must be a tendency towards a difference between the profitability of the different portfolios and the percentage of real estate in the total assets of the different portfolios. If there are significant differences between the performances of the different portfolios, and in the percentage of real estate in the different portfolios, then the hypothesis of this research will be accepted as true.

3.4 Sample, collection and statistical analysis of the data

The population studied was comprised of university students enrolled in the subject of Capital Markets who did not invest regularly in stock exchanges; the students were selected from four universities in four different towns of the State of Santa Catarina.

To test the Inheritance Effect, the researchers reinforced the idea that the portfolios were attributed randomly to the participants since the aim of the research was to discover whether the different portfolios would generate different behaviors over the 20 simulated quarters. The behavior of the participants was measured by means of two quantitative variables (the percentage of real estate in the portfolio and the total assets in the portfolio), to assess variability, followed by a qualitative variable (portfolios 1, 2, 3 and 4), seeking to determine the influence of this qualitative variable on the quantitative variables, i.e., the participants' behavior.

This model corresponds to a design with a factor (portfolio) which can be controlled by the researcher. In models of this type, the statistical method used to test the effect of the factor (portfolio) on the response variables of the experiment (total assets, for example) is Variance Analysis (ANOVA) (BOX, HUNTER and HUNTER, 1969). This method compares the averages for the variables of the results of the four portfolios and enables the researchers to establish whether there is sufficient evidence to affirm that they are not the same.

The data were processed using the statistical software SPSS for Windows. In the stage of describing the information collected, analytical and graphical univariate descriptive procedures were used, such as: calculation of statistics, frequency tables, histogram, boxplot and scatterplot. These procedures proved to be essential for verifying the presuppositions of the various analyses used in the confirmation stage.

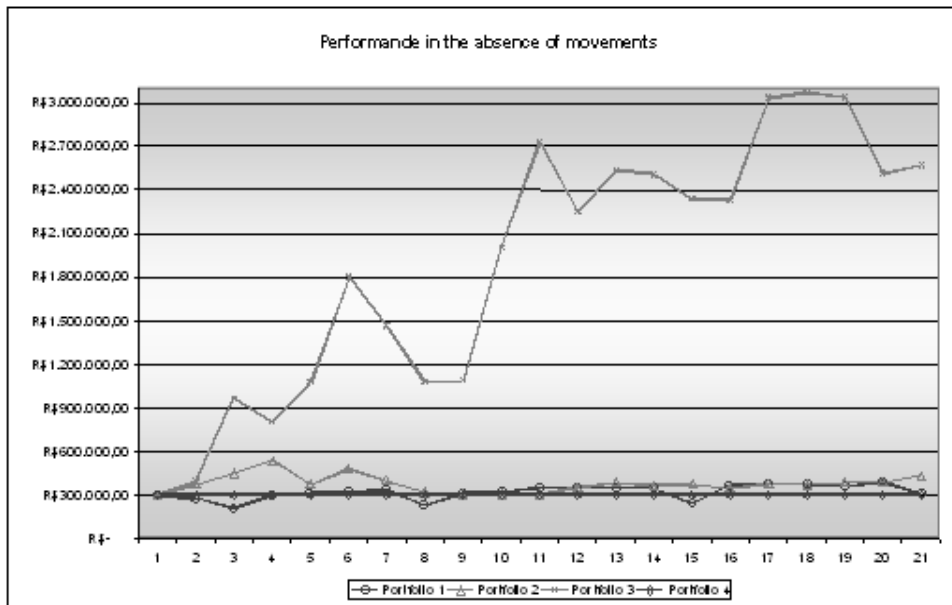
4 Results

Two hundred and twenty six individuals were researched and considered: 53 for portfolio 1, 58 for portfolios 2 and 3, and 57 for portfolio 4. All the individuals investigated were students taking higher education courses, at the start of the subject Capital Markets.

