New Advances in Behavioural Finance

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Edited by

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CHAPTER 1

INTRODUCTION

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Behavioral Finance is the study of the influence of psychology on the behavior of investors and other financial decision-makers. It also seeks to explain how these decisions are reflected on corporations and financial markets.

Throughout its development over the past three decades, the new knowledge generated by Behavioral Finance about financial markets has been huge. For example, today we know that financial markets are inhabited by investors who do not diversify their portfolios as much as they should (French and Poterba, 1991; Barber and Odean, 2000), who trade excessively (Barber and Odean, 2001, 2002) and who often exhibit herding behaviors (Barber *et al*., 2009; Li *et al*., 2017). In addition, investors are often mistaken and these mistakes impact stock prices (Cooper *et al*., 2001; Rashes, 2001).

We are now aware that stock returns are predictable, exhibiting some persistent patterns. For example, the momentum effect according to which stocks with higher returns in the recent past continue to outperform while past losers tend to have lower returns in the near future, is a pervasive feature of stock markets (Jegadeesh and Titman, 1993; Fama and French, 2012; Asness *et al*., 2013). In addition, we know that the momentum effect tends to be stronger amongst the most traded stocks (Lee and Swaminathan, 2000) and in the stocks with information that is more difficult to process (Zhang, 2006). This effect seems to be explained by cultural factors (Chui *et al*., 2010), among others. A number of theoretical behavioral models connect the behavioral features observed in individual decision-making with the patterns of predictability found in empirical studies on financial

market prices (Barberis *et al*., 1998; Daniel *et al*., 1998; Hong and Stein, 1999).

We also know more about the decision making-process of professional investors, commonly known as arbitrageurs, like mutual fund managers and pension fund managers. These institutional investors are becoming increasingly important in modern financial markets and are generally understood to perform the task of correcting the mispricing errors made by other investors. In fact, it is well established that the stocks held by these informed investors tend to have more efficient prices (Nagel, 2005; Phalippou, 2008). However, it has also been found that institutional investors suffer from significant limitations in their quest against pricing errors (Shleifer and Vishny, 1997) and that, in some circumstances, they can even contribute to increase the inefficiency of financial markets (Nagel and Brunnermeier, 2004; Griffin *et al*., 2011).

The battle between Behavioral Finance and Neoclassical Finance has left some important "casualties" in the neoclassical side. For example, today, after the pioneering results by Lo and MacKinlay (1988) and Jegadeesh (1990), no self-respecting scholar still argues that returns in stock markets can be best described by a “random walk” in all circumstances. In addition, the standard equilibrium model of pre-behavioral finance, the Capital Asset Pricing Model, was also discredited for lack of empirical support and was replaced by models that reflect the different investment styles available to investors such as the three-factor model of Fama and French (Fama and French, 1993) and the Carhart's four-factor model (Carhart, 1997), for example.

This book gathers contributions in several areas of Behavioral Finance and is divided into three parts. Part I is devoted to the financial decisions made by individuals in different contexts: in a TV contest (chapter 2), in a laboratory experiment (chapter 3) and in international stock markets (chapter 4). The analysis of how decisions are made in different environments is one of the distinct features of Behavioral Finance, contributing to increase the robustness of its conclusions. In chapter 2, Lobão studies the players' decisions in the Portuguese version of the TV show “The Price is Right”, reporting significant deviations from the optimization rules assumed by axiomatic rationality. The results indicate that the normative logic of choice is descriptively false, corroborating the perspective of Tversky and Kahneman (1986), among others. If individuals are shown not to be able to maximize their expected utility in a decision environment where rules are relatively simple and clear, it is plausible to admit that in contexts of greater

ambiguity and complexity and where learning is a difficult process (e.g., in financial markets) the decisions will deviate even further from the predictions of axiomatic rationality.

