

Real Option Method and Escalation of Commitment in the Evaluation of Investment Projects

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Abstract: Problem statement: This study applies an experimental method to find out whether using the real option method along with the discounted cash flow techniques can reduce the decision-makers' Escalation of Commitment (EC hereafter) or their desire to keep up their commitment to a failed project. **Approach:** The real option method used for the evaluation of long-term projects also measures the flexibility value which may be produced during the implementation of the project. **Results:** The results indicate that those who use the real option method show lower EC to a failed project than those who merely use the net present value method. **Conclusion/Recommendations:** The major conclusion might be that using the real option method in capital budgeting can affect the users' behavior and decisions and lead to better decision-making in the long-term projects. In view of the fact that long-term investment projects are costly and time-consuming, a greater need is felt for better methods of evaluating such projects and, in consequence, researchers should also consider the other affective aspects of using real method options on the users' behavior and decisions.

Key words: Investment projects evaluation, economic feasibility study, real option method, capital budgeting, investment option, personal justificatory, social context, dependent variables, measurement tools

INTRODUCTION

This study aims to find out whether the decision-makers who use the real option method together with other discounting methods such as net present value in capital budgeting are less likely to show escalation of commitment (EC hereafter) towards a failed project than those who solely use the conventional and discounting methods. EC occurs when despite receiving negative feedback from a project, the decision-makers raise their commitment to that project to make sure it won't be abandoned (Teach, 2003). The situations in which people show EC to a failed project depend on many conditions and processes. One of such situations in which people have the potential of commitment rise is capital budgeting, because in capital budgeting there are two factors which facilitate EC; that is, uncertainty and accountability for measures taken within the project.

Real option method measures the value of the project, taking into consideration all current option available to the management, such as the abandonment, relinquishment or continuance of the project and the expected cash flow for each option. This method is

applied where there is uncertainty regarding an action. It is used to assess the management flexibility in case of uncertainty. Copel and Staw and Teach believe the use of real option method leads to better decision-making (Copeland and Antikarov, 2003; Staw, 1976; Teach, 2003).

These arguments are based on the fact that the use of this method improves the quality of the management's available information. Coy, however, argues as there is no specified date for exercising the option of abandoning the project, the managers might abandon the project before or after its optimal time and this, in turn, may rather worsen than improve the problem of EC (Coy, 1999).

Little research has been conducted on the EC in capital budgeting. Moreover, the results have not made it clear whether using real option method in a failed project has any effect on EC. No experimental research within Iran's economic, cultural and social context has directly considered this question. Besides, the use of the managers who are practically involved in capital budgeting has not been given proper consideration. This research intends to investigate these matters using an experimental method.

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Theoretical bases for the hypotheses: Capital budgeting is among the strategic decisions in the management of a company. Such decisions are of utmost importance because they remain in effect for several periods of time and consume a great portion of the company's funds. Making such decisions requires careful consideration and analysis.

Escalation of commitment: EC in a failed project occurs when despite receiving negative feedback on the last decision, the decision-maker raises his commitment to the project (Staw, 1976). EC, regardless of whether the decision yields positive or negative results, refers to the activities done without the consideration of the decisions taken at the decision-making stage.

Many accounting studies have focused on EC in the field of capital budgeting and have investigated the affective factors in the reduction of EC. Researchers have studied a number of the potential factors influencing EC. These factors can be classified into three groups:

- Personal justificatory hypotheses stating that decision-makers escalate their commitment for that stage of activity which justifies their initial choice
- Prospect theory that indicates the decision-makers who receive negative feedback and consider themselves to be in a counterproductive system are motivated to exhibit riskier dynamic behavior; and
- Other factors including sunk costs, the extent to which the project has been completed and evident and real desire to avoid wasting capital and time (Staw, 1976)

It has generally been agreed that EC is created by several factors not merely one particular factor (Ross, 1995).

MATERIALS AND METHODS

Real option method: The first use of the term "real option" dates back to thirty years ago and refers to the application of the techniques of evaluating the options in real investment scenarios. The analyses regarding the real option evaluation basically involve considering the potential decisions which might be taken during the implementation of a project and the best possible reaction of the management to each of these decisions. To gain the final value using the real option method, the manager needs to estimate the net present value of different options such as relinquishment or implementation of the project and then, considering the weighted mean of the possible results of each option, he

should determine the final value of the project with respect to the probability of the occurrence of each option. The final value of a project which has been calculated using real option method is always either larger than or as large as the final value determined by net present value. The difference between the obtained values using these two methods reflects the flexibility value at the management's disposal (Bargh and Ferguson, 2000).

