MANAGERIAL FLEXIBILITY USING ROV IN SOUTH AFRICA: A SURVEY OF THE TOP 40 JSE LISTED COMPANIES

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Abstract

The traditional DCF (Discounted Cash Flows) -based techniques have been criticised in finance literature for their failure to incorporate flexibility in the evaluation of projects. Academics are advocating the use of Real Option Valuation theory (ROV) as it quantifies managerial flexibility, thereby bridging the gap between strategic thinking and finance theory and practice. The purpose of the study is to determine whether the largest firms in South Africa are using ROV and also to assess some of the factors that may influence their use of the technique. This paper presents the results of a survey of firms included in FTSE/JSE Top 40 index. The results suggest that while managers in these firms recognise and feel the need for flexibility in projects, most firms do not use ROV to plan their investments. This is largely attributed to managers being unaware of the technique, while the influence of the other factors is less clear.

Keywords: Real Option Valuation, Real Options, ROV, Managerial Flexibility, Project Evaluation

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Introduction

Several techniques are available for the evaluation of investment projects in firms. Past studies suggest that most firms use the traditional DCF (Discounted Cash Flow) -based techniques such as the Net Present Value (NPV) and Internal Rate of Return (IRR) for evaluating their projects (Abdullah and Nordin, 2005). According to Paddock, Siegel and Smith (2001: 775) and Dixit and Pindyck (1995: 106) these techniques are popular in practice because they are theoretically sound and easy to use. Until recently, these techniques also had the support of academics. Of late, they have been criticised in the literature because they are believed to ignore critical strategic aspects of capital investments. The traditional DCF-based techniques assume that investment opportunities are based on now-or-never decisions. As a result, a firm would be unable to explore a very unpredictable but highly promising investment if the investment does not immediately reflect profit potential. Some strategists, academics and corporate practitioners have expressed some dissatisfaction with these techniques. Schwartz and Trigeorgis (2001: 5) suggest the use of Real Option Valuation (ROV) theory as an alternative or extension to/of these techniques.

Flexibility in projects

Managers aim to pursue investment projects that offer important strategic benefits that will ensure that the firm stays competitive in the long term. They recognise the importance of investing in Research and Development (R&D) projects and marketing of new products. Decisions on some of these investments are largely based on managers' intuition and the need to create flexibility in investment projects. However, some of these projects may not offer immediate profit but only potential success in the future. R&D investments could on their own, prove unviable in the short term but may give firms the opportunity to invest in highly profitable projects later on, as is typical in the Information Technology and Pharmaceutical industries. Some mergers and acquisitions may be pursued solely to open up opportunities in markets that would otherwise be unavailable without the initial investment. Some partnerships that have resulted in bancassurance groups are the result of such thinking.

Managers realise that the dynamics of a highly uncertain proposed project could change favourably or unfavourably in the future, which would then affect the success of the project. Formulating strategy then recognises the importance of creating flexibility in management's projects in order to respond to changes in the risk and value of the projects. Even though most of these investments may be strategically sensible, they would be rejected under the traditional DCF-based techniques as they are likely to yield low or even negative NPVs. For example, the NPV assumes a static state of the world where the investment decision is only made today or is lost forever. As a result, the possibility to 'wait-and-see' that is required from a strategic point of view is ignored under the traditional DCF-based techniques. There is therefore a gulf between strategic thinking

and corporate finance, as most financial managers use these traditional DCF-based techniques for evaluating projects in their firms.

The real option valuation (ROV) technique was then developed to bridge this gap. The technique is used to reconcile the differences between the analyses of capital projects from a strategic standpoint with their financial evaluation. This is done by treating opportunities in these projects as real options. A real option gives the holder the right and not the obligation to act on a project's flexibility (delay, abandon or expand a project) within a specified period of time (Wang 2003: 24). Therefore, real option values represent the value of flexibility that managers have in projects. According to real options theory, a real option can be created by making a small investment that gives a firm the discretionary ability to exercise the option when the investment turns out positive (Kukovetz 2002: 39). The option can be exercised by increasing investment in that market. This gives firms the opportunity to invest in a risky project in the future when the risk is reduced, while at the same time limiting the potential loss of capital when the project turns out negative. The traditional DCF-based techniques ignore this flexibility in projects. However, this does not imply that these techniques should not have a place in the capital budgeting process. On the contrary, DCF tools such as the NPV play a very important role in valuing real options. According to Dias (2004: 94), ROV is seen as a complement to, rather than a substitute for DCF techniques. Under the ROV technique, the NPV of a project today is used to determine whether the project is worth considering.

