

Manager's Irrational Behavior in Corporate Capital Investment Decision-Making¹ Xijuan Shao, ² Lixin Wang
^{1, 2} South China University of Technology**ABSTRACT**

The purpose of this paper is to explore manager's irrational behavior and reasons for it in corporate capital investment decision-making. The authors present the approach to discovering manager's irrational behavior in corporate capital investment decision-making; classify the irrational behavior by the steps in decision-making; propose hypotheses on reasons for each irrational behavior; conduct empirical test through hypothesis testing and questionnaires; summarize the real reasons for each irrational behavior according to the empirical results.

Findings- When estimating cash flow, managers will use heuristics for lack of clear frame of mind. Therefore, cognitive bias and psychological factors take place in heuristics. The main reason causing irrational behavior in the determination of discounted rate is the deficiency in financial literacy. Since most managers are confused with the concept of cost of capital, method of risk management and models of discounted rate, cognitive bias and psychological factors function in this step. When selecting indicators, managers present irrational behavior because of psychological factors but cognitive bias.

Keywords: *Manager's Irrational Behavior; Corporate Capital Investment Decision-making; Behavioral decision-making*

1. INTRODUCTION

Under condition of incomplete information, the majority of corporate capital investment decision-making is uncertain. When people make decision under uncertainty, their behavior is always irrational systematically, caused by psychological factors such as cognitive bias, sentiment or emotion (Camerer 2004 and Kahneman 1979). The irrational behavior of managers will lead to serious decision-making errors and do harm to corporate value. Shefrin (2001) defines "Behavioral Costs" as the negative correlation between irrational behavior and corporate value. Behavioral Costs are much more impactful, concealed and uncontrollable than Agency Cost, because managers are not aware of their irrational behavior. Actually, they believe they are doing the "right" things (Shefrin 2007). Therefore, it is necessary to bring managers' behavior into decision-making system to prevent their irrational behavior. Before this, we should explore the specific irrational behavior and reasons for it in the process of corporate capital investment decision-making.

Although an increasing amount of research has been devoted to irrational behavior in corporate capital investment decision-making (Shefrin 2001, Malmendier 2001, Heaton 2002, Gervais 2002), most focus has been placed on summarizing the performance of psychological phenomenon, or on analyzing the relationship between decision-making results and merely one of the behavior factors like over-confidence, confirmation bias or anchoring effect. Research on the estimation of cash flow, risk analysis, the estimation of cost of capital and selection of decision indicator, which are key steps in capital investment, is relatively scant. Meanwhile, to avoid the incompleteness, all kinds of behavioral factors should be taken into consideration. This is because the interaction of various behavioral factors leads to the appearance of

certain behavior. Thus, the need for the following research is expected to be growing: along the steps of corporate capital investment decision, we should list each specific irrational behavior, conduct in-depth explanation and experiment by the methodology of Behavioral Decision. The good news is that we can know more about reality and theory from the following two aspects.

In the United States, people conduct a large-scale survey and intensive interview to understand corporate behavior in investment decision-making every four years (Graham, 2001). Similar studies are carried out in succession in some European countries (Niels, 2006). Studies above focuses on revealing the procedure, methodology, motivation and factors in investment decision-making, instead of manager's irrational behavior. Nevertheless, we can use the questionnaire method in those studies for reference.

In addition, since Kahneman, the master in Behavioral Decision Science, won Nobel Prize in economics, Behavioral Decision Theory has received attention and become widely used. Kahneman, Slovic and Tversky (1982) study three kinds of Heuristic Bias, which are due to thinking short cuts. Hsee (1996) explores the Evaluability Hypothesis to explain preference reversals between Joint and Separate Evaluations of Alternatives. Babcock and Loewenstein (1997) analyze how Self-Serving Biases neglects the information which doesn't support the current view. Kahneman and Tversky (1984) investigate Prospect Theory. Classified by the sources and application of funds, Mental Accounting is put forward by Thaler (1999). The literatures above offer us theoretical basis to dissect the causes of irrational behavior.

The remainder of this paper is organized as follows. The following section outlines the discovery and classification of manager's irrational behavior. The third section presents hypotheses on the reasons why irrational behavior happens. The fourth section presents the data.

The empirical findings and their implications for financial practices are discussed in the fifth section. The final section concludes.