Review of the related literature: Conlon and Wolf (1980) conducted a study to find out whether the method and indices of evaluation can reduce EC. Results showed that only along with other factors, rather than alone, do evaluation methods show a significant effect on EC (Conlon and Wolf, 1980).

Ross, Coy, Copeland and Antikarov studied separately the use of real option methods with discounting and conventional methods. The results of these researches showed the use of real option method together with discounting and conventional methods leads to better decision-making. They argued that using the real option method improves the quality of the information at the managers' disposal (Copeland and Antikarov, 2003; Coy, 1999; Ross, 1995).

Newton *et al.* (2004) discussed the advantages of the use of real option method and concluded that using the real option method along with other methods has some merits. Bargh and Ferguson (2000) showed the construct accessibility has a significant effect on the decision-makers' understanding, behavior and their use of received information. A research, titled "investment option, base rates and discounted cash flow techniques" was carried out by Dastgir in England. Results showed that using the real option method together with other conventional and discounting methods offers an appropriate tool for decision-making.

He and Mittal found out in their empirical research that the closer the project is to the end, the greater the need to finish the project and the less great the need for information for completing the project are and, vice versa, the earlier stage the project is at, the greater the need for information for completing the project is. Therefore, at the middle stages of the project, the decisions about EC are the most sensitive and the more risky the decision, the less the desire for EC (He and Mittal, 2007).

Moon discovered in his research that to decide about the EC, the decision-makers consider the factors related to the future of the project (the completion rate) and also those related to the past (sunk costs); so that the higher the sunk costs, that is at the final stages of the project, the greater the need felt for EC. Besides, the higher the

project's completion rate, the greater the need for continuing and completing the project (Henry, 2001).

Research questions and hypotheses: Research questions are as follows:

- Does the real option method affect the EC in capital budgeting?
- How does the use of real options in capital budgeting affect the managers and decision-makers' behavior?
- Does there exist any relation between partial judgment and the acceptance of EC in capital budgeting using real option method?

In response to the above question the following hypotheses were put forward.

Hypothesis 1: When the real option method is applied explicitly to the evaluation stage of the project, it is less likely that the decision-makers show EC to the failed project than when only discounting and conventional methods are used.

Hypothesis 2: Gaining an understanding of the construct accessibility of possibility of abandoning the project early changes the relation between the capital budgeting technique used by a decision-maker and his EC towards a failed project.

Research method: This is an experimental research in which there are two groups: experimental and control.

Population and sample: Given the impossibility of gathering the top managers of companies for conducting experimental studies and the necessity of testees' familiarity with capital budgeting methods, in this research after identifying the total number of the managers in 2011, a sample of 80 financial managers of contracting companies were randomly selected as the representatives of managers. Moreover, all the participants were graduates in accounting and management. They had an average work experience of 7 years in capital budgeting.

Measurement tools: The required data in this study were collected through a questionnaire comprised of three general sections. The first section presented a general picture of the research topic and also general information about the participants including their age, sex, major of study and the latest academic degree and experience.

The second section consisted of two different parts. The former involved a brief explanation on the applied

capital budgeting methods (real option or net present value), how to perform calculations and how to make decisions according to these methods. In the latter part, the manner of calculation in the methods and decision-making in capital budgeting were elaborated and exemplified.

The third section was constituted of three parts. In the first part the hypothetical project was explained to the participants and then they were asked to comment whether they would accept or reject the project giving a rating from 0-100. In the second part, a hypothetical problem during the implementation of the project was posed to participants and they were asked to decide whether to continue or abandon the project and then asked to comment on a scale of 0-100. In the third part the participants were required to answer 9 six-choice questions (0-5) about the hypothetical project.

After developing the questionnaire and testing its validity, both the experimental and control groups were provided with the information about the questionnaire. In the questionnaire the capital budgeting method and the time were manipulated in two stages as independent variables. At the first stage both the experimental and control groups (each containing 40 participants) were told that the company in question was using the net present value method in the project. Both groups were given 90 minutes to answer the questions. The second stage was conducted with just the experimental group and the control group left. The experimental group were told that the company was using the real option method in the project evaluation. Time, the second independent variable, was measured at two stages. First, at the stage of the acceptance of the project and then at the stage of the recommendation to continue the project after the problem is posed.