From Financial to Real Options

Damodaran (1998: 778) notes that while a financial option may be written on an exchange-traded commodity such as oil, gold or on financial assets such as shares and interest rates, a real option is an option on a capital project and is therefore a more owner and project-specific option. Real options are therefore considered to be an extension of financial options because both give the investor the right to make an investment decision on the underlying asset. A real option is an option on a real asset and in principle is that same as financial options. As a result, real options can be valued using either the Binomial or the Black-Scholes model as is done for financial options.

Both approaches primarily require five inputs, namely the value of the underlying (S_0), the exercise price (X), life of the option (T), risk-free rate (r) and the volatility of the underlying (σ). A sixth parameter, dividend yield (δ), is incorporated into the value of the option if the underlying pays a dividend or some cash stream. The same inputs are used to determine the value of a real option. The difference is that the underlying is a nontraded, over the counter (OTC) asset, it is more difficult to estimate the value of a real option. The problem is therefore that information is not readily available.

For the underlying, Gitelman (2002: 61) recommends the use of proxies in commodity markets, physical and financial investments, similar investments or even proxy company stocks that match the project under review. However, Copeland and Antikarov (2001: 6) argue that it may not always be possible to find proxies for some projects. They therefore recommend using the project's present value without flexibility as the underlying security because the present value of the project's cash flow without flexibility is probably the most unbiased estimate of the project's market value. The present value of the initial investment made by the holder of a call option to obtain the underlying is treated as the exercise price of the option (Benaroch, 2002: 81).

T is the maximum amount of time for which the investment decision can be deferred, which is the period over which the option is available for the holder to exercise. While financial options tend to have a relatively short term to maturity, real options may be open to holders for a much longer period. According to PWC (2003: 13) South African firms generally use the rate on the R153 bond as a proxy for the long term risk free rate (r). As with financial options, σ represents the volatility of the underlying instrument. The volatility measures the uncertainty of a project's cash flows. According to Smit and Trigeorgis (2004: 11), the dividend yield (δ) represents the opportunity cost of delaying investment in the project. The dividend on an underlying project can be in the form of lost and irrecoverable cash flows due to delaying investment in a project or it can be a competitor's pre-emption in a similar project.

Using these inputs, the option value can be calculated from either the Binomial Lattices approach or the Black-Scholes model (Lewis, Enke and Spurlock, 2004: 39). Both approaches are also used to determine financial options values. Because the NPV ignores the presence of the real options (flexibility) in the evaluation of projects, Copeland and Antikarov (2001: 13) argue that this technique generally undervalues projects. As a result, project values when flexibility is incorporated will tend to be higher than their simple NPV values. This will not necessarily result in all projects being accepted or every real option to delay the investment decision being justified. This is because as with financial options, the rule is only to buy a real option if its theoretical option value/pay off is greater than the actual cost of the option (Howell and Jägle, 1997: 918). This would imply that the relevant flexibility adds more value to the underlying project than what it costs to create or buy the flexibility. It is then appropriate that in the evaluation of a project, its flexibility value is added to its passive NPV, to yield the Expanded Net Present Value:

$$ENPV = \text{Passive NPV} + \text{Option Value}$$

Types of Real Options

Different types of flexibility in investment projects can be classified into any one of several types of real options, and this classification depends on the features of the specific flexibility. Three of the real options discussed by Broyles (2003: 135) are listed below:

- The option to delay or defer investment in a project
- The option to abandon, and
- The option to rescale the size of a project.