2. DISCOVERY AND CLASSIFICATION OF MANAGER'S IRRATIONAL BEHAVIOR

In this paper, Manager's Irrational Behavior, definition of which is the same as that in behavioral corporate finance theory, is defined as managerial behavior that is less than fully rational, or managerial behavior that doesn't meet the definition in rational decision theory (Baker et al., 2004). Namely, Irrational Behavior is the behavior excluding that of completely rational people. Irrational Behavior not only includes limited rational behavior, but also emphasizes on systematic mistakes rising from cognitive bias and psychological factors under uncertainty in intuitive decision-making.

Our approach to discovering irrational behavior in managers is as followed. Firstly, we had more than 50 classes with CFOs and senior managers. We had recess interviews and kept in touch with them after classes by

phone and E-mail. Secondly, we participated in MBA's and EMBA's case study in their courses like Financial Management or Financial Decision. Thirdly, we gave full guidance to MBA, EMBA, or Master of Engineering throughout their dissertation, topics of which came from financial practices. Fourthly, we took part in appraisal meeting on investment projects held by Guangdong Provincial Economic and Trade Commission or Department of Finance of Guangdong Province in China every year. We acquired large amount of significant information from those meetings. Fifthly, we provided advices for companies in their capital investment decision-making. This was an opportunity for us to join in corporate capital investment decision-making directly.

Based on the practices above and literature reviews, we summarized 12 kinds of irrational behavior. According to steps in capital investment decision-making, including estimation of cash flow, determination of discount rate and selection of decision indicator, irrational behavior is divided into three categories. Table 1 displays the three categories and the approach to discovering them.

Table 1: Manager's Irrational Behavior in Corporate Capital Investment Decision-making

Ways to discover					
Category	Communications with students	Analysis Reports	Case study in MBA	Consulting	Literature Review
Step 1: Estimation of cash flow					
Regard interest as incremental cash flow	√	√	√	√	0
Take no account of working capital	0	√	√	√	0
Take no account of opportunity cost	√	√	√	√	0
Ignore the specific impact of competition on cash flow	0	√	√	√	0
Overestimate sales	√	0	0	√	√
Underestimate cost	√	0	0	√	√
Take account of sunk cost	√	√	√	√	√
Step 2: Determination of cost of capital					
Determine cost of capital based on all risks	√	√	√	√	0
One size fits all	√	√	0	√	√
Determine cost of capital based on financing	√	√	√	√	0
Step 3: Selection of decision indicator					
Use static payback period	√	√	0	√	0

Use profit-based indicators	√	√	√	√	√
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Table 1 outlines the manager's irrational behavior in corporate capital investment decision-making and the ways to discover them. In table 1, √ represents higher frequencies and O represents that the specific phenomenon has not been found out or verified. The interviewees are mainly CFOs and senior managers. Analysis Reports consist of dissertation of on-job postgraduates, applications for investment projects, feasibility report and business plan. Literature Reviews refer to research papers on Behavioral Corporate Finance, excluding survey report.

In table 1, O represents that the phenomenon has not been found out or verified with adequate information. We would like to make some explanation on it. When communicating with students, we didn't discover that they took no account of working capital and that ignored the specific impact of competition on cash flow. This is probably because it is only presented in predicting Statement of Cash Flows in analysis report, rather than oral communication. To our best knowledge, only when a project is finished can people know whether sale has been overestimated or cost has been underestimated. Due to the limitations of time and tracking, we are unable to determine whether this behavior happened from merely analysis report or case study. During case study discussion, the tendency to one size fits all didn't exist for the reason that each group studied just one case. In the last column, O means that in-depth research has not been found out in the field of Behavioral Corporate Finance. Taking the behavior using static payback period for example, we discovered that the description is not intensive enough: "More than 50% of CFOs made use of static payback period (Graham, 2001)".

3. HYPOTHESIS ON REASONS

As a preliminary step to find out the real reasons for irrational behavior in corporate capital investment decision-making by the method of hypothesis testing, we need to pose hypotheses for the 12 kinds of irrational

behavior. Hypotheses are based on interviews and behavioral decision theory.

3.1 Regard Interest as Incremental Cash Flow in The Calculation of NPV

According to modern financial decision theory, we cannot take cash flow from financing like interest payments as incremental cash flow when we are calculating the NPV of a project. In practice, people always go against the principle. Those people claim that interest payments appear once they determine to invest in the project and to borrow money from outsiders. In the contrast, they save interest charges when they had no interested in the project or no need to be in debt. In light of it, they believe that interest payments are incremental cash flow.