The sample was comprised of 107 women and 119 men, with an average age of 24.84 years. Of the participants, 162 were students taking courses in Business Administration, 48 were taking courses in Economics and 16 were taking courses in Accounting. The research was conducted in four universities, with 98 students from the Federal University of Santa Catarina (UFSC); 60 from the University of the South of Santa Catarina (UNISUL); 48 from the State University of Santa Catarina (UDESC), and 20 from the University of Vale do Itajaí (UNIVALI).

The four initial portfolios, randomly distributed among the participants, had significantly different performances when no movement was made throughout the simulation. The graph below shows the performance of each portfolio in the absence of alterations throughout the 21 quarters.

Figure 1: Graph of the development of performance of portfolios in the absence of any movement throughout the 21 rounds



Source: Elaborated for the authors.

According to the methodology established, the hypothesis would be accepted as true if the participants who received portfolio 2 had a significantly lower performance than those who received portfolio 3, even if the participants of portfolio 4 (cash only) had an intermediate performance since they were not tied to any share in the simulation. In addition, it was expected that the percentage of real estate assets of portfolio 1 would be higher than the percentage for the other portfolios throughout the entire simulation.

The data were grouped by the criteria portfolio, and the specific effect of the initial portfolio on the average assets of the participants was studied. Table 1 summarizes the main descriptive statistics of the participants' assets by portfolio.

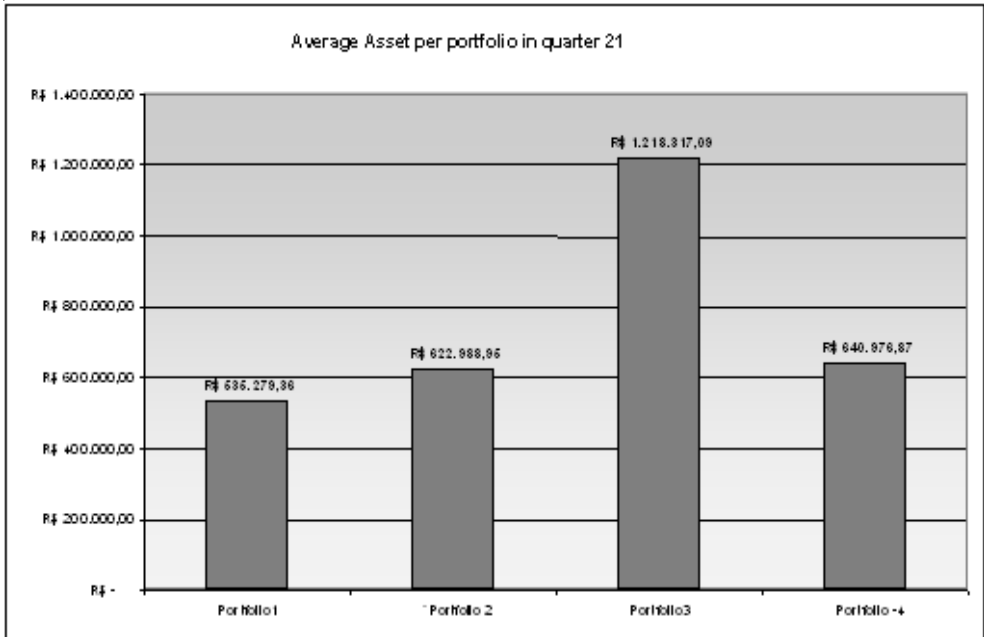
Table 1: Summary of the main descriptive statistics of the participants' assets, by portfolio

Portfolio	No	Average	Standard Deviation	Minimum	Maximum
Portfolio 1	53	535,279.3583	408,191.2527	44.180,00	2.360.625,71
Portfolio 2	58	622,988.9531	360,395.7561	90,972.48	2,086,798.04
Portfolio 3	58	1,218,317.0897	659,992.0203	103,220.00	2,569,359.63
Portfolio 4	57	640,976.8653	844.460,7900	708.00	5,750,960.30
Total	226	759,739.9902	658,572.7488	708.00	5,750,960.30

Source: Elaborated for the authors.

The difference between the asset average of the four portfolios can be seen in Figure 2, which confirms that the final asset average of portfolio 3 was far higher than the averages for the other three portfolios, followed by the average for portfolio 4, portfolio 2 and portfolio 1.