Real options can give firms the opportunity to participate in projects that have a high profit potential but that currently seem too risky to conclusively decide whether or not they are worth investing in. This type of option is referred to as the option to delay (defer or postpone) because it gives the investing firm the flexibility to delay making the decision until a later date when more information is available and there is less uncertainty. This is a common feature of most projects, and is more prevalent in natural resource and R&D based industries. Merck, a Pharmaceutical firm, used ROV to plan a venture in its attempt to enter a new line of business (Bowman and Moskowitz, 2001). The venture entailed acquiring a new technology from a small biotech firm that could be used to design a new product. Merck were given the right to purchase the technology if during a period of four years, the progress in the development of the product was unsatisfactory. Merck ended up paying $2.8 million to have the option to delay the investment of $25.4m in a project that at the time had 50% volatility.

Some real options give firms opportunities to abandon projects should market conditions decline so dramatically that the firm starts to incur big losses due to keeping the project functional. This type of flexibility is known as the option to abandon because it gives the investing firm the opportunity to get out of an existing project when its costs rise so high or revenue declines so much that it is worth more to disinvest entirely from the project than to keep it operational. This option is more useful in capital intensive projects and can be used to enable a firm to exit an industry in which the firm is incurring major losses. The option to abandon represents a put option on the underlying investment and is therefore exercised when the value of the underlying falls below a given level (which may be the salvage value).

The profitability and success of an expansion project may be relatively clear in the short term but less so in the longer term. It then becomes important for a firm to be able to adjust the scale of such an investment as its profitability becomes clearer due to prevailing market conditions in the future. However, it may prove more costly for a firm to simply adjust the size of a project without an option to rescale. The option gives the firm the opportunity to adjust the scale of a project in response to changes in the market, at a relatively low cost (hopefully lower than the cost of flexibility). The importance of the flexibility to rescale projects is illustrated by de Weck, de Neufville and Chaize (2004) in their analysis of the Iriduim and Globalstar project initiated by Motorola and Qualcomm. The venture incurred huge losses and eventually resulted in debts of 5 and 3.5 billion dollars for Motorola and Qualcomm respectively. De Weck, de Neufville and Chaize (2004: 132) illustrate that about as much as 25% of the life cycle cost of the project could have been saved by incorporating the option to rescale when planning the project. In other words, the value of flexibility in this case was equal to a quarter of the life cycle cost of the project.

The option to rescale normally entails investing in capacity to enable the firm to scale up operations when market conditions are favourable and to scale down when the market conditions deteriorates. The flexibility is normally created by initially investing in a small but vital portion of the project's capacity to enable a quick and cheaper integration of new operations into the existing one. For example, a United States based automobile manufacturer believing the tastes of consumers in South Africa are likely to change, might decide to construct a production plant in Port Elizabeth. The firm would probably be unsure of the demand for its range of automobiles as the South African market is dominated by European car makers. Based on market research, the firm should be able to estimate the expected base case demand and build plant capacity to meet its expectations.

Let us assume that the cost of the base case plant capacity is R500m and the discounted benefits are R520m, implying a NPV of R20m. However, if the launch is a greater success than expected and demand for the manufacturer's product is beyond what the base case capacity can satisfy, then the firm misses an opportunity for greater profit. If on the other hand, demand is much lower than expected, then the firm stands to make a big loss on the investment. The opportunity to adjust the scale of the investment can be incorporated into the investment by structuring the capacity of the plant to enable the firm to expand or contract at a cost than otherwise. This may entail investing in excess capacity in the plant and leaving the excess capacity unused for some time (for example one year) until it becomes clearer whether the launch of the product will be successful or not. If the launch is not as successful as expected, then the firm can shrink its operations and lease the unused capacity to other firms in similar industries. An important issue to consider is how the firm could incorporate the value of this flexibility in its evaluation of the project. This is dealt with in the next section.

Steps in valuing a real option

If it is assumed that the firm will observe the market for one year before deciding whether the launch has been successful or not, then the term to maturity of

the option will be two years. The following additional assumptions are also made for the project:

- the investment required for the excess capacity in the plant is R50m (option premium),
- the scale of production can be expanded by 50%, a R255m (S_0) increase in discounted benefits,
- follow-up investment required for expansion is R150m (X) with the flexible capacity,
- the risk-free rate is given as 8% and the assumed volatility for the project is 50%.