In chapter 3, Goulart, Costa Jr., Andrade and Santos examine the disposition effect in a laboratory experiment. The disposition effect can be defined as the tendency to hold on to losing stocks for too long while selling winning stocks too early. This effect impacts most investors (Barber *et al*., 2007) and may contribute to the momentum pattern mentioned above (Grinblatt and Han, 2005). The main result of the study is that there is a significant increase in the disposition effect when the financial performance of individual decision-makers is to be made public. These findings suggest that social incentives may be important in the financial markets and go in the same direction as other studies that conclude that social interaction induces stock market participation and trading (e.g., Hong *et al*., 2004).

In chapter 4, Lobão e Maio analyze the effects of national culture on herding formation in international stock markets. It is now well established that national culture plays an important role in the decisions that take place in financial markets (e.g., Beugelsdijk and Frijns, 2010; de Jong and Semenov, 2006). The evidence shown in the chapter indicate that investors deciding in more masculine cultures and in cultures characterized by a higher power distance tend to be less prone to herd. The main implication of these results is that culture is an important omitted variable in studies that examine cross-country differences in financial decision-making.

Part II of the book includes studies on how market prices are formed. In chapter 5, Lobão and Almeida explore the possibility of predicting large and sudden negative returns (i.e., price crashes) in a sample of large European stocks. This topic is of great importance as crashes can cause substantial losses in investors' portfolios. The authors conclude that the usefulness of the indicators to identify the stocks more prone to crash critically depends on the notion of crash under consideration. Despite this, some characteristics such as the stock's past return, its volatility, its size, and the relationship between market capitalization and book value make it possible to build strategies that allow to improve the risk-return relationship of the investors' portfolio.

In chapter 6, Lobão and Brito study the stock price reaction to earnings announcements made by a group of European firms with large capitalization. Existing empirical evidence suggests that stock markets typically underreact to earnings information, creating the so-called post-earnings announcement

drift (PEAD) (Bernard and Thomas, 1989). Lobão and Brito find only slight signs of PEAD, which illustrates the importance of considering the decisions of informed investors in the formation of prices. The results obtained by Lobão and Brito show that if the stocks are traded in markets with better information conditions - typically the case of the most liquid stocks such as those included in the sample - price inefficiencies are expected to be less significant as a result of the performance of those sophisticated investors. This indicates that the existence of a significant PEAD may result from an inefficient incorporation of information into prices, which is usually attributable to an environment inhabited essentially by uninformed investors and where significant barriers to arbitrage play an important role (Mendenhall, 2004; Chung and Hrazdil, 2011).

The following two chapters address the distribution of market prices. In an efficient market, prices are expected to be uniformly distributed. However, the literature on the topic concludes that asset prices tend to be less frequent at certain price levels (case in which such price levels are understood to be considered as a psychological barrier) or tend to be more frequent at certain price levels (what is usually called price clustering). In Chapter 7, Fonseca, Lobão and Pacheco examine for the first time the existence of psychological barriers in round numbers in the markets of American Depository Receipts (ADRs) and Exchange Traded Funds (ETFs). Several studies have concluded that prices exhibit important barriers in round numbers in asset classes such as single stocks and stock indices (e.g., Lobão and Pereira, 2017; Lobão and Couto, 2019), derivatives (Schwartz *et al*., 2004) and cryptocurrencies (Fonseca *et al*., 2019). In contrast to this empirical evidence, the authors found significant signs of psychological barriers in only two ETFs and one ADR, among the 12 assets under scrutiny (six ADRs and six ETFs). Research on psychological barriers in these two markets is still in its infancy; in the future it would be of interest to identify the determinants of psychological barriers and to understand the impact of arbitrage forces on the phenomenon.

In chapter 8, Lobão and Pinto explore the tendency of prices in the Nord Pool Electricity Market to accumulate around specific values. The main conclusion is that hourly prices in eleven of the 21 bidding zones under analysis cluster in a statistically significant way. The results suggest that the prices in the that market are not uniformly distributed and therefore cannot be adequately described by a “random walk”.