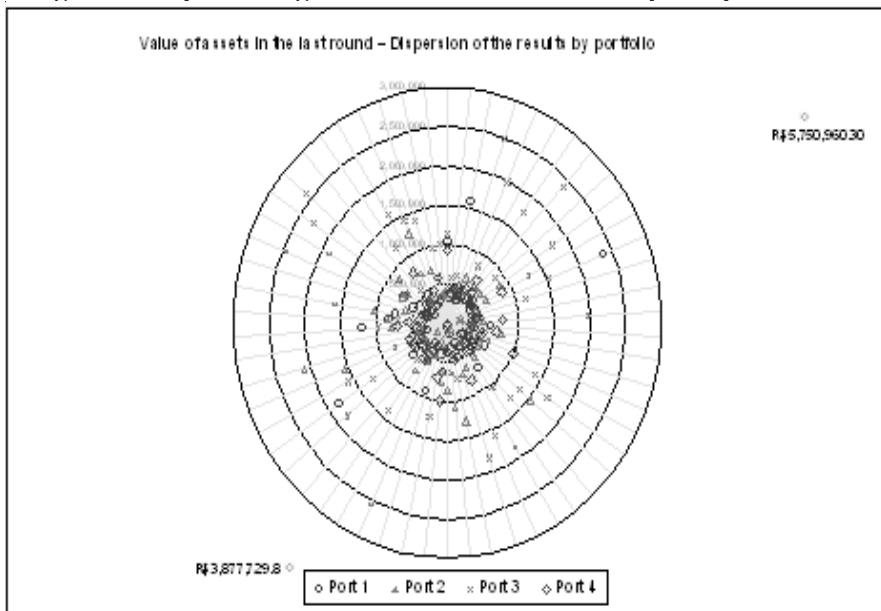
Figure 2: Graph of the asset profiles of the portfolios in quarter 21



Source: Elaborated for the authors.

The scatter of results around the average can be seen in the graph below.

Figure 3: Graph showing scatter of the final value of the participants' assets

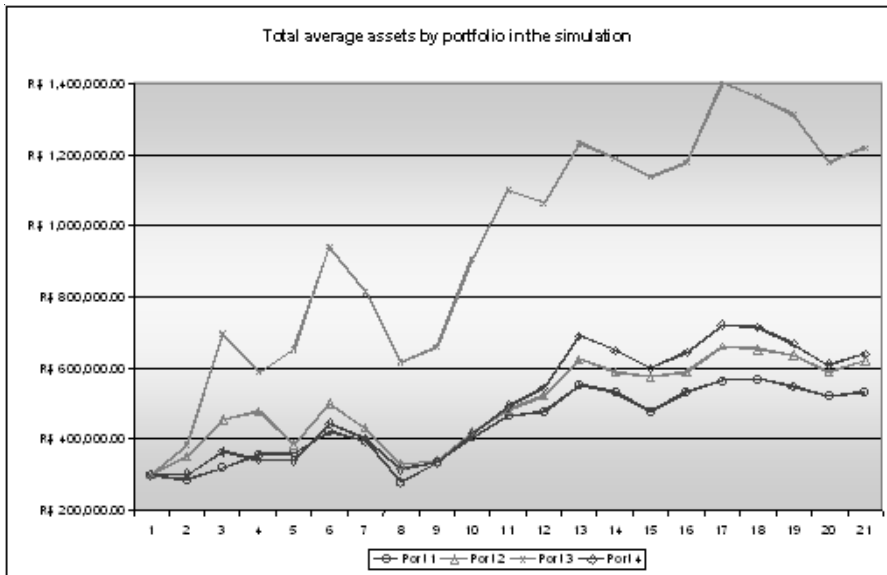


Source: Elaborated for the authors.

The clear advantage of those who began with portfolio 3 was therefore verified when comparing the final assets of all participants. The high return of two participants who received portfolio 4 – comprised only of cash – is also highlighted.

The following graph shows the development of the average assets of the four portfolios throughout the simulation.

