Real Options Adoption in Capital Budgeting: A Highlight of Recent Literature

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Abstract
This paper presents a literature review of recent empirical surveys on capital budgeting methods. The focus lies on the investigation of Real Options' adoption for capital budgeting as this is recorded to relevant surveys. The studies include a wide range of questionnaires and examine various aspects of capital budgeting, resulting in findings not always comparable to each other. Although this poses a methodological issue, as surveys results cannot be compared in a quantitative way but only qualitative, however, these studies reveal the adoption trend of real options in various settings among different countries and businesses. A preliminary background is presented initially and next the surveys are presented with focus on the capital budgeting methods utilized.
Keywords: Real options, capital budgeting

Capital Investment Decisions

Capital budgeting decisions are among the most critical for firms' performance and future prospects. As such it has evolved during the years through extensive academic research assisted by technology and has offered a variety of methods and techniques that are extending the traditional methods. However a question arises, as it is not clear whether managers or firms have indeed adopted the novel more

sophisticated methods, such as real options. It is a fact that technology has boosted the academic research and the appearance of more complex models; however firms are not always follow the trend as in general the more complex a method is the less easy can be explained and adopted. As it can be seen traditional appraisal methods are still in use at a great extent ([13], [3], [17], [9], [6]).

Factors that affect the selection of appraisal method are not always deterministic and often reflect manager's education, background and perspective and not firms' formal procedures. The decision is unstructured and involves high risk. So, in many cases it is considered as an art rather than science and a manager may feel overconfident on own experience. Studies on behavioral finance show that the process of investment appraisal is not without behavioral biases as subjective processes are intervening [5].

Capital investments are evaluated by numerous methods as presented in literature. Two core concepts underlie in the evaluation of projects for most of the methods. The first is the utilization of cash flows of the project rather than accounting profit as measure of profitability and the second is the idea of discounting. The usage of cash flows instead of the profits helps to identify additional aspects except of profitability such as the payback period. The discounting of future cash flows reflects the associated risk as well as the time value of money. It is common for companies to use more than on method for the appraisal.

In capital budgeting the traditional method to evaluate investments or projects under uncertainty is based on the discounted cash flow method (DCF) by means of net present value (NPV). The net present value of a project is calculated by subtracting the initial investment amount from the present value of future project cash flows. The present value is the sum of future cash flows discounted by a certain rate which estimates the risk involved. A project is acceptable as investment if the NPV is positive. Although DCF has been criticized for major drawbacks, empirical surveys among managers support that it is still widely used for capital budgeting decisions [6]. Real option is closely related to corporate capital investment decision-making and has been introduced as an alternative approach for investment appraisal under uncertainty. The starting point of real options research was the criticism to traditional strategic investment decision making and capital budgeting methods. In general a real option represents or reflects the option or options that a company has when it comes to deciding whether

to invest in a project, to delay, put it on hold, expand or reduce an investment or any other flexibility it may also have.

Although real options has been introduced more than thirty years ago, and despite its promotion by academy, it seems that there exists a gap between theory and practice, as the theoretical development of investment appraisal techniques followed a must faster path than their acquisition in practice. Several surveys show that despite the criticism of traditional methods, companies are still using them. Several studies have been executed during the past decades in relevance to the practice of capital budgeting in general as well as the valuation approaches that are followed by firms. They try to close the gap between theory and practice and identify whether academic approaches are diffused into firms. This is not surprising as the capital budgeting decisions affect a firm's future position at great extent.

In the following a review is presented summarizing the key facts from several past surveys on capital budgeting practices. Although the literature is vast and spans across four decades we focus on studies from past five years only as they indicate recent and current trends.

Empirical findings on Real Options utilization

Verma et al., presented in 2009 their study on capital budgeting practices in India [18]. The population was all the manufacturing companies in India applying capital budgeting techniques. The size of the sample was 100 manufacturing companies covering various size-groups, industry–groups, age groups, ownerships and various geographical areas. From these 15 companies responded and after a follow up 15 more responded taking total usable responses to 30 or 30% response rate. Payback period, NPV and IRR were three most popular capital budgeting techniques. The firms used often or always NPV at 63%, IRR 76,7%, Payback 77%, ARR 16,6%, and profitability index 40,1%.