Obviously, the root cause of the mistakes those people make is that they confuse "project-company system" with "bank-company system". This is a phenomenon rising from "Representative Bias". Actually, "incremental" belongs to the project instead of the company. Interviewees present this irrational behavior due to their wrong guideline resulting from Representative Bias. Thus, we posed Hypothesis 1.2 and Hypothesis 1.3 to explain

the irrational behavior. Meanwhile, we proposed Hypothesis 1.1 to test whether lack of financial literacy is one of the reasons for the behavior. Specific content is listed in Table 2.

Table 2: Hypotheses on reasons for the irrational behavior

Category	Hypotheses on reasons
Step 1: Estimation of cash flow	
1. Regard interest as incremental cash flow	1.1: Lack of financial literacy
	1.2: Unfamiliar with the guideline of evaluation of investment projects
	1.3: Depend on intuition and surface-observation
2. Take no account of working capital	2.1 : Carelessness
	2.2: Don't take working capital as incremental cash flow because it is not period cost.
	2.3: Don't take working capital as incremental cash flow because cash doesn't totally outflow.
	2.4: Unfamiliar with the relationship between growth of business and changes in working capital
	2.5: Unfamiliar with the relationship between cash flow

	and changes in working capital
3. Take no account of opportunity cost	3.1: Unknown about opportunity cost
	3.2: Lack of financial literacy
	3.3: Availability Bias
	3.4: Believe that opportunity cost is latent earnings but real cash flow.
4. Ignore the specific impact of competition on cash flow	4.1: Hard to acquire information of competitors
	4.2: Relatively difficult to describe and calculate the relationship between competitors and manager's company
	4.3: Take no account of competitor's threat
	4.4: Think of threat into consideration but ignore its influence
	4.5: Representative Bias
5. Overestimate sales	5.1: Over-optimistic about market
	5.2: Over-confident about products or ability
	5.3: Confirmation Bias
6. Underestimate cost	6.1: Over-confident about the ability of cost control, purchase or negotiation
	6.2: Confirmation Bias
	6.3: Availability Bias
7. Take account of sunk cost	7.1: Framing Effect and Loss Aversion
	7.2: Endowment Effect
	7.3: Anchoring effect
	7.4: Confirmation Bias
	7.5: Over-confidence
<u>Step 2: Determination of cost of capital</u>	
8. Determine cost of capital based on all risks	8.1: Unknown about the relationship between Systematic Risk and required rate of return
	8.2: Intuitively believe that Nonsystematic Risk also requires return
	8.3: Hard to distinguish Systematic Risk and Nonsystematic Risk
	8.4: Easy to perceive all risks
9. One size fits all	9.1: Believe that the discount rate should be the cost of capital of company because the project is invested in by company
	9.2: Conformity
	9.3: Easy to use regardless of its inaccuracy
	9.4: Ambiguity Aversion
10. Determine cost of capital based on financing	10.1: Representative Bias
	10.2: Framing Effect
	10.3: Availability Bias
<u>Step 3: Selection of decision indicator</u>	
11. Use static payback period	11.1: Calculation isn't the key to the behavior
	11.2: Unknown about Discounted Payback Period
	11.3: Framing Effect and Loss Aversion
	11.4: Mental Accounting
	11.5: Ambiguity Aversion
12. Use profit-based indicators	12.1: Prefer simple conceptions although they are vague
	12.2: Cater to shareholders

Table 2 presents the hypotheses on reasons for the irrational behavior in corporate capital decision-making. Hypotheses are based on interviews and behavioral decision theory.

3.2 Take No Account of Working Capital

Working capital is long-term fund, which guarantees that a company has the ability to continue its operations. The majority of projects need to increase working capital at the beginning of a project or when sales are on the rise and management efficiency remains at the same time. Modern financial management theory underlines that working capital cannot be forgotten. However, when reading analysis reports including applications for investment projects, feasibility report and

business plan, we found that people often overestimated cash flow and value without regard to working capital. According to interviews and accounting knowledge, Hypotheses 2.1-2.5 are put forward.

