

To Invest or Not To Invest?

An approach to making optimal investment decisions

Background on Real Options Valuation

Projects are dynamic in nature as key forecast assumptions considered in project feasibility studies may be highly volatile over time. The Real Options Valuation (ROV) approach is an attractive complement to the standard deterministic valuation approaches such as the Discounted Cash Flow (DCF) methodology, Monte Carlo Simulation and Decision Tree Analysis. The ROV approach explicitly addresses the flexibility that is inherent in any project and is most valuable to apply when there is high uncertainty with regard to the underlying asset value and the benefits that will result from investing in such asset. The ROV approach also provides management with significant flexibility at certain key decision points to change the course of a project in a favourable direction and the ability to exercise the available options. A clear picture of what might happen in the future as well as the contingent strategic decisions is produced, making the successful management and implementation of the project simpler, clearer and optimal.

Limitations of Using the Traditional Methods

The DCF methodology is a well-established technique that has been used for decades in valuation of businesses and project feasibility studies. The theory behind the technique is sound, and the results are as good as the assumptions. However, the DCF fails to capture certain realities of today's corporate world. The following are some of its shortfalls:

- The DCF methodology takes a deterministic approach based on a single set of forecast assumptions and a single value (Net Present Value, Internal Rate of Return, and Payback Period) as outcome. In the real world, cash flows are uncertain, highly volatile and probabilistic. Adding sensitivity analysis to the DCF methodology through studying different scenarios may give more insight into the uncertainty, but still each scenario is based on a fixed path outcome representing a single value.
- The DCF methodology does not take into account management's flexibility to change the course of the project through contingent intervention.
- To account for the risk associated with the project payoff, it is often the practice when applying the DCF methodology to discount the cash flows at a higher rate to

incorporate uncertainty of future cash flows. This could imply that only the downside of the risk is accounted for, with no consideration for additional benefits that may arise. This inherent bias may result in rejection of potentially highly successful projects.

Monte Carlo simulation is an extension of, but not a substitute for the DCF methodology. Whereas the DCF methodology takes one set of input parameters and calculates one project NPV, Monte Carlo simulation effects the exact same calculation a multiple of times by just changing the input parameters each time. Therefore it has the same pitfalls as the DCF methodology.

Decision Tree Analysis (DTA) is a more sophisticated tool than the DCF methodology and offers value when a project is multistage and contingent decisions are involved. It differs from the DCF methodology in that, to account for market risk, it uses probabilities of outcomes instead of risk-adjusted discount rates. However, these probabilities are subjective and management can pick numbers to skew the decision in their favour. Secondly, there is no agreement in the finance community as to whether it is completely the private risk that controls cash flows inside the tree, making it difficult to select an appropriate discount rate.

Real Options Valuation Approach and Benefits

In view of the limitations of the traditional methods, ROV offers a dynamic approach to project valuation.

- ROV is **NOT** a substitute for any of the traditional methods. Instead, it uses the DCF methodology as a building block and allows one to integrate decision trees, as necessary, into a sophisticated framework that provides analysts and decision makers with more important information. ROV thus incorporates DCF, DTA and simulations to the next level by capturing the additional value created by the options embedded in a project when the payoff uncertainty is high. Uncertainty creates future management decision opportunities that are reflected in the value of the option. The higher the uncertainty, the higher the option value, and the higher the upside potential. Decisions are therefore not reached based only on a single number, but a range of probable outcomes reflected as a normal distribution of values. Probabilities of success and failure can easily be calculated.
- By making use of decision trees, ROV provides an overall strategic map depicting the contingent decisions and the options available to management.

- ROV does not assume passive project management, but considers active project management as an important factor in the success of a real project.
- Unlike the DCF methodology, ROV takes into account the uncertainties inherent in any real project.
- Unlike DTA, it uses objective probabilities as dictated by the volatility of the future cash flows of the project.
- ROV provides more information to help in the decision-making process where the DCF methodology cannot unequivocally point to either an investment or no-investment decision. ROV can become a “tie breaker” where two or more competing projects have similar NPV’s.
- ROV is not for qualifying projects which are clearly no-go investments. If the project NPV is significantly negative, the decision to invest or not to invest can simply be taken based on the DCF methodology.

ROV incorporates the following methods into one framework:

- The Black-Scholes Formula from financial option theory;
- Simulations; and
- Binomial Lattices.

ROV Option Categories

The following scenarios may result in a need to perform an ROV assessment:

- **Option to defer (wait)** - Based on the DCF analysis, a project might have a negative NPV. However, real conditions may be volatile and the original assumptions might change in the future in which case a company may decide to use an option to wait to make better informed decisions.
- **Option to expand** - A company has healthy cash reserves and can afford to expand current operations or establish itself in other places. The current uncertainty shows a high value for the option to expand which can help the company to chart out a strategic map for future growth. There is an expansion factor involved.

