Using real options in strategic decision making

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To maximize a firm's value its managers must match internal capabilities to external opportunities. Flexibility in timing of decisions about the firm's capabilities and opportunities give managers 'real options'. What are they and how do we use them?

There are four components in the manager's toolkit for valuing investment opportunities: payback rules, accounting rates of return, net present values (NPV) and real options.

Payback rules ask how many periods management must wait before cumulated cash flows from the project exceed the cost of the investment project. If this number of periods is less than or equal to the firm's benchmark, the project gets the go-ahead. Subsequent cash flows, whether positive or negative, are not factored into the calculation.

One example of an accounting rate of return is the ratio of the average forecast profits over the project's lifetime (after depreciation and tax) to the average book value of the investment. Again comparison with a threshold rate is sought before investment goes ahead.

Both these measures enjoy the benefit of simplicity. Cash flows are easier to forecast in the near future than the distant future, so a payback rule can be implemented more accurately. And accounting rates of return are computed from data that is routinely compiled by management accountants, making comparison and monitoring relatively easy.

But by far the most popular of these tools is NPV. It takes the sum of expected cash flows over the lifetime of the investment project and discounts it by an appropriate cost of capital, since cash today is worth more than cash tomorrow. If this discounted amount is positive, management proceeds with the investment.

To implement NPV, we need estimates of expected future cash flows and an appropriate discount rate. And there's the rub. An NPV calculation only uses information that is known at the time of the appraisal. To borrow a popular metaphor, think of poker. The ante is $1, say, and you bet between $1 and $10 on every open card. How much would you place as your final bet before the first card had been dealt?

This example brings out starkly the problem of uncertainty. You are being asked to make an NPV calculation using only what is known before the game begins. And your choice is all-or-nothing, not an initial choice followed by more choices as information becomes

available. In poker, players pay a small amount to stay in the game. Depending on the next turn of the card, they then fold, match or raise the bet.

NPV techniques were first developed to value bonds. There is little investors in bonds can do to alter the coupons they receive or the final principal paid (the future cash flows), or the yield rate (the appropriate discount rate). Companies, however, are not passive investors: managers have the flexibility to sell the asset, invest further, wait and see or abandon the project entirely.

It is precisely the way in which real options deal with uncertainty and flexibility that generates their value. Real options are not just about "getting a number", they also provide a useful framework for strategic decision making.

So what is a real option? It is the right – but not the obligation – to acquire the gross present value of expected cash flows by making an irreversible investment on or before the date the opportunity ceases to be available. Although this sounds similar to NPV, real options only have value when investment involves an irreversible cost in an uncertain environment. And the beneficial asymmetry between the right and the obligation to invest under these conditions is what generates the option's value.

Consider an investment project where there is uncertainty about the state of the world. Suppose it can be either good or bad and it's as likely to be one as the other. If it is good, your investment project returns $5. If it is bad, you lose $6. An option to invest in this project is available for the irreversible cost of $1.

An NPV calculation, where you invest now or never, values the project at 50%x$5 – 50%x$6 = -$0.50. If you sink $1 and wait and see, the real option value of the project is 50%x$5 – 50%x$0 - $1 = $1.50 as you don't have to invest if the state of the world is bad. So flexibility can be profitable!

This flexibility has several strategic forms.

- Using real options values the ability to invest now and make follow-up investments later if the original project is a success (a *growth* option). These kinds of options characterise pharmaceutical R&D rather well, for example.

- Real options can also value the ability to abandon the project if it is unsuccessful (an *exit* option). A North Sea oil company has had much well-publicised success valuing its 5-year oil and gas exploration licenses in this way.

- Real options can value the ability to vary your firm's inputs, output or production methods in response to changes in prices or demand (a *flexibility* option). During the 1980's all the major auto manufacturers implemented the lean production methods

pioneered by a Japanese car giant. Although the capital cost of flexible production lines was higher, they meant more than one model could be built on each separate production line at every plant.

- And real options can value the ability to wait and learn, resolving uncertainty, before investing (a *timing* option). Eurotunnel has a statutory option on a second tunnel under the English Channel, to be opened not earlier than 2020 (its lease on the first tunnel expires in 2052). The current fixed link came in one year late and 11 billion over budget. What price the ability to resolve uncertainty this time?

If real options only have value when costs are sunk and returns uncertain, what exactly determines their value? In order to exercise a real option, you must pay the exercise price. The less you pay the better. So the option's value increases with the ratio of cash flows (returns) to investment cost (exercise price).

Similarly, you don't have to incur this investment cost until you decide to exercise the option. Therefore a real option is a free loan, and its value increases with