Scholleova and Svecova presented in 2010 the results from a survey that took place at Czech companies during 2007 [16]. 252 questionnaires were received and the responses were compared to similar surveys. Coming to the methods that were utilized, NPV was used by 22%, IRR by 22%, Payback Period by 27%, profitability index by 8%, discounted Payback Period by 11% and others by 4%. Although the research setup and results were not presented in a thorough manner, it is presented as indicative.

In 2010 Haddad et al., presented the results of their study conducted for Taiwanese firms' capital budgeting practices [7]. The characteristics of the survey were not presented in details. However, the sample was 25 firms in Taiwan and the questionnaires were sent to CFOs. As can be seen the respondents use always or almost always the NPV at 30,43%, PB at 52,17%, IRR at 47,83%, ARR at 26,09, Discounted PB at 21,74%, Profitability index at 17,39% and modified IRR at 13,04%. They conclude that the payback method is used more often and the NPV technique is always or almost always used by a relatively small percentage of firms.

Building upon previous similar studies, Bennouna et al., [2] executed a survey that was published in 2010 in order to evaluate the capital budgeting techniques in Canada. They reviewed existing literature on the subject and identified gaps that their own study was aiming to cover. Their target was on the one hand to extend the existing body of literature by providing updated results on capital budgeting techniques usage and on the other hand to explore domains that were not included in the past. So they compiled findings of previous studies and included the study of real options adoption as well. The initial sample was 500 firms included in the Financial Post magazine under the assumption that they would accurately reflect the largest Canadian firms and that they would be easily accessed. Survey questionnaires were mailed to CFOs and the response rate was quite low, as 88 firms or 18.4% out of the 478. 22 out of the 500 were not reached. The response rate was considered as sufficient considering similar studies. An overall assumption was that small firms tend to use naïve methods in contrast to larger firms that confront to financial theory, so the initial population of 500 firms was considered as adequate for the study. The results showed that 17 out of the 88 firms did not use DCF and from the rest 71 firms or 80.7% that use DCF, 94.2% uses NPV and 87% IRR. Regarding real options only 8.1% or 4 firms used it. Among others findings 78.5% was found to be using the non-DCF payback period. Authors argued that DCF was found as the most widespread method aligned with relevant past studies and non-DCF methods although declining were still in use. Also they mentioned that adoption of real options was surprisingly low considering the extent of relevant literature. They also mentioned that several areas of DCF analysis were not applied correctly. Limitations of the study were the non-response bias, the small sample size that included only large firms from the specific area that makes

generalizations very risky. Concluding, they emphasized the theory-practice gap on the usage of sophisticated methods and the limited usage of real options despite its extended presence in academic literature.

Shinoda presented in 2010 the results of a survey that took place between 2008 and 2009 in Japan focusing on capital budgeting practices [15]. The sample was 2,224 firms listed on the Tokyo Stock Exchange and the form was questionnaire that was sent to managers by post. 225 usable responses were received, which was considered as comparable to the rates in other similar surveys in Japan and U.S.A. The respondents stated that they use five always or often, net present value at 30,5%, internal rate of return 24,5%, accounting rate of return 30,3%, payback period at 50,2%, discounted payback period at 20,4% and real options at 0,5%. The results of this survey showed according to the author that the difference between academics and managers of firms listed on the Tokyo Stock Exchange in Japan was shrinking and those firms in Japan remained heavily dependent on payback period methods.

Khamees et al., presented a study in 2010 providing empirical evidence about capital budgeting in Jordan an emerging economy [11]. They distributed during 2006 a questionnaire to 81 industrial corporations in Jordan, listed in Amman Stock Exchange. The returned and qualified questionnaires were 53 with a response rate of 65.4%. The respondents stated that they use five well-known capital budgeting methods, net present value at 49,3%, internal rate of return 55,7%, accounting rate of return 50,7%, payback period at 58,6% and profitability index at 61,4% where the scores were calculated using an averaging formula. Authors argued that the results did not reveal that discounted or undiscounted cash flow methods were preferred over the other methods as the JIC gave almost equal importance to the discounted and undiscounted cash flow methods in evaluating capital investments projects. In addition, the profitability index technique was the most frequent used technique followed by the payback period.