The next two chapters focus on the impact of sentiment on stock markets. One of the main results of Behavioral Finance is that investor sentiment

significantly influences stock prices. When the sentiment is more positive (negative), markets tend to become overpriced (underpriced), so future returns tend to be lower (higher) (Baker and Wurgler, 2007; Baker *et al*., 2012). In chapter 9, Paule-Vianez and Orden-Cruz investigate the impact of public fear associated with the COVID-19 pandemic on the stock markets of Portugal and Spain. The authors show that investor sentiment has negatively affected the returns of the Iberian markets, especially in the Portuguese stock market.

In chapter 10, Sena, Tasa and Ugurlub study the long-term impact of four events (the terrorist attacks that occurred in 11 September 2001 and in London in 2005, the Brexit referendum of 2016 and the US presidential election of 2016) in the stock markets of 20 countries. The main result is that events of political nature (the Brexit referendum and the US presidential election) had a greater effect in the long run. More specifically, the Brexit referendum caused the greatest long-term impact as it negatively and significantly affected long-term returns in 17 of the 20 countries under scrutiny.

The last part of the book is concerned with financial literacy, illustrating the potential for convergence between this field of study and Behavioral Finance. In fact, it is necessary to understand how individuals use the financial information at their disposal in order to design literacy programs that will allow them to overcome the errors that usually affect their judgment. In chapter 11, Ribeiro, Madaleno, Botelho and Lobão show, on the basis of data collected in an online survey, that there is a low correlation between the levels of financial literacy and digital literacy. This finding suggests that it is key that literacy programs consider the skills of using digital tools by the individuals to whom these programs are directed.

In chapter 12, Ribeiro, Madaleno, Botelho and Lobão analyze the determinants of financial and digital literacy. Their main result is that male individuals, with lower levels of risk aversion and with higher levels of education and income tend to present higher levels of financial literacy and digital financial literacy. In addition, older individuals tend to exhibit a lower level of digital financial literacy. These results are potentially useful for promoters of financial literacy and digital literacy programs.

In summary, we believe that the chapters of this book present a rich and updated view of the paths taken by Behavioral Finance in the last decades. It is likely that the tendency of cross-disciplinary integration that we have been witnessing will continue as scientific disciplines other than psychology,

such as sociology or neuroscience, can help to understand how financial decisions are made. The body of work included in this book can be a stimulus for further investigation in that direction.

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PART I:

FINANCIAL DECISION-MAKING

CHAPTER 2

RATIONALITY IN THE FIELD: EVIDENCE FROM A TV SHOW

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Abstract

We test the rationality of choices made by the contestants in the Portuguese version of the TV show "The Price is Right". Using data of 327 bidding contests that took place in the episodes aired between August 1990 and April 2015, we document that in general players used the informational advantage provided by sequential nature of the game to their profit. However, the last player is shown to depart significantly from the optimal strategy. Overall, our results suggest that the rules of axiomatic rationality are not a suitable starting point for a descriptive theory of how individuals decide.

Key-words: rationality, TV show, learning, Portugal

1. Introduction

Although choices under risk are fundamental in every branch of finance, empirical testing of the theories of rational choice has proven to be difficult. Given the criticism against experimental studies (e.g., Rabin, 2006), the rationality of choice of such different agents as professional athletes (Pope and Schweitzer, 2011), casino players (Croson and Sundali, 2006) and online bettors (Lobão and Rolla, 2015) has been assessed in their natural environment. In addition, TV game shows have proved to be a great laboratory to study economic decision-making as the rules of the games are

better defined than in real life and the stakes are usually much more substantial than those in experimental studies. Consequently, researchers have analyzed the behaviour of contestants in TV game shows, for example "Cash Cab" (Bliss *et al*., 2012), "Come Dine with Me" (Schüller *et al*., 2014), "Deal or No Deal" (Blavatskyy and Pogrebna, 2010; Baltussen *et al*., 2016), "Divided" (van Dolder *et al*., 2015), "Friend or Foe?" (Oberholzer-Gee et al., 2010), "Jeoparty" (Jetter and Walker, 2017) and "The Price is Right" (Bennett and Hickman, 1993; Berk *et al*., 1996; Tenorio and Cason, 2002; Lobão, 2020).