3.3 Take No Account of Opportunity Cost

There exist four causes resulting in this irrational behavior. To begin with, managers don't understand the concept of "opportunity cost". Secondly, they know about the word but are unaware of it in the estimation of cash flow. This is probably because they are lack of financial literacy. In addition, even if they are skilled in finance and accounting, they left out opportunity cost because it refers to cash inflow when projects are rejected. Due to "Availability Bias", most people take cash flow into consideration when projects are accepted rather than rejected. Finally, unlike cost in accounting, opportunity cost belongs to economics, making managers believe that it isn't real cash flow, let alone incremental cash flow. In terms of the reasons above, we posed Hypotheses 3.1-3.4. In the interviews, we discovered that Hypothesis 3.3 and Hypothesis 3.4 were main causes. With the purpose of knowing about professional qualities of managers, we proposed Hypothesis 3.1 and Hypothesis 3.2.

3.4 Ignore the Specific Impact of Competition on Cash Flow

In practice, managers usually predict sales growth rates on the basis of industrial data once they are bullish on the industry. In fact, managers should realize that the good news of industry is also beneficial to their competitors in sales price, sales volume and cost, which eventually influence the estimation of cash flow in their projects. In the interviews, we found that most interviewees neglected competitor's influence and eventually overestimated cash flow of projects.

"The Illusion of Validity" contributes to the irrational behavior. The Illusion of Validity is a kind of cognition bias. In reality, managers make decisions mainly depending on familiar and accessible information, especially those intimately related, while they subjectively reduce the weight of unfamiliar information. In decision maker's opinion, it is easy to acquire the industrial information rather than those of competitors. Thus, they tend to estimate project's cash flow on the basis of industrial prospect. What's worse, there exists Representative Bias when managers believe that

promising industry symbolizes promising earning, projects or company.

The psychological factor leading to the ignorance of competition is "Ambiguity Aversion", which means that people are unwilling to make decision based on vague data. As we all know, it's much easier to make predictions of industry than of competitors. Even though we are able to forecast the future of competitors, the results are always not accurate enough, bringing managers about Ambiguity Aversion.

In light of two factors mentioned above, we built Hypothesis 4.1, 4.2 and 4.5 in Table 2. In order to test whether people take competitor's threat into consideration, we posed Hypothesis 4.3 and Hypothesis 4.4.

3.5 Overestimate Sales and Underestimate Costs

A common event happens that managers are inclined to overestimate sales and underestimate cost. Most studies attributed this to principal-agent problems. On the contrary, Shefrin (2007) discloses that behavioral biases give rise to this irrational behavior because managers presented it unintentionally. Based on literature reviews and investigation, we summarized three kinds of behavioral bias.

One of the behavioral biases refers to "Confirmation Bias". Managers often pay special attention to a project unconsciously once they tend to invest in it. At the same time, they elide other latent projects automatically.

People always take expenditure and risks thinkable into account, while they subjectively ignore unfamiliar or unknown information's weight. This is because they are presenting "Availability Bias".

Comparing to ordinary people, senior managers are easier to be overconfident or overoptimistic. Overconfident on their ability and intuition, managers usually overestimate investment income and probability of success but underestimate costs and risks (Shefrin, 2007).

Hence, to verify our suspect, we proposed Hypothesis 6.2 for Confirmation Bias, Hypothesis 6.3 for Availability Bias, Hypothesis 5.1, 5.2 and 6.1 for overconfidence and over-optimism.

3.6 Sunk Cost Fallacy

Substantial focus has been placed on explaining Sunk Cost Fallacy from the aspect of psychology (Garland et al.1991, Brockner 1992, Schaubroeck and Davis 1994, Arkes 1996). However, the literatures exploring it by behavioral decision theory in corporate capital investment decision-making is very thin. Considering Sunk Cost's confidentiality and universality, we found out reasons for Sunk Cost Fallacy according to cognition bias and psychological factors in the process of decision-making.

We put forward the Hypotheses 7.1-7.5.

3.7 Determine Cost of Capital Based on All Risks

Cost of capital is the rate of return required by investors, merely in relation to Systematic Risk of projects. Nevertheless, managers tend to determine their cost of capital based on all risks, including Systematic Risk and Nonsystematic Risk in practice. Consequently, the cost of capital they estimated is not accurate.