Six steps are followed to incorporate flexibility in projects (Wang, 2003). First of all, the most important uncertainties of the project are determined, which in this case is the demand for the manufacturer's automobile. Secondly, the option holder makes an approximation of the probability distribution of the uncertainties, which usually is the lognormal distribution. The volatility of the investment is based on previous similar projects of similar size. In the third step, all the relevant and available options are identified and analysed. The relevant options in this case are the options to expand and contract the scale of the project. The fourth step entails estimating the value of the option. The value of the option to rescale based on the Black-Scholes model is calculated as R94m.

In the fifth step, all the valued options are compared and the ones with the highest payoffs are selected. For the current project, the firm should attempt to obtain the option to rescale because the cost of creating flexibility, R50m, is lower than the value of the flexibility. In other words, the option premium of R50m is less than the value of the option of R94m, implying that the option is under-priced. It should be noted that the option to scale down the project has not been taken into account in this case, but would be expected to affect the final value of the flexibility to rescale the entire project. The sixth and final step in the ROV process involves monitoring the uncertainties and deciding when to exercise the option. The option to expand should only be exercised when the discounted additional benefits (R225) due to expanding, are higher than the cost of expanding (R150m), such that the additional NPV is greater than zero.

Table 1 below summarises some of the features of the different types of flexibility discussed above.

Table 1. Features of different types of options

Type of option	Feature of Investment	Types of projects where application could be viable
Option to delay	Call option on underlying project	Natural resource extraction industries, real estate development
Option to abandon	Put option on underlying project	Capital intensive industries, in financial services, airlines.
Option to rescale	Underlying project + call (or put) option on underlying	Natural resource industries, fashion apparel, commercial real estate.

Source: Trigeorgis (2001)

Previous studies

Despite being preferred in the literature over the traditional DCF-based techniques, studies suggest that most firms are still not using ROV. None of the firms in the studies by Busby & Pitts (1997) and Collan & Långström (2002) used ROV. However, according to AT Kearny (2005:1), ROV does seem to be gaining support, not only among academics but also with some practitioners. In a study of 392 firms, Graham (2001) concludes that some firms in the US actually use the technique. Graham suspects that these firms use it as a strategic tool rather than for project evaluation. Some of the firms noted to have applied ROV include Airbus, Enron, General Electric, Hewlett Packard, Intel, Merck and Toshiba (Boyer, Christoffersen, Lasserre and Pavlov, 2003: 3). This had led to the belief that the technique is slowly being adopted, especially by firms in the more developed countries. None of the studies found seem to suggest whether or not the technique is used in the emerging market countries such as South Africa.

Focus of the survey

The survey in the current study involves observing the capital budgeting practices of the 40 firms included in the FTSE/JSE Top 40 index. Appendix A – The list of companies in the JSE TOP 40 Index as at June 2005. These companies are from the Resources (mining), Basic Industries (construction and building materials, forestry and paper, steel and other metals and general industries), Cyclical Consumer Goods (household goods and textiles), Non-Cyclical Consumer Goods (beverages, foods producers and processors and health), Cyclical Services (general retailers, media and photography and support services), Non-Cyclical Services (food and drug retailers and telecommunication services), Financials (banks, insurance, investment companies, real estate, speciality and other finance).

The focus is on whether these firms ever have flexibility in their projects and how managers deal with this flexibility. The main objective of the study was to determine whether some of the largest firms in South Africa use ROV to plan investments, and in

addition, some of the reasons that might influence them to either use or not use the technique.

The target population was chosen because firms in the index are some of the largest and top companies in South Africa and are considered more likely candidates for the use of ROV. There is generally little indication that companies in South Africa use ROV. A survey of all companies listed on the JSE would most probably not deliver more meaningful results than the chosen population. This is therefore a pilot study to determine whether the survey should be extended to include all companies. The survey questionnaire, which was pre-tested before being sent out, was used as primary source of information for this research. The survey questionnaires were sent out during April 2006. Personal interviews were also conducted in some instances to enhance the qualitative assessment of the current situation regarding the use of ROV in South Africa.