This chapter adds to this literature. The bidding game contest, which occurred on the Portuguese version of the TV show "The Price is Right", is the focus of our study. In each auction, four contestants sequentially guess the retail price of an item worth about 50 euros. The bidder whose guess is closest to the retail price without exceeding it wins the prize and plays in subsequent games for more expensive prizes.

In this chapter we explore the ability of individuals to adopt the optimal strategy in the bidding game. Our results indicate that, in general, players take advantage of the sequential nature of the bidding game. However, there are significant departures from optimal behaviour since the fourth player only bids optimally in less than 27% of the rounds.

The remainder of this chapter develops as follows. In section 2, we describe the game show in greater detail. Section 3 describes the optimal strategy to be adopted by the participants of the bidding game and, in particular, by the fourth bidder. Section 4 presents the sample considered in the empirical study. In section 5 we discuss our empirical findings. Section 6 concludes the chapter.

2. Description of the game

RTP, the Portuguese public broadcasting television, has been airing "The Price is Right" for more than three decades now. The show lasts 50 minutes and includes a bidding game. The rules of this bidding game are simple. At the start of each episode, four audience members are called from the audience to come down and compete in the bidding game. The contestants are then presented with a commercially-sold item on display, accompanied by a short description. The four players participate in a sequential auction, from left to right on the screen in the first round, on the retail price of the item so that the guesses of the previous bidders are known at the time each contestant makes his decision. A bidder must round his bid to the nearest

euro and cannot submit the same bid as a previous contestant. Verbal advice from the audience is allowed. The winner of the auction, who bids closest to the actual retail price without going over, gains the item and the opportunity to play for more valuable prizes later in the program. If all four bids exceed the actual price, the game is replayed in the same bidding order. If a bidder bids the exact price, a 50 euros bonus is awarded to the winner. The winner, who leaves the bidding podium to compete individually in other games, does not make any payment in exchange for receiving the item. After each bidding game, a new contestant is selected from the audience to replace the previous winner in the contestants' row. A new prize is revealed and bidding proceeds with the new contestant bidding first with the sequence continuing left to right. Thus, unless the first bidder wins, the bidding order changes in the next auction. Overall, the sequential bid auction occurs three times over the course of a show. It is possible, therefore, that one or more players participate in all three games without ever winning.

3. The optimal strategy

Given the sequential nature of the auction, the fourth bidder has two important advantages over her competitors. First, the fourth bidder can learn the values of her opponents' bids and then adjust the estimated value based on this information. Second, the fourth bidder has the opportunity to maximize her probability of winning by placing a cut-off bid, that is, bidding exactly one euro above a competitor. Since this strategy effectively slashes that competitor's probability of winning to zero (unless that bidder has guessed the exact value of the item), the ability to submit a cut-off bid is a strategic advantage of bidding last. In his analysis of the game, Berk *et al*. (1996) show the fourth contestant should always bid either one euro, the lowest existing bid plus one euro (L+1), the middle existing bid plus one euro (M+1), or the highest existing bid plus one euro (H+1). Furthermore, Berk *et al*. (1996) conclude that when players follow a rational strategy (i) the fourth bidder must win at least as often as the third bidder and the third bidder must win at least as often as either the first or second bidders, (ii) the first and second bidders together cannot win more than 4/9 of the time, (iii) the fourth bidder should win at least 1/3 of the time, , and (iv) that players should bid in descending order at least 1/8 (= 12.5%) of the time.

4. The sample

One hundred and thirteen shows of the Portuguese version of "The Price is Right", aired between August 1990 and April 2015, were viewed and the

results were manually transcribed. The bids, the order of the bids, the retail value of the prize and the gender of each bidder were recorded. The ordering of rounds within each show was also preserved and the rounds (in number of 9) in which all the bids exceeded the price of the prize were excluded from the sample (since there were no winners). In all, the dataset included 327 bidding contests and a total of 1,308 bids.

The statistical description of the retail prices of the prizes under dispute are presented in table 1.

Table 1 – Retail prices of the prizes under dispute in the bidding game (in euros)

Mean	Median	Maximum	Minimum	Stand. deviation
51.23	45.00	99.00	21.00	21.44

The retail prices varied from 21 euros to 99 euros being the average retail price of 51.23 euros.