Total risk of an asset is measured by standard deviation of yield, which is easy to perceive. On contrary, β , which stands for Systematic Risk, is difficult to calculate. Therefore, due to "Availability Heuristic", the challenge to estimate Systematic Risk makes people pay more attention to Nonsystematic Risk than Systematic one (Shefrin, 2007). For example, managers often link risk with volatility in accounting profit, which shows Nonsystematic Risk. Besides, because of Representative Heuristic, people hold the point of view that company with high volatility in non-system must be company with high volatility as a whole and finally with high cost of capital. In light of the analysis above, we posed Hypotheses 8.1-8.4.

3.8 One Size Fits All

Modern finance theory presents that expected cash flow should be discounted by cost of capital based on Systematic Risk of projects. In fact, there exists the phenomenon that one size fits all among 59 percent of CFOs (Shefrin, 2007). They view Weighted Average Cost of Capital (WACC) as the discounted rate in each project. We summarized three causes resulting in the irrational behavior. First of all, conformity affects them. Meanwhile, we have to use Capital Asset Price Model (CAPM) or Three-Factor Model to calculate discounted rate once operational risk of projects is not the same as the one of company. Apparently, the calculation is an arduous work for most people. Thirdly, it is convenient for them use WACC because some companies calculate it regularly. Given all of three causes, we proposed Hypothesis 9.2, 9.3 and 9.4. In addition, we presented Hypothesis 9.1 to verify whether lack of financial literacy is one of the reasons for the behavior.

3.9 Determine Cost of Capital Based On Financing

In investment decision-making, cost of capital is the opportunity cost of capital, which depends on Systematic Risk but financing cost. In practice, people often confuse cost of capital with financing cost. This is because Representative Heuristic appears in the comprehension of cost of capital. For most part, financing cost is associated with corporation instead of projects. Only when the corporation consists of one project and the market is efficient without friction (no taxation or distribution fees) is financing cost equal to cost of capital in the project. Otherwise, financing cost has more relevant with the risk of corporation. In the meantime, as a result of "Availability Bias" and "Framing Effect", it is easier to

perceive the information on projects or latent financing methods than cost of capital or overdraft risk. We posed Hypothesis 10.1, 10.2 and 10.3.

3.10 Use Static Payback Period

Static Payback Period implies how long investor can recoup their principle, excluding opportunity cost of capital. Clearly, this is an inaccurate decision indicator, which underestimates the payback period. Shefrin's (2007) investigation indicates that 57% of CFOs take Static Payback Period as decision indicator. We made explanations on it basing on Mental Accounting Theory and Prospect Theory.

Both principle and opportunity cost of capital are cost for the project. The only difference between them is their origins: the former refers to the capital invested in reality while the latter comes from the gains when the project is rejected. People using Static Payback Period signifies that they hope to recoup their principle rather than cost of capital. Obviously, people's attitude on the two kinds of cost is so different that they deposit them into two mental accounting. In capital investment decision-making, they take whether principle can be recouped as a reference point, and the potential project is deemed to failure if the expected result is under the reference point. Otherwise, the project is supposed to make profits. Due to Loss Aversion, people are inclined to accept project over the reference point. They make decisions by using Static Payback Period, the wrong decision indicator.

In addition, when calculating operating profit, people regard principle as the cost of the project, ignoring cost of capital. Apparently, the project will have deficit once the principle cannot pay back. Managers can't put up with this worst situation. In contrast, when principle pays back, people are tolerable although the return doesn't meet their requirement. Hence, the wrong decision indicator, Static Payback Period is able to at least guarantee that each project breaks even. This irrational behavior suggests that people get used to "profit" rather than "value" in investment decision-making. According to the analysis above, we posed Hypothesis 11.1, 11.3 and 11.4. Meanwhile, "Ambiguity Aversion" and ignorance of Discounted Payback Period possibly lead to this irrational behavior. In light of the two latent factors, we proposed Hypothesis 11.5 and 11.2.

3.11 Use Profit-Based Indicators

The rise of profit cannot refer to the increase of corporate value, because profit-based indicators take no account of time value and cost of capital in equity. Meanwhile, they are usually affected by accounting policy. Using profit-based indicators always leads to acceptance of next-best or harmful project. In view of our investigation and interviews on the relationship between good project and high profit, we put forward Hypothesis 12.1 and Hypothesis 12.2.