Survey Results

A response rate of 53% was achieved in the survey, with 21 of the 40 respondents invited to take part in the survey returning completed questionnaires. Included in the 21 is one respondent that indicated that the questionnaire was not relevant to their core business. It was assumed that the responded is therefore not familiar with ROV and did not use it. Of the 21 firms, only two use ROV to plan projects. One firm is in the Banking Industry and one in the Mining Industry. This low usage of ROV therefore confirms that a further survey of all companies would in all likeliness not be more meaningful. What could be considered is a survey of all mining companies in South Africa. It is more likely that these companies would use ROV.

As a result of the low usage of ROV, no meaningful conclusion can be drawn from the relationship between the use of ROV and the factors expected to affect its use. The fact that the number of firms using ROV is too small (2), makes it impossible to test whether the relationship between the use of ROV and the other factors is statistically significant.

The most pertinent question posed by this study was whether respondent firms are using ROV in their projects. Respondents were deemed to be using ROV if they claim to use it either as a primary or secondary capital budgeting technique. A secondary aim of this question was to assess which other techniques firms are using in their capital budgeting process. As suspected, traditional DCF-based techniques are still popular with the respondent firms. This is perhaps not too surprising as most firms, not just in South Africa, seem to favour these techniques. A summary of the techniques discussed in the paper and the percentages of firms that use these techniques is shown in Figure 1 below.

The NPV and the IRR appear to be the most popular techniques among firms. These techniques were recommended in the literature prior to the emergence of the ROV. The NPV is the most widely used technique, with 18 (86%) respondents using it as a primary technique while three use it as a secondary technique. In effect, all respondents are using NPV for their project evaluation whether as a primary or secondary technique. Only 2 out of 22 (9%) for the firms use ROV.

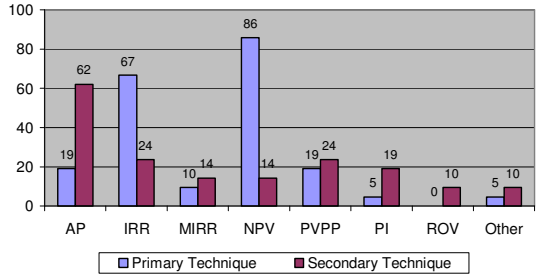

Figure 1. Capital budgeting techniques used by firms

There is still some suggestion that firms do not always use the best techniques recommended in the literature. Firstly, the Modified Internal Rate of Return (MIRR) is less popular with respondents than the IRR, despite the former addressing some of the limitations of the latter. Rather surprisingly, the Average Payback Period (AP) is used more than the Present Value of Payback Period (PVPP) even though the AP does not take the time value of money into account. However, this does not detract from a more encouraging finding that at least firms are using the NPV, which among the traditional DCF-based techniques, is considered more theoretically sound. The Profitability Index (PI) is used least of all as primary technique. Some questions were used to determine the existence of the options to delay, abandon and rescale, respectively, in respondent firms' projects. Other questions were intended to determine the frequency with which these options occur in the projects of firms. Since only two firms use ROV, the flexibility referred to here by the respondents are not of the type created by ROV. It only refers to the need for flexibility in general terms. The results suggest that none of the three options is significantly more recurrent than any other.

Questions were also included to determine the importance that respondents generally attach to each type of flexibility. Table 3 below summarises the desire of managers to have flexibility, where desire is reflected by the ratings of importance they give to each type of flexibility. A few of them do not consider any of the options to be important, but at the same time, not many consider the options to be absolutely crucial either. It is to be expected that respondents that value flexibility more would be more likely to use ROV than those that value it less. However, as already mentioned, the number of respondents using ROV is too little to determine whether any pattern exists between use of ROV and the rating firms give flexibility.