Figure 4: Graph of the development of the participants' average performance for the four portfolios throughout the 21 rounds



Source: Elaborated for the authors.

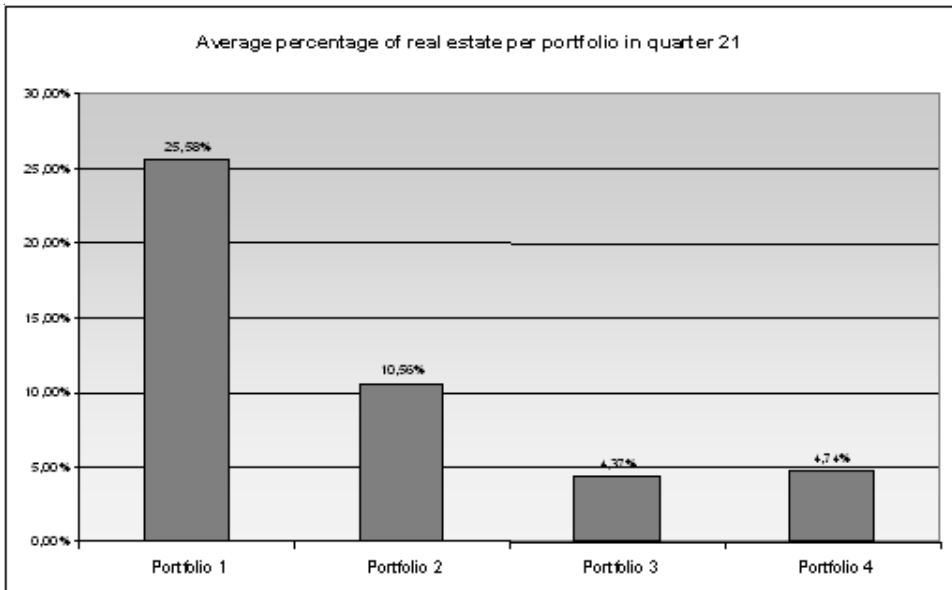
In the behavior of portfolio 4 - comprised solely of cash in the initial quarters – it was observed that, contrary to expectations, this portfolio performed lower than portfolio 2. A possible explanation for this could be the delay of the participants who received portfolio 4 in making up their portfolios, having kept a significant portion of the assets invested in cash in the early quarters.

Table 2: Summary of the main descriptive statistics for percentage of real estate for each portfolio

Portfolio	No	Average	Standard Deviation	Minimum	Maximum
Portfolio 1	53	,2558456	,3069445	,00000	,99553
Portfolio 2	58	,1055759	,2123272	,00000	,94216
Portfolio 3	58	4,370181E-02	,1448090	,00000	,68674
Portfolio 4	57	4,370181E-02	,1089664	,00000	,44388
Total	226	,1102739	,2204602	,00000	,99553

Source: Elaborated for the authors.

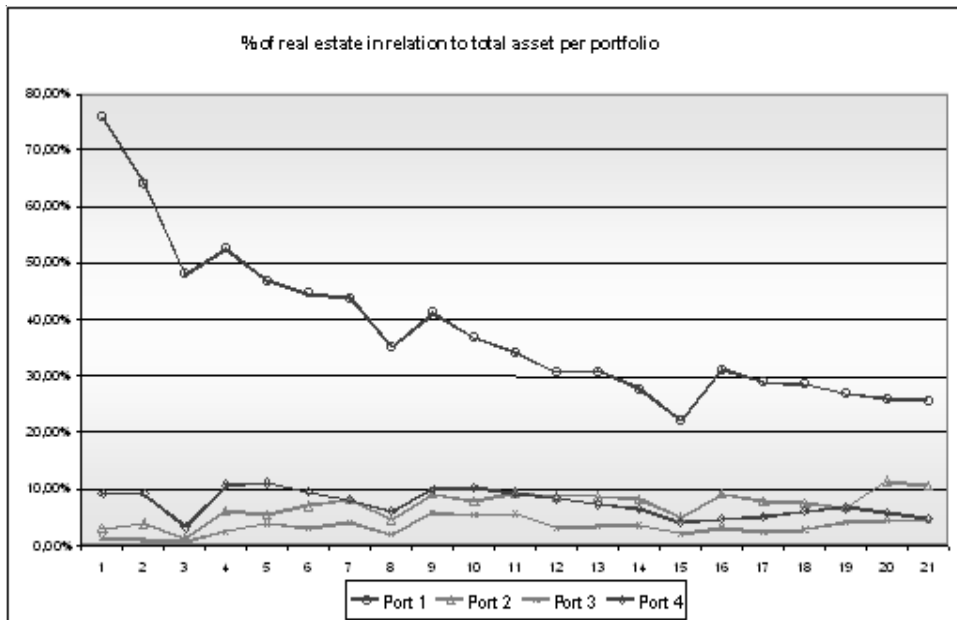
Figure 5 shows the differences in average percentages of real estate for the four portfolios. As the figure shows, the average of the final assets of portfolio 1 is far higher than the averages for the other portfolios.