3.12 Data

We made empirical tests to verify the hypotheses in Table 2. The data for this study are collected and analyzed by the questionnaires filled in by managers experienced in capital investment decision-making. The respondents consist of three kinds of people: (1) CFOs ;(2) students skilled in finance, majoring in finance or accounting and at present working for department of finance in corporations;(3) MBAs with more than 4 years working experience and having ever participated in capital investment decision-making.

In this study, in terms of section 2 and section 3, questions are divided into three categories in the questionnaire. Firstly, we hope that some reasons based on interviews and Behavioral Decision Theory will be recognized by respondents. Therefore, accepting hypothesis means the recognition of our opinion while denying hypothesis is negation on these questions. Secondly, some reasons rise from logical deduction. For instance, taking no consideration of working capital is possibly attributed to carelessness. Although we have found no evidence of it, it is a hypothesis indeed. Of course, whether the result is consistent with the hypothesis has nothing to do with our opinions, but we can learn more about the reality from the questionnaires. The third kind of question is just the opposite of the first one, such as hypothesis 4.3. We hope to be denied by the respondents in this question. Hence, rejecting hypothesis means the recognition of our opinion.

There are 46 questions in the questionnaires, eight of them belonging to the second category and the rest of them belonging to the first or third category. In order to

verify which irrational behavior is caused by lack for financial literacy, namely cognition bias like Ambiguity Bias and Representative Bias, we posed 6 hypotheses in Table 2.

We make use of Likert to represent and assign the answers score 1 to 5 to each question: completely disagree, disagree, neutrality, agree, and completely agree. After testing 15 questionnaires, we gave out 80 questionnaires to the respondents through E-mail and acquired 47 effective questionnaires in one week.

4. EMPIRICAL RESULTS

We use One-simple T-test to examine the 46 hypotheses in Table 2. The null hypothesis in T-test states that population mean is equal to 3, which indicates that respondents are neutral with regard to the specific reason. The alternative hypothesis states that population mean isn't 3, suggesting that respondents support or oppose the reasons. Confidence level is 95%.The empirical results are shown in Table 3(specific results in Table 4). According to Table 3 and Table 4, we found that in 41 hypotheses P-value is equal or less than 0.05, implying that most reasons are related to the irrational behavior in corporate capital investment decision-making. Furthermore, as shown in Table 4, population mean are larger than 3 in 38 hypotheses, so we concluded that people stand by the 38 reasons and that people disagree with the rest.

Based on the results in Table 3, we disclosed the reasons behind each irrational behavior.

Table 3: Empirical Results

Reasons	Hypotheses on reasons	Whether support the hypotheses	Whether gain recognition by us
Step 1: Estimation of cash flow			
1.Regard interest as incremental cash flow	1.1	No	—
	1.2	Yes	Yes
	1.3	Yes	Yes
2.Take no account of working capital	2.1	No	—
	2.2	Yes	Yes
	2.3	Yes	Yes
	2.4	No	No
	2.5	No	No
3.Take no account of opportunity cost	3.1	No	—
	3.2	Yes	—
	3.3	Yes	Yes
	3.4	Yes	Yes
4.Ignore the specific impact of competition on cash flow	4.1	Yes	Yes
	4.2	Yes	Yes
	4.3	No	—
	4.4	No	—
	4.5	Yes	Yes
5.Overestimate sales	5.1	Yes	Yes

	5.2	Yes	Yes
	5.3	Yes	Yes
6.Underestimate cost	6.1	Yes	Yes
	6.2	Yes	Yes
	6.3	Yes	Yes
7.Take account of sunk cost	7.1	Yes	Yes
	7.2	Yes	Yes
	7.3	Yes	Yes
	7.4	Yes	Yes
	7.5	Yes	Yes
<u>Step 2: Determination of cost of capital</u>			
8.Determine cost of capital based on all risks	8.1	Yes	Yes
	8.2	Yes	Yes
	8.3	Yes	Yes
	8.4	Yes	Yes
9.One size fits all	9.1	Yes	—
	9.2	Yes	Yes
	9.3	Yes	Yes
	9.4	Yes	Yes
10.Determine cost of capital based on financing	10.1	Yes	Yes
	10.2	Yes	Yes
	10.3	Yes	Yes
<u>Step 3: Selection of decision indicator</u>			
11.Use static payback period	11.1	Yes	Yes
	11.2	No	Yes
	11.3	Yes	Yes
	11.4	Yes	Yes
	11.5	Yes	Yes
12.Use profit-based indicators	12.1	Yes	Yes
	12.2	Yes	Yes

Table 3 presents the empirical results on each hypothesis. As illustrated in previous section, not all the hypotheses are recognized by us, with the purpose of learning more from reality or denying the specific hypothesis. Therefore, whether the hypotheses gain recognition by us is shown in column 4. - in column 4 means that the hypothesis is to learn more from the reality, and it is nothing to do with our opinion. Among the 38 hypotheses recognized by us, 36 of them are significantly stood by respondents.