Table 2. Frequency of occurrence of flexibility options in projects

Frequency	Option to delay		Option to abandon		Option to rescale	
Range	No.	%	No.	%	No.	%
0-20%	8	47	10	59	7	41
21-40%	6	35	1	6	3	18
41-60%	2	12	3	18	2	12
61-81%	1	6	2	12	3	18
81-100%	0	0	1	6	2	12
Total	17	100	17	100	17	100

(only includes respondents that did not have any flexibility options)

Table 3. Importance of flexibility in influencing investment decisions

Importance	Option to delay		Option to abandon		Option to rescale	
Importance	No.	% of 18	No.	% of 17	No.	% of 17
Completely	0	0	0	0	0	0
Not especially	2	11	4	22	2	11
Moderate	11	61	4	22	4	22
Very	3	17	10	56	12	67
Extremely	2	11	0	0	0	0
Total	18	100	18	100	18	100

It is noted though that the two respondents that use ROV do not appear to value flexibility significantly more than the other firms. This has led to the conclusion that firms that desire flexibility do not necessarily use ROV therefore suggesting their use of the technique is determined by other factors. It may, however, be expected that those who do not consider flexibility to be important will most likely not use ROV. A fair number of firms in the study claim to have established policies to identify and assess flexibility options (these are not real options, i.e. in the derivative or ROV-sense, it is points at which the project should be flexible) in capital projects. Out of 20 firms, 12 claim to have considered such aspects, ten of which do not use ROV in capital budgeting. This reinforces the belief that firms do recognise flexibility even if they do not use ROV. Whether these firms quantify this flexibility is not dealt with in the questionnaire. In addition, 19 respondents claim to have anticipated the presence of these flexibility options in their projects. This implies that managers do recognise the presence of flexibility options during the planning of a project, prior to implementation.

Table 3. Attributes of flexibility in investment decisions

	Anticipated		Necessary		Available		Exploited	
	No.	%	No.	%	No.	%	No.	%
Yes	19	95	16	80	18	90	14	70
No	1	5	4	20	1	5	3	15
Not sure	0	0	0	0	1	5	3	15
Total	20	100	20	100	20	100	20	100

It seems that most firms attempt to incorporate flexibility in their decisions when planning projects. Most respondents claim to have considered flexibility as necessary when deciding whether to approve a project. Of the 18 firms that anticipated flexibility in projects, 16 considered the option to be a necessary feature of the project. This result reaffirms the finding that managers generally desire flexibility.

Only three respondents of the 18 claim to have not taken any of the opportunities available to them but two respondents were not sure. It is possible that the opportunities were not exploited because in the end respondents deemed it not worthy to do so, perhaps due to prevailing market conditions at the time. Respondents might be unsure of whether an opportunity had been exploited, if the project to which the opportunity relates is still under way and the opportunity is still available. As a result, the respondent might be uncertain whether the opportunity will be eventually taken up or not.

A number of authors have put forward possible reasons that might explain why firms are not using real options in evaluating their projects/investment. These included the awareness of ROV, the complexity of ROV, the competitive structure of the industry, type of firm and capital intensity of a firm's projects. Respondents were also are asked to indicate their knowledge of the terms 'real options', 'growth options' and 'operating options'. Given that in previous studies respondents had claimed to know the terms but seemed to associate them with financing alternatives, respondents were asked to define the term real options to determine whether they would define it as it is used in the literature.

Factors affecting the use of Real Options

Awareness of ROV – Although few managers are aware of real options, a larger percentage is aware, compared to the results in the previous studies. In

total, 12 respondents claim to know about Real Options, with varying levels of knowledge though. Of these, only seven are able to illustrate their knowledge of the term by giving accurate definitions and correct examples of real options. 35% (7 out of 20) of all respondents are deemed to be aware of ROV with only 2 out of the 7 actually using ROV. It may be concluded that although awareness may affect the use of ROV, it is most likely not the only contributing factor because 70% (5 out of 7) of respondents that are aware of it, do not use it.

Complexity of ROV – Respondents claiming to have some knowledge of the term real options had to rate (on a scale of 1 to 5) how complex they deem the application of ROV to be. No definitive conclusion can be made about whether the complexity of ROV affects its use by firms. The two respondents claiming to know real options very well but are not using it, deem the technique to be very complex. In addition, neither one of the firms that use ROV deem its application to be straightforward. At best, one of them described it as 'Somewhat Complicated'. It may not be unreasonable to assume that the complexity and the availability of information to value real options, affects its use. In addition to this, the availability of information may also contribute to the complexity.