Figure 5: Differences in average percentages of real estate for the four portfolios

Source: Elaborated for the authors.

In view of the results, it can be affirmed that the average percentage of real estate for portfolio 1 in the 21st quarter differs significantly from, and is higher than, the other three portfolios which did not receive real estate at the start of the simulation. The following graph shows the movement in the percentage of real estate present for each of the portfolios throughout the 21 quarters of the simulation.

Figure 6: Graph showing movement in percentage of real estate in the portfolios



Source: Elaborated for the authors.

According to the graph and the statistical results, it was demonstrated that the percentage of real estate was higher among the participants who received portfolio 1, even 21 rounds after the start of the simulation. This led to the conclusion that the Endowment Effect caused a simple random attribution to influence the amount of real estate retained by the participants in their portfolios for the entire period of the simulation.

5 Final Considerations

To investigate the Endowment Effect the participants in the study received a case study which reported a specific situation in which four managers, who initially received a portfolio of three hundred thousand *reais* (Brazilian currency) in cash - to be managed for a period of 5 years or 21 quarterly rounds -, had to take part in a draw through which they received one of the four different portfolios proposed in the case study.

Portfolio 1 had 280 thousand *reais* invested in real estate and 20 thousand in cash. Portfolios 2 and 3 were wholly invested in shares; however, the shares of portfolio 2 had a significantly lower performance than those of portfolio 3. Finally, portfolio 4 was wholly invested in cash.

According to the Theory of Expected Utility, the participants would not base their decision on the portfolio initially received since investors look to the future results

of an investment and not to the past ones. Thus, right from the first round, each participant would invest his 300 thousand *reais* in the share he judged most appropriate. Therefore, at the end of the 21 rounds comprising the simulation, the effect of the initial portfolio should be imperceptible.

However, according to Prospect Theory, the participants would be affected by the initial portfolio. Thus, based on the premise that the Endowment Effect would be apparent at the end of the simulation, those participants who started with real estate – portfolio 1 – should still have a significantly higher percentage of real estate than the other portfolios. It was also expected that the participants who received portfolio 3 would have a significantly higher performance than those who received portfolio 2 since the shares which initially comprised portfolio 3 performed higher than portfolio 2 throughout the simulation. Finally, it was expected that portfolio 4, wholly comprised of cash, would perform somewhere between portfolios 2 and 3.

The investigation showed that the percentage of real estate comprising portfolio 1 in the last quarter was significantly higher than that of the other portfolios. It was also demonstrated that portfolio 3 had significantly higher profitability in comparison with the other portfolios. As a result, it was concluded that the portfolio factor influenced the profitability and the composition of the different portfolios.

The influence of the initial portfolio, according to Prospect Theory, is a result of the higher attachment that people normally have to a given *status quo*. In the simulation, the participants believed that the initial portfolio was the point of reference to which they “should” return. The commitment to the *status quo* was initially maintained, even when presented with the case study which sought to eliminate it, thus emphasizing the random distribution of the portfolio as well as the original intention that the managers should receive only cash.

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