El Sady et al., presented in 2011 the findings from their survey which took place in 2009 in Kuwait [14]. The sample was only Kuwaiti firms and the final sample comprised 511 Kuwaiti firms from investment, real estate, industrial, service and food sectors. Listed firms in Kuwaiti Stock Exchange from the five mentioned sectors were 167 and unlisted firms were 344, from the same sectors with comparable size and capital for the validity of the analysis. Questionnaires were sent

in 2009 and 382 questionnaires were returned with 74.76% response rate. The usable questionnaires (133) from Kuwaiti listed firms (70.42%) and 136 from Kuwaiti unlisted firms (39.53%) with a total number of 269 and usable response rate of 70.42%. The usable questionnaire rate as percentage of total questionnaires counts was 52.64%. The common techniques were NPV, ROA, ROE and PI, which accounted for 21.62%, 12.97%, 9.91% and 9.73% of all respondents, respectively. Profitability index was used by 9.73%, Payback period by 8.47% and real options by 0%.

Ekeha presented at 2011 the study results of a comparison of capital budgeting techniques by companies in Europe and West Africa [4]. The survey was between 225 European and 120 West African companies aimed to analyze the use of capital budgeting techniques by companies in both economic blocs. The questionnaires were sent to 225 Europe and 120 West African listed and non-listed companies in the period between August 2006 and January 2007. The questionnaire was sent to CFOs and received 36 responses, 28 from Europe and 8 from West African companies, resulting in a response rate of 12% for the European and 6% for the West African companies. The main findings of the analysis can be summarized as follows. First, European CFOs use the NPV method significantly more often than their West African colleagues do. Second, West African CFOs use the ARR method significantly more than European CFOs do. Third, CFOs of West African companies less often make cost of equity estimations as compared to European CFOs. These results may be explained by the fact that there is still a gap with respect to the level of economic, financial, human and technological development between the two continental blocs. At the same time, however, the study also found that the use of the IRR method does not seem to differ significantly between European and West African companies.

Al-Ajmi et al., presented their study at 2011 for the use of capital budgeting techniques of conventional and Islamic financial institutions [1]. Two hundred questionnaires were distributed to the target population composed of 98 banks of which 26 are Islamic, 37 insurance companies of which 9 are Islamic insurance and 65 investment companies, of which 21 follow Islamic Sharia'a principles. The response rate was 52.5%. The most popular technique used was IRR followed by NPV. Around 92.4% of the respondents indicated they use this method always or almost always. The second most popular

method (NPV) was used by 66.7% of respondents mostly or always. Of the non-DCF methods (PB and ARR), ARR was the third most popular technique with 53.3%. PB was used by 52.4%.

Macquieira et al., presented in 2011 the results from their survey on Latin American firms for capital budgeting decisions [12]. They followed Graham and Harvey approach and expanded it in several topics. The sample was composed of 290 answers from 7 main countries — Argentina, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela — and some isolated observations from Bolivia, Brazil, Costa Rica, El Salvador and Mexico. According to the results, the most widely used methodologies were the NPV with 72.41% and IRR with 70% of respondents used these techniques either always or almost. The next popular method was the payback period at 62.07% of respondents. Profitability index with 53.79% and sensitivity analysis with 58.97% were also frequently used. Real options were used by 24.48%. Concluding they commented that Latin American firms — similar to US firms — used NPV and IRR as the main tools for analyzing investments but survey suggested that firms in emerging markets tend to make a more extensive use of Payback and the Profitability Index than their US counterparties. The extensive use of these tools seemed to be aligned with the particular instability and market development of Latin American countries and to the specific choices among small and medium firms — even those located in the US market.