5. Empirical results

5.1. Bidding rounds

We begin by examining the winning percentage of each of the bidders in table 2.

Table 2 – Winning percentage and overbidding according to the bidding order

Contestant	No. of wins	Winning percentage	Percent of bids that exceed the actual retail price	Average bid (in euros)
1	67	20.49%	19.57%	39.03
2	73	22.32%	25.08%	41.64
3	89	27.22%	19.88%	40.92
4	98	29.97%	23.55%	41.20

Table 2 shows that the bidding order seems to be relevant to the probability of winning the bidding game. The first bidder won less often than the second bidder, the second bidder won less often than the third bidder and the fourth bidder won the most often. This confirms the proposition (i) presented above and suggests that each bidder use the informational advantage of learning the values of her opponents' bids to adjust the estimated value based on this information. A Chi-square test rejects the hypothesis that the winning percentage is the same across the four bidders at better than the 10% level (p-value=0.05831).

The first and second bidders won together 42.81% of the rounds, that is, they won less than 4/9 (about 44.44%) of the rounds thus confirming the proposition (ii) stated above.

Regarding proposition (iii), Table 2 shows that the fourth bidder won slightly less than 1/3 of the rounds (29.97%). There were no significant differences in the average bid presented by each of the four bidders. Overall, considering the results presented here we cannot reject the hypothesis that the contestants had rational expectations. Regarding the results presented by Berk *et al.* (1996) in the US, there is only one difference that should be mentioned. Contrary to what happened in Portugal, the fourth bidder in the US game won the bidding contest in more than 1/3 of the rounds (39.5%).

Proposition (iv) predicts that if contestants bid rationally, the first bid should be highest and the rest should follow in descending order. Table 3 shows the bidding-order frequency observed in our sample.

Table 3 shows that the strictly descending order (1234) was observed only in 3.06% of the rounds. The most prevalent pattern is the strictly ascending order (4321) which was observed in about 11% of the auctions. The hypothesis that the bidding orders occur equally often is strongly rejected by a Chi-square test at better than the 1% level. Therefore, the proposition (iv) is rejected. These results mirror the evidence collected in the US by Berk *et al.* (1996).

Although the results in table 2 are consistent with the presence of rational expectations in the participants of the bidding game, the results in table 3 indicate that the players do not typically follow the optimal strategy. The apparent conflict between these two sets of results suggests that it is important to understand the features of the strategy adopted by the players, and in particular by the fourth bidder.

Table 3 - Bidding-order frequency

Bidding order (descending)	Frequency
1234	3.06%
1243	3.36%
1324	2.75%
1342	2.45%
1423	3.06%
1432	2.45%
2134	3.98%
2143	5.50%
2314	3.98%
2341	2.75%
2413	3.36%
2431	6.73%
3124	2.45%
3142	3.06%
3214	5.50%
3241	4.59%
3412	3.67%
3421	4.59%
4123	3.98%
4132	4.28%
4213	4.28%
4231	3.67%
4312	5.50%
4321	11.01%

5.2. The strategy of the fourth bidder

As mentioned before, the fourth contestant should always bid either one euro, the lowest existing bid plus one euro (L+1), the middle existing bid plus one euro (M+1), or the highest existing bid plus one euro (H+1). Table 4 presents data regarding the behaviour of the fourth bidder.

Table 4 – Strategies adopted by the fourth bidder

	No. of observations	Percentage of total	Winning percentage
Optimal strategy	88	26.91%	50.00%
Sub-optimal strategy	239	73.09%	22.59%

In our sample there were only 88 bids (26.91% of the total bids) of the fourth bidder that were consistent with an optimal strategy. Of these, in half of the cases the fourth bidder won the round. However, about three quarters of the bids (73.09%) depart from the optimal strategy. In this case, the percentage of rounds won was substantially lower (only 22.59%). Since the first group of bidders performed significantly better (z stat=4.79; $p<0.01$), it is surprising that only 26.91% of the fourth bidders adopted the optimal strategy. In two different US samples, Bennett and Hickman (1993) and Berk *et al*. (1996) show that the fourth bidder adopts optimal strategies 45.39% and 43.52% of the time, respectively. Thus, in our sample the frequency of the optimal strategy is even lower.