The questionnaire had two dependent variables. The first was the Recommendation to Continue the Project and the second was the acceptance of the project which both were answered on a 101-point scale of 0 (completely disagree) to 100 (completely agree). The second dependent variable was the relation between the score of the recommendation to continue the project and EC. The higher the mentioned score, the higher the EC. EC is often measured by money. In this study, however, it is measured by recommendation.

The two questionnaires were the same in terms of the information given to the participants but were different in the applied methods.

Validity and reliability of the questionnaire: In order to evaluate the reliability of the research tools, Cronbach's alfa coefficient method was used. The calculated Chronbach's alfa Coefficient in this research was 88% which is indicative of the enough reliability of

the research tools. Following the preliminary development of the measurement tools, during the assessment, in order to evaluate the validity of the questionnaire, it was commented on by the experts and commentators. At the stage of the assessment of the measurement tools, the questionnaire was once more distributed among a number of experts and commentators in order to use their suggestions for improving the questionnaire. Thus the content validity of the questionnaire seems to have been met.

Moreover, given that in this research it is predicted that the people who use the real option method with other methods show less EC in comparison with those who do not use this method, the confirmation of the this hypothesis will be indicative of the construct validity of the measurement tools.

Statistical methods of the research: The statistical methods used in this research were descriptive and inferential statistics including mean, variance, t test and one-way analysis of variance. In order to make a comparison between the means of the scores of the two groups in the research hypotheses, t test was used. It is worth mentioning that in the hypotheses of this research the significance level was $\alpha = 5\%$.

RESULTS

Hypothesis 1: The first hypothesis proposed when the real option method is applied explicitly to the evaluation stage of the project, it is less likely that the decision-makers show EC to the failed project than when only discounting and conventional methods are used. To test this hypothesis we use descriptive and inferential statistics.

Table 1 shows the results of the descriptive and inferential statistics of the first hypothesis.

In Table 1 the mean of the participants' given scores to the second question of the second part of the questionnaire was analyzed. This question asked the participants to determine the probability of the continuation of the project. To answer this question a 101-point difference spectrum (0-100) had been used so that 100 indicated "completely" agree and 0 denoted "completely disagree". 40 members of the control group and 20 of the experimental group answered the mentioned question. The mean scores for the control and experimental groups were 68 and 29, respectively. t statistic was -3.66 and the error level stood at 0.04. Table 2 has a more detailed look at the second question and presents the number and percentage of the participants who recommended the continuation of the project. According to Table 2, 60 members of the

control group and 10 of the experimental group had recommended continuing the project. Regarding the fact that lower number of the participants in the experimental group recommended the continuation of the project in relative to the control group, it might be concluded that the real option method is more precise than the conventional and discounting methods.

With respect to Table 1 and 2, because the significance level of this question is 0.04, it can be claimed with a confidence level of over 95% that the people who apply the real option method at the evaluation stage of the long-term projects exhibit lower EC in the event of the project failure compared with those who only use the conventional and discounting methods. The reason may be that net present value method considers only the expected value of the future cash flows and, unlike the real option method, does not take into regard the option of abandoning the project before its completion. The above hypothesis is supported by the current theories in this field.

Hypothesis 2: The second hypothesis put forth that: "gaining an understanding of the possibility of abandoning the project, changes the relation between the capital budgeting technique used by a decision-maker and his EC towards a failed project".

To test the second hypothesis, a path analysis diagram drawn by Amos software was used. This diagram measures the direct effect of the capital budgeting methods (recommendation to continue the project) and also their indirect effects (recommendation to continue the project) on EC, through through the effect of the capital budgeting (Capbud) on the construct accessibility of possibility of abandoning the project only (CAPA) and EC or the Recommendation to Continue the Project (RCP). Figure 1 presents the results of testing the second hypothesis through path analysis.