Maroyi et al., presented in 2012 their study on capital budgeting techniques for mining companies in South Africa conducted in 2011. The sample was chosen from companies listed in the mining sector of the Johannesburg Securities Exchange (JSE) which was summed to 20 firms. The survey was conducted by questionnaires (17 firms) and interviews (3 firms) and responses were 10 out of 17, a response rate of 37%. Respondents used the NPV technique in evaluating major projects by 69%, IRR by 46%, PB by 23% and 7.7% of the respondents did not use any technique to evaluate their projects.

Jain et al., conducted a survey, published 2013, in Indian companies regarding the capital budgeting practices among others [10]. The sample selected for this study was limited to 166 non-financial Bombay Stock Exchange (BSE) 200 companies engaged in manufacturing and service rendering businesses. The research instrument was questionnaire and the initial response was very poor. There were 31 responses received out of 166 (response rate of 18.67%).

The 31 respondent companies did not respond to all the questions contained in the questionnaire. The results showed that internal rate of return was used by 78.57%, payback period by 64.28%, Net present value by 50.00%, Accounting rate of return on investment by 39.28%, Profitability index/present value index by 21.42%, real options by 50%, abandonment options by 17,64% and any other technique by 7.14%. They argue that it was encouraging to see that half of the sample companies were using real options in making capital budgeting decisions and that all companies using the abandonment option were necessarily using the real option too, in combination, while making their capital budgeting decisions. This was as they comment in sharp contrast to findings of the Bennouna et al. (2010) study of large Canadian firms, where, even in large firms, only 8% use real options.

Hanaeda and Serita presented in 2013 the results of their survey conducted during 2011 about capital budgeting techniques for Japanese firms [8]. The questionnaire was based upon Graham-Harvey survey in order to be feasible to compare to international firms. The sample was 3,618 firms in Japan listed in "Japanese Company Handbook Vol.3 2011" published by Toyo Keizai Inc., which cover all listed firms in Japanese stock exchanges including the JASDAQ markets in June 2011 and the questionnaire was sent by mail to financial divisions. Respondent firms were 225 that comprised to response rate of 6.2%, which was acceptable and was probably due to the Great East Japan Earthquake occurred on March 11th 2011. From the respondents the results indicated that the utilization always and almost always of internal rate of return was used by 26,9%, payback period by 56,9%, discounted payback period by 15,6%, Net present value by 25,7%, profitability index 32,4%, simulation 8,3%, Accounting rate of return on investment by 43,4%, real options 1%, and other technique by 4,1%. Authors concluded that the most popular technique of capital budgeting was payback period method while NPV and IRR were not popular in Japanese firms as only 25.7% of correspondents of survey always or almost always use NTV and IRR. Also international comparisons indicated that capital budgeting practices of Japanese firms were different in some respects from US and other countries firms.

Conclusion and future work
From the previous review, it can be concluded the following:

1. From a methodological point of view every study is unique more or less as it takes place at a specific time and place which means that market conditions are very specific to the study. The sample is also unique and includes firms that are selected based on their size or their presence at an index. Another factor is that the management team or the decision making body changes from time to time making the uniqueness even stronger. Thus it is almost impossible to replicate the same survey at another point of time, as both, market and firms will have changed substantially.

2. Researchers follow a different methodology each time with different objectives and research questions, different questionnaires and different samples. This makes almost impossible to compare survey results without risking being inconsistent. Thus even for studies that were repeated at the same markets at different point of time, results cannot be compared, unless the researchers follow a very strict approach on their methodology. However, even if this can be organized, market and firms are not static, so results on real options adoption may be impacted by market influence or external factors and not by decision.

3. Real options in most of the studies are a kind of byproduct of the research, namely the survey design was not based upon the real options adoption, and it was not included, or included partially. Only few surveys were built around real options adoption and as said before they cannot be replicated to reveal the adoption progress through the years.

4. Although quantitative comparison cannot be done for the aforementioned reasons, some qualitative results can be inferred. One key result is that adoption rates of real options in capital budgeting practice despite their presence for an extended period remain relatively low compared to the so called 'legacy' DCF methods.