Table 4: Specific statistical result

Hypothesis	t	df	Sig. 2-tailed	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
1.1	1.14	46	0.26	0.23	-0.2	0.65
1.2	3.88	46	0	0.66	0.32	1
1.3	6.79	46	0	1.02	0.72	1.32
2.1	1.2	46	0.24	0.21	-0.1	0.57
2.2	2.65	46	0.01	0.45	0.11	0.79
2.3	7.92	46	0	0.98	0.73	1.23
2.4	-0.7	46	0.51	-0.1	-0.4	0.21
2.5	0	46	1	0	-0.4	0.35
3.1	-0.6	46	0.55	-0.1	-0.5	0.25
3.2	3.33	46	0	0.55	0.22	0.89
3.3	4.65	46	0	0.79	0.45	1.13
3.4	2.74	46	0.01	0.45	0.12	0.78
4.1	8.03	46	0	1.02	0.77	1.28
4.2	6.32	46	0	0.87	0.59	1.15

4.3	-6.6	46	0	-1	-1.4	-0.7
4.4	-2.2	46	0.03	-0.4	-0.7	-0
4.5	2.25	46	0.03	0.43	0.04	0.81
5.1	12.4	46	0	1.38	1.16	1.61
5.2	15.3	46	0	1.34	1.16	1.52
5.3	15.2	46	0	1.45	1.26	1.64
6.1	10	46	0	1.13	0.9	1.35
6.2	10.7	46	0	1.3	1.05	1.54
6.3	8.67	46	0	1.15	0.88	1.42
7.1	14.2	46	0	1.49	1.28	1.7
7.2	7.47	46	0	1.09	0.79	1.38
7.3	11.5	46	0	1.32	1.09	1.55
7.4	10.5	46	0	1.17	0.95	1.39
7.5	4.47	46	0	0.68	0.37	0.99
8.1	4.17	46	0	0.75	0.39	1.1
8.2	5.15	46	0	0.81	0.49	1.12
8.3	3.8	46	0	0.7	0.33	1.07
8.4	4.95	46	0	0.87	0.52	1.23
9.1	3.5	46	0	0.62	0.26	0.97
9.2	2.17	46	0.04	0.38	0.03	0.74
9.3	4.3	46	0	0.83	0.44	1.22
9.4	5.11	46	0	0.85	0.52	1.19
10.1	6.89	46	0	1.09	0.77	1.4
10.2	6.13	46	0	1.09	0.73	1.44
10.3	5.7	46	0	0.92	0.59	1.24
11.1	6.48	46	0	1.15	0.79	1.51
11.2	-7.2	46	0	-1.2	-1.5	-0.9
11.3	5.39	46	0	0.85	0.53	1.17
11.4	9.6	46	0	1.19	0.94	1.44
11.5	7.42	46	0	1.02	0.74	1.3
12.1	4.59	46	0	0.75	0.42	1.07
12.2	11.1	46	0	1.21	0.99	1.43

Table 4 shows the specific statistical result of each hypothesis. The Confidence Interval is 95% in this empirical test.

are accepted and ignore the cash flow when the projects are rejected.

4.1 Regard Interest as Incremental Cash Flow

This is not because managers are lack of financial literacy, but because they present Representative Bias when they are using Representative Heuristic. Confused “project-company system” with “outside investor-company system”, they view every cash flow related to “company” as incremental cash flow in corporate capital investment decision-making. Obviously, their frame of mind is wrong.

4.2 Take No Account of Working Capital

Instead of deficiency in experience or carelessness in the estimation of cash flow, Representative Bias plays a key role in this irrational behavior. Actually, managers often fail to distinguish “company” from “project” in “project-company system”.