Table 5 shows the three types of optimal strategies and their rate of success.

Table 5 – Optimal strategies adopted by the fourth bidder

	No. of observations	Percentage of optimal bids	Winning percentage
1 euro	0	0.00%	-
L+1	21	23.86%	23.81%
M+1	25	28.41%	32.00%
H+1	42	47.73%	73.81%

H+1, that is, the strategy of bidding the highest existing bid plus one euro is the most frequent of the optimal strategies (representing 47.73% of the total of optimal bids) and is also the strategy that performs best since it won 73.81% of the rounds where it was used.

The high rate of success of the H+1 strategy suggests that the first three bidders present a systematic downward bias when estimating the price of the prize. To test this hypothesis, we compare the average bid of the first three bidders with the actual retail price. Table 6 presents the results.

Table 6 – The average of the three first bids and the price of the prize

	No. of observations	Percentage of total
Average bid > retail price	75	22.94%
Average bid < retail price	247	75.54%
Average bid = retail price	5	1.53%

Table 6 shows that in 75.54% of the rounds, the first three bidders presented a systematic downward bias when estimating the price of the item. Only in 22.94% of the auctions the average of the first three bids exceeded the price of the item. The difference in these frequencies is statistically significant at the 1% level. This means that for the fourth bidder it would be advantageous to adopt the simple strategy of bidding one euro above the highest existing bid. In fact, when we compare the overall rate of success of the fourth bidder (29.95% in table 2) with the rate of success that the fourth bidders would have obtained had they adopted a H+1 strategy in all the rounds (44.95%), we conclude that the two proportions are significantly different (z stat=3.96; $p<0.01$). This indicates that the H+1 strategy outperforms the observed choices of the fourth bidders. These results are in line with those presented by Bennett and Hickman (1993) and Berk *et al*. (1996) for US samples.

Bennett and Hickman (1993) suggest that the fourth bidder can adopt a second-best strategy in alternative to the H+1 strategy. Given the advantage held by the fourth bidder in a sequential game, a second-best outcome of the fourth bidder is to avoid cutting-off the first bidder. In fact, if the first bidder wins, the fourth bidder will keep his advantageous position as we will repeat as the fourth bidder in the following round. Thus, one should expect first bidders to be cut-off less often than either the second and third bidders (unless of course the first bidder was the one that made the highest bid). In our sample, first bidders were cut-off twelve times in which the fourth contestant was not following the H+1 strategy. In similar circumstances, second and third bidders were cut-off fourteen and twenty times, respectively. Thus, following the hypothesis suggested by Bennett and Hickman (1993), it seemed that fourth bidders were not as likely to cut-off the first bidder as either of the other two contestants.

5.3. Learning

In order to assess whether the fourth bidder learns in the show as each day's rounds proceed, we refer to a logit regression in which we regress the optimal bids (bidding L+1, M+1 or H+1) to round numbers and some

control variables. The dependent variable is defined as a binary variable equal to one if the fourth bid was either L+1, M+1 or H+1, and equal to zero otherwise. ROUND is the round number of the respective show that day and that varies in our sample from 1 to 4, since there were four bidding rounds in the days where all the contestants overbid. Our control variables are GENDER, which is the gender of the fourth bidder (1 for male and 0 for female) and PRIZE, which is the retail price of the item under dispute. The control variables take into account the possibility that the behaviour of the fourth bidder may vary depending on its gender and on the price of the prize.

Table 7 shows the estimated coefficients in the logit regressions.