5. Although adoption rates are low to what expected, it seems that they tend to follow an increasing trend.

References

[1]. Al-Ajmi, J., Nadhem, A., Hameeda, A. H. (2011). Investment appraisal practices: A comparative study of conventional and Islamic financial institutions, *Advances in Accounting,* Volume 27, Issue 1, June, p. 111-124, ISSN 0882-6110.

[2]. Bennouna, K., Geoffrey, G. M., Marchant, T. (2010). Improved capital budgeting decision making: evidence from Canada, *Management Decision,* Vol. 48, Iss: 2, p. 225 – 247.

[3]. Brounen, D., De Jong, A., Koedijk, K. (2004). Corporate Finance in Europe: Confronting Theory with Practice, *Financial Management,* 33, 4, p. 71-101.

[4]. Ekegey, G. E. (2011). Capital Budgeting Practices and Economic Development: A Comparative Study of Companies in Western Europe and West Africa.

[5]. Gervais, S. (2010). Capital Budgeting and other Investment Decisions, in Behavioral Finance: Investors, Corporations, and Markets (eds H. K. Baker and J. R. Nofsinger), John Wiley & Sons, Inc., Hoboken, NJ, USA.

[6]. Ghahremani, M., Abdollah, A., Mostafa, A. (2012). Capital Budgeting Technique Selection through four Decades: With a Great Focus on Real Option, *International Journal of Business and Management, 7*(17), p. 98-119.

[7]. Haddad, K., Sterk, W., Wu, A. (2010). Capital Budgeting Practices of Taiwanese Firms, *Journal of International Management Studies,* Volume 5, Number 1.

[8]. Hanaeda, H. (2013). Toshio, Capital Budgeting Practices: Evidence from Japan (August 19).
http://dx.doi.org/10.2139/ssrn.2312264

[9]. Hermes, N., Smid, P., Yao, L. (2007). Capital budgeting practices: A comparative study of the Netherlands and China, *International Business Review,* Vol. 16 (5), p. 630-654.

[10]. Jain, P. K. (2013). Financial management practices: An empirical study of Indian corporates. New Delhi [u.a.]: Springer India.

[11]. Khamees, B. A., Nedal, A., Al-Thuneibat, A. A. (2010). Capital budgeting practices in the Jordanian industrial corporations, *International Journal of Commerce and Management,* Vol. 20 Iss: 1, p. 49 – 63.

[12]. Maquieira, C. P., Preve, L. A., Sarria-Allende, V. (2012). Theory and practice of corporate finance: Evidence and distinctive features in Latin America, *Emerging Markets Review,* Volume 13, Issue 2, June, p. 118-148, ISSN 1566-0141.

[13]. Ryan, P. A., Ryan, G. P. (2002). Capital Budgeting Practices of the Fortune 1000: How Have Things Changed?, *Journal of Business and Management,* Vol. 8, No. 4, p. 355-364.

[14]. El-Sady, H. M., Hosny, I. H., Sultanova, V. (2011). *Capital Investment Practices: A Survey of Large Corporations in a Developing Market*, Global Review of Accounting and Finance, Vol. 2. No. 2, September, p. 39-60.

[15]. Shinoda, T. (2010). Capital Budgeting Management Practices in Japan, Econ. J. of Hokkaido Univ., Vol. 39, p. 39 – 50.

[16]. Scholleova, H., Fotr, J., Svecova, L. (2010). Investment decision making criterions in practice, *Economics and management,* 15, ISSN 1822-6515

[17]. Verbeeten, F.H.M. (2006). Do organizations adopt sophisticated capital budgeting practices to deal with uncertainty in the investment decision? A research note, *Management Accounting Research,* Vol. 17 (1), p. 106-120.

[18]. Verma, S., Sanjeev, G., Roopali, B. (2009). A survey of capital budgeting practices in corporate India, VISION- *The Journal of Business Perspective I,* Vol. 13, July-September.

[19]. Vongai, M., Huibrecht, M. (2012). A survey of capital budgeting techniques used by listed mining companies in South Africa, *African Journal of Business Management,* Vol. 6 (32), p. 9279-9292.