- **Option to contract** - Due to changing and uncertain demographics, the market demand for its products is shrinking. A company may consider an option to contract its operations in the near future through outsourcing and internal cost reduction. There is a contractual factor involved.
- **Option to abandon** - A company is concerned that it may have to close one of its major plants due to competitive market conditions. Currently, there is a great deal of uncertainty, but management feels that the uncertainty will clear in the near future allowing additional time to make a better informed decision using an option to abandon.
- **Option to choose** - A company has to make a difficult choice between four strategies: continuation of the status quo, expansion, contracting, or total abandonment of some of its operations. It can use a "chooser" option to optimize its investment decision and make the right choice.
- **Parallel compound option** - A company has two or more simple options to consider at the same time.
- **Sequential compound option (option to stage)** - Because of market uncertainty regarding profitability, a company may decide to use the option to stage a project. The project is divided into phases where the success or failure of one phase leads to an option to start or abandon the next phase. In this case, the value of a predecessor option depends on the value of the successor option. This is a common option in large projects.
- **Learning option** - This option helps clear the uncertainty related to the success or failure of a new product or service.
- **Rainbow option** - A company wishes to invest in a project where, for example, the payoff from the project is subject to more than one source of uncertainty.

Industry Applications

The ROV approach has proven application in many industries. A few specific examples are given, but by no means present a complete list:

- **Natural Resources** –The natural resources industry is in the vanguard in as far as ROV is concerned. For example, in the oil industry, significant investments are required in terms of exploration (seismic, exploration, well tests etc.) and production drilling. There is usually high uncertainty and a substantial time lag before actual production begins. Obtaining a lease for an oil field gives the company the right, but not the obligation, to perform the initial exploration and drill for oil, thereby creating a call option. Because of high uncertainty in oil availability at the specific field under investigation and the volatility of world oil commodity prices, a company may want to wait for uncertainties to clear before actual drilling starts. Recent application examples include The Gulf Oil, Shell and Chevron Texaco investments in the Athabasca Oil Sands Project, and Chevron Texaco plants in Venezuela.
- **Airlines** - Buying aircraft, especially new aircraft, is a risky investment. Buying options to purchase additional aircraft in the future is a common practice in this industry. As the uncertainty clears over time, and if the expected payoff from expanding operations is higher than the purchase price of the aircraft, an airline company will exercise the option and expand its operations.
- **Auto manufacturers** - Because of market uncertainties, an auto manufacturer may be contemplating scaling down some of its operations by either selling or outsourcing one or more of its plants in order to gain efficiency through consolidation.
- **Real Estate and Construction** - The optimal time for a strategic decision whether to defer (i.e. wait), sell (i.e. abandon) or develop real estate cannot be captured by conventional deterministic approaches. Real estate contains a multiplicity of embedded real options. There are many situations where implicit options exist in real estate investments. For example:
 - Do you purchase or lease a slightly larger piece of land than that required for the possibility of future expansion?
 - Do you build in phases or construct everything at once when the economic outlook is uncertain?

- Do you renovate a building or leave it as it is?
- Is it optimal to buy and service land, and then sell it now or in the future? When is it optimal to do so? Or is it optimal to buy and sell un-serviced land? When is it best to construct?
- **Manufacturing** - Considering the uncertainty in the market, a manufacturing company may consider a “chooser” option where it could abandon, contract, expand, or continue its operations in their current state depending on how the conditions play out.
- **Pharmaceuticals** - Drugs are proven effective after going through clinical trials and approval. Using the real options approach, a project can be abandoned or go to the next phase as the private uncertainty related to the effectiveness of a drug is resolved. In essence, this is acquiring a call option, the underlying asset of which is the payoff from future drug sales.

Value Analytics Solution Strategy

An integrated project valuation framework that includes the DCF and DTA tools as well as the ROV methodology will include the following steps:

- Framing of the problem;
- Estimate the baseline investment cost and the present value of the payoff or expected free cash flows of the project;
- Conduct an initial analysis comparing the baseline project investment versus the present value of the payoff;
- Estimate the option value of the project using the ROV modelling tools;
- Analyze the option results to gain better insight into and better understanding of the project economics;
- Prepare the results for presentation to management in an easily understandable format and
- Product delivery.

Value Analytics provides expert customized ROV solutions to various industries. We are willing to give a short presentation on the application and benefits of Real Options in your industry.

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