4.3 Take No Account of Opportunity Cost

In practice, managers comprehend the concept, but they don't realize that opportunity should be taken into consideration in corporate capital investment decision-making. At the same time, influenced by Availability Bias, managers merely think of the cash flow when the projects

4.4 Ignore the Specific Impact of Competition on Cash Flow

As shown in table 3, it's so hard to estimate the influence by competitors that managers ignore the impact of competition. In the contrast, they believe that they can acquire the industrial information and make estimation based on it easily. Due to Ambiguity Aversion, the Illusion of Validity and Representative Bias, managers make use of industrial data available rather than vague data of competition.

4.5 Overestimate Sales or Underestimate Cost

Affected by Availability Bias, managers merely focus on the expenditure and risks thinkable and neglect the unfamiliar ones, leading to underestimation of cost. Meanwhile, managers tend to be much more overconfident or overoptimistic about their ability of risk management than ordinary people do. Furthermore, the behavior above contributes to the intention of investment, and consequently the irrational behavior appears more clearly

under Confirmation Bias.

4.6 Take Account of Sunk Cost

“Framing effect”, “Loss Aversion”, “Anchoring Effect”, “Endowment Effect”, “Confirmation Bias”, “Overconfidence” and the interaction between them function in capital investment decision-making, making managers concentrate on sunk cost. Owing to Loss Aversion, managers are afraid of losing all of their sunk cost. Consequently, they often gear up their investment. Influenced by Anchoring Effect, they underestimate the additional investment. In the meantime, Endowment Effect let them hard to tear apart the project invested in. They pay special attention to the evidence supporting their additional investment all the time thanks to Confirmation Bias. Finally and unluckily, they struggle to save the day, unknown about their overconfidence.

4.7 Determine Cost of Capital Based on All Risks

The irrational behavior happens not because of limitation of time or material, but because of lack of literacy on risk management. As a result, when using heuristics, managers always replace Systematic Risk with all risks. This is usually caused by Representative Bias and Availability Bias.

4.8 One Size Fits All

Lack of financial literacy and unfamiliarity with related models contribute to the irrational behavior. Meanwhile, Ambiguity Aversion and Conformity encourage managers to use simple methods to determine discounted rate.

4.9 Determine Cost of Capital Based On Financing

Most managers are confused with the concept of cost of capital. Therefore, when depending on heuristic in decision-making, they usually regard financing cost as cost of capital.

4.10 Use Static Payback Period

This is because people usually deposit principle and cost of capital into different Mental Accounting. In decision-making, they take whether principle can be recouped as a reference point. Due to Loss Aversion and Ambiguity Aversion, they are unwilling to face loss of principle, ignoring the mysterious indicator: cost of capital.

4.11 Use Profit-Based Indicators

There exist two reasons resulting in this irrational behavior. “Net Present Value” is a very hard concept for managers to grasp. Besides, managers hope to cater to shareholders because shareholders always focus on profit-based indicators under Representative Bias.

5. CONCLUSIONS

In this study, using empirical test and questionnaires, we conclude the reasons for irrational behavior in every step of corporate capital investment decision-making. (1) When estimating cash flow,

managers will use heuristics for lack of clear frame of mind. Therefore, cognitive bias like “Representative Bias” or “Availability Bias” and psychological factors like “Ambiguity Aversion” or “Loss Aversion” take place in heuristics. (2) The main reason causing irrational behavior in the determination of discounted rate is the deficiency in financial literacy. Since most managers are confused with the concept of cost of capital, method of risk management and models of discounted rate, cognitive bias like “Representative Bias” or “Availability Bias” and psychological factors like “Ambiguity Aversion” function in this step. (3) When selecting indicators, managers present irrational behavior because of psychological factors but cognitive bias.

In general, the appearance of each irrational behavior originates from their specific uncertainty, cognitive bias and psychological factors. The interaction between them also contributes to the wrong frame of mind. Meanwhile, irrational behavior in each step has its generality. In capital investment decision-making, managers can design effective method, such as warning signs or clear frame of mind, to prevent irrational behavior. Thus, Behavioral Decision Theory will have important implications for financial practice, not limited to the explanation of phenomenon. Furthermore, our findings encourage the interaction of Rational Decision Theory and Behavioral Decision Theory, improving the methods of corporate capital investment decision-making and level of managers.

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