Table 1: The mean of the given scores to the 2nd question by the participants

	Capital budgeting method				Test result
	Real option	Net present value	t statistic	Error level	
The number of participants	40	80			
The mean of participants' scores 0-100	29	68	-3/66	0/04	Pass

Table 2: The percentage and number of participants who recommended continuing the project

	Capital budgeting method	
	Real option	Net present value
Total number	40 N=10	80 N=60
Number and percentage	25%	75%

Table 3: Questions 2, 5 and 6 of the third part and question 2 of the second part of the questionnaire

Question	The mean of the experimental group	The mean of the control group	Error level
Question 2 (the second part): As the responsible manager mark the questionnaire to determine the probability of continuing the project	29	68	0.030
Question 5 (the third part): I had considered the possibility of the failure of the project before accepting it	1.5	-0.1	0.056
Question 6 (the third part): I had considered the possibility of the project failure before recommending continuing the project	1.6	0.5	0.010

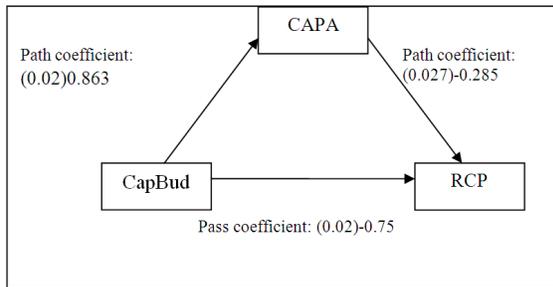


Fig. 1: Path analysis diagram

In Fig. 1 the numbers inside the parentheses are the error levels and the numbers outside are path coefficients. In the path analysis diagram the effect of the path coefficient of the capital budgeting method on the recommendation to continue the project is directly meaningful and this shows that the participants who used the real option method are less likely to recommend continuing the project compared to those who used the conventional and discounting methods.

Questions 5 and 6 of the third part and question 2 of the second part of the questionnaire are contained in Table 3. (The mean scores of questions 5 and 6 are on the scale of -5-5 and that of question 2 is on the scale of 0-100).

The effect of the variable of capital budgeting methods on the Construct Accessibility of Possibility of Abandoning the project (CAPA) is 0.863 which is meaningful at the confidence level of over 99%. The effect of the variable of CAPA on the variable of the Recommendation to Continue the Project (RCP) is -0.285 which is meaningful with the confidence level of more than 95%. Therefore the indirect effect of the variable of the capital budgeting methods on the variable of the RCP is (0.863, -0.285)-0.159.

These effects are completely in line with the third hypothesis. This means there is a meaningful positive relation between the capital budgeting methods and the construct accessibility of possibility of abandoning the project and there is, on the other hand, a meaningful negative relation between the construct accessibility of possibility of abandoning the project and the recommendation to continue the project ; so that, there

is a probability of recommending continuing the project and, in fact, the reduction in EC on the part of those who use real option method because they consider the earlier abandonment of the project. Thus the second hypothesis is confirmed.

DISCUSSION

Previous studies have shown that the use of real option methods in the evaluation of investment projects yields better results. In testing their hypotheses, most of these studies have used the university students who were familiar with investment project evaluation. Although such students have the same cognitive desires as those of managers, in practice, different results may be produced. To study this matter in the present study, the researchers have used the managers involved in investment project evaluation and in the end, obtained similar confirming results.

CONCLUSION

This research uses an experimental method to investigate whether considering real options in capital budgeting has any effect on EC in a failed project. The results showed the people who use the real option method at the stage of initial evaluation are less likely to decide to continue the project in case the project fails than those who use solely net present value method. The results also showed that the reduction in EC in case of using real option method is because of the increased construct accessibility of possibility of abandoning the project. In other words, the principal factor in the reduction of EC is this point that the project can be abandonment before the completion so that the sunk costs can be somewhat recovered.

Considering the established higher efficiency of the real option method than other conventional and discounting methods in this research, it is suggested that those who are somehow responsible for the acceptance and implementation of the projects use this method along with other methods. The central bank, for instance, can notify other banks to do so in order to make better decisions about granting loans and credits. Moreover, with respect to the importance of this issue, it is also

suggested a chapter with the title of "real option method" be included in the course of capital budgeting in financial management lessons at undergraduate level.

This research faced some limitations which must be considered in the generalization of the results. While the experimental studies in social sciences have yielded useful results in different fields, it must be noted that these results are obtained in the conditions of laboratory environment and, therefore, drawing conclusion from these results should be done with enough care and consideration.

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