Table 7 – Logit regressions regarding the learning hypothesis

Const.	ROUND	GENDER	PRIZE	Adj. R-square
-0.728** (0.018)	−0.135 (0.345)	-	-	-0.008
−0.971*** (0.004)	−0.153 (0.287)	0.468* (0.070)	-	-0.004
−0.757 (0.104)	−0.161 (0.266)	0.471* (0.069)	−0.003 (0.507)	-0.008

Notes: The dependent variable is defined as a binary variable that equals unity if the fourth bid was either L+1, M+1 or H+1, and equals zero otherwise. ROUND is the round number of the respective show that day; GENDER stands for the gender of the fourth bidder and equals unity if the fourth bidder is male and zero if the fourth bidder is a female; PRIZE represents the retail price of the item under dispute in euros. Robust p-values in parenthesis. *, ** and *** represent significance at the 10%, 5% and 1% levels respectively.

The results do not confirm the hypothesis that fourth bidders learn to cut-off other contestants as the show proceeds. In fact, the sign of the coefficient on ROUND is always negative but the coefficients are not statistically significant at the conventional levels. This result goes against the findings of Bennett and Hickman (1993), Berk *et al*. (1996), Tenorio and Cason (2002) and Healy and Noussair (2004) that conclude that more experienced players tend to behave more in line with what would be optimal than inexperienced individuals. The coefficient of GENDER is positive and statistically significant at the 0.1 level, which means that male players are more likely to cut-off previous bidders. The retail price of the prize does not seem to be relevant in the decision to adopt an optimal behaviour, thus corroborating the result obtained by Tenorio and Cason (2002).

The higher propensity of men to adopt aggressive behaviours in the bidding game (cutting-off other contestants) is consistent with the evidence that suggests that men are less risk averse in the context of decisions with financial implications, including betting decisions. For example, Bruce and Johnson (1994) find greater risk propensity amongst male bettors and higher levels of bettor confidence in their choices. Lower risk-taking by women was also found in financial markets (Barber and Odean, 2001) and corporate finance (Faccio *et al.*, 2016). The difference in behaviour between the two genders may be due to the style of information processing, as suggested by Graham *et al*. (2002).

The outcome of adopting aggressive behaviours seems to depend on the context in which the decision takes place. In our research and in other studies related to betting decisions (e.g., Bruce and Johnson, 1994), the adoption of more aggressive behaviour favors male decision-makers who thus tend to perform better. However, in the context of financial markets and corporate finance, the higher risk aversion of women has been found to make them to perform significantly better than men (Barber and Odean, 2001; Faccio et al., 2016).

6. Conclusion

The basic tenet of traditional finance is rational behaviour which means that an individual is assumed to be always rational in decision-making, acting within his own self-interest. People are expected to maximize their expected utility. In this chapter, we tested these assumptions recurring to the decisions of subjects in the bidding game of the Portuguese version of the TV game show "The Price is Right".

Our evidence shows that, in general, players take advantage of the sequential nature of the bidding game. Bidders seem to adjust their estimates considering the information provided by the contestants that bided previously. This informational advantage leads the first bidder to win less often than the second bidder, the second bidder to win less often than the third bidder and the fourth bidder to win most of the time. However, there are significant departures from optimal behaviour and the strategic advantage of the fourth player does not seem to be well understood. In fact, the fourth bidder only bids optimally in about 27% of the rounds. Had the fourth bidder played optimally he would have won about 45% of the time instead of 30% of the time as it was observed in our sample. Moreover, there seems not be any significant learning effects and men were found to adopt optimal strategies more often than women.

Tverky and Kahneman (1979, 1986) have shown that subjects in many cases violate the tenets of rationality. Our results illustrate a deviation from those rules and suggest that the rules of axiomatic rationality are not a suitable starting point for a descriptive theory of how individuals decide.

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CHAPTER 3

HEDGING AGAINST EMBARRASSMENT

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Abstract

This chapter assesses the extent to which the expected disclosure to peers of an individual investor's financial performance influences his/her stock-trading decisions. In a lab experiment, participants trade in incentivized stock market simulations, knowing that their financial performance will be either made public or kept private. The results show a significant increase in the disposition effect when financial performance is to be made public, resulting from a spike in the realization of gains. We conclude by suggesting that this phenomenon may be due to individuals' strategic attempt to hedge against the embarrassment of ending the trading session at the bottom of the performance ranking.

Key-words: Disposition effect; Behavioral finance; Lab experiments; Self-conscious emotions.

1. Introduction

In a Wall Street asset management company, a regular meeting is conducted in order to evaluate the financial performance of its various fund managers. During the meeting, managers who had the worst performance over the past months are asked to come forward and explain to colleagues and to senior managers why they failed to achieve a good performance. An experienced fund manager, John, is concerned about being among the worst performers, which will force him to come forward in the next meeting. To minimize the risk of this unpleasant experience, John wonders about adopting an investment strategy that could avoid putting him in the bottom group.

The previous scenario illustrates the potential influence of social comparisons and, in particular, the role played by the disclosure of an individual investor's financial performance in determining investment decisions. Recent evidence suggests that, in fact, social comparisons play a major role in the way individuals make investment decisions (Linde and Sonnemans 2012). In the previously described "fund manager" example, two questions arise: if John knows that his performance will be revealed to his peers at a later point in time, will he behave differently in the trading sessions relative to a scenario in which his performance is expected to remain private? If so, how would the expected disclosure of his performance impact his investment decisions?

In this chapter we assess a yet unexplored route in the field: *whether*, and if so, *how* the expected disclosure to peers (vs. privacy) of individual investors' financial performance influences one of the most prevalent anomalies in behavioral finance, the disposition effect—that is, investors' higher propensity to sell the stocks that have increased (vs. decreased) in value relative to the purchase price (Odean 1998, Shefrin and Statman 1985, Weber and Camerer 1998).

The expected disclosure of investment outcomes can be of relevance to both individual and professional investors. Professional traders and asset managers, for example, have their respective performances made public in various setting, such as bonus payments and the disclosure of managed-funds' performance. In fact, internal public disclosure of employees' performances is often used for the incentive purposes (Endlich, 2000; Derman, 2004). In his biography, *My Life as a Quant*, the famous physicist and later financial expert Emanuel Derman describes how annual bonus payment used to work during his time as an employee at the

investment bank Goldman Sachs. At that time, the payroll system was unable to cut a check for more than $100,000 US dollars. If an employee's year-end bonus was, for example, $1,000,000, then he would receive ten checks, each one sealed in its own envelope, with the whole bundle neatly stacked and secured by a rubber band. "Thus, although bonus amounts were private, and you were encouraged to keep them that way, you could guess the order of magnitude of someone's bonus by the thickness of their deck of checks. Even a mini-bundle of two checks was instantaneously distinguishable from one. Some traders received a fat stack and some of them flaunted it. One well-paid young trader had a habit of taking his bundle and silently riffling through it, meticulously counting the envelopes one at a time in full view of his colleagues." (Derman, 2004 p. 185).

To test whether and how the expected disclosure to peers (vs. privacy) of individual investors' financial performance influences the disposition effect (hereafter DE), we conducted a lab experiment in which undergraduate students participated in a simulated trading session. Participants were either told that their performance in the simulation would be made public (vs. kept private). They then played the simulation, revealed, or did not, their performances to others, and were paid according to their final earnings. The findings show that participants made different financial decisions in the stock market simulation when they expected their performance to be made public compared to the situation in which they expected their performance to be kept private. Precisely, the disposition effect increased significantly in the public condition, primarily driven by an increase in people's propensity to sell stocks that had increased in value relative to the purchase price.

Although we do not provide direct evidence for the underlying process, we speculate that the spike in the realization of gains observed in the public condition may at least in part result from people's attempt to avoid the embarrassment of finishing the trading session at the bottom of the performance ranking. That is, investors derive explicit disutility from ending in the bottom group when having to disclosure his or her financial performance to peers, which contrasts to the notion of a rational investor who only derives utility over final wealth. Our evidence suggests that the spike in the realization of gains is the channel through which this process occurs. Put simply, selling gains may be seen as a good/safe strategy for someone who wants to avoid the bottom investors' performance rank.

The rest of the chapter is organized as follows. In Section 2, we discuss the related research. In Section 3, we detail the lab experiment whereas in