Industry Structure – According to Weeds (2002: 3), a firm might not be able to delay an investment decision if it faces competition in the same market. If there are sustainable benefits to investing early then competitors will all try to pre-empt each other thereby reducing the value to delay. This is referred to as the First Mover Advantage (FMA). However, even in the face of competition it may still be possible to delay the investment decision. This is the case when there are significant advantages to waiting for a competitor to move in order to observe their entry into the market. This is referred to as the Second Mover Advantage (SMA).

It was expected that firms facing a sustainable SMA in a majority of its projects would be more likely to use ROV as opposed to those facing a FMA. Respondents were asked to indicate which of the FMA and SMA is more prevalent in their industries. However, the relationship between the industry structure of competition and the use of ROV could not be tested because of the small number of firms using ROV. Neither one of the firms using ROV observed a sustainable FMA in their projects. In addition, the firms that believe their industries conferred FMA were among those that observed the option to delay the least in their projects.

Capital Intensity – Firms with capital intensive projects should benefit more from using ROV depending on the size of the project. Capital intensity is represented by the average amount a firm invests in projects. The questionnaire attempted to obtain this information from respondents. The relationship between the desire for flexibility and the capital intensity of projects was tested. The results of the Spearman test for correlation suggest that this relationship is statistically insignificant. The p-value for the option to delay was well above the 0.05 threshold at 0.44297, with 0.17747 recorded for the option to abandon and 0.69249 for the option to rescale. This result does not make intuitive sense. There is also little evidence from the results to suggest that capital intensity affects the use of ROV.

While one of the firms that use ROV has the highest average investment in projects, the other firm falls in the lower half of responses when ranked on capital intensity. It may be reasonable to assume the desire for flexibility would increase with capital intensity within a firm.

Conclusions

The results of this survey clearly indicates, as was expected, minimal usage of ROV in project planning among the FTSE/JSE companies in South Africa. Most respondent firms do not use ROV. Only 2 out of 22 (9%) are using it. Although this conclusion is based on half of the targeted sample, it seems somewhat unlikely that a notably higher number of firms out of the 19 that did not respond, is using ROV. If this low usage of ROV can be extrapolated and taken as true for all South African listed companies, an assumption which is not unreasonable, it may signal inefficiency in short range project planning and a problem with longer range strategic planning. This will most certainly hamper the development of the economy and business environment as a whole and more so in the case of an emerging market. The capital intensity of projects, the awareness of ROV, the industry structure and the complexity of ROV were all suggested as possible factors affecting the use of ROV. The number of firms using ROV is too small to determine the existence of a statistically significant relationship between this use and other factors. It is noted however, that very few respondents are aware of ROV, adding to the suspicion that awareness may in part explain why managers are not using ROV. On the other hand, most of the firms deemed to be aware of ROV are not using it. This has led to the belief that the use of ROV also hinges on other factors as well. It is noted that managers in all of the firms that are aware of real options, perceive the application of ROV to be complicated, including the firms using the technique.

Furthermore, some firms seem to actively seek out optionality in projects by setting up programs designed to identify such flexibility. Given that some of the flexibility is created or negotiated as opposed to coming natural to the projects, further suggests that managers desire to have flexibility in their projects.

The complete adoption of ROV in companies still seems to be some way off despite being considered by academics as superior to other techniques. However, firms are slowly adopting, and this might be speeded by globalisation as firms are exposed to each other's financial practices. While ROV seems to address some of the concerns managers may have about the

traditional DCF-based techniques, firms should still establish whether this technique will benefit them before embarking on using it. Not all projects may benefit from ROV. It is apparent though that flexibility may be an important feature of projects that managers look out for. Most of the modern businesses have to plan for expansion to growth the business. This process implies many risks due to an uncertain business environment. Using ROV may be the best approach to transfer some of the risks to other parties willing to take it. Further research should be undertaken in the area of pricing and the gathering of information. The likelihood of usage of ROV is probably the highest in the Information Technology and Mining Industries. Research should also be undertaken in these sectors of the economy, to determine how the industry may be assisted in applying real options and therefore make better use of available funds to further maximise shareholder wealth. Companies in South Africa should be made more aware of the benefits of Real Option Valuation Theory. Articles should be placed in industry journals and papers should be delivered at industry seminars, workshops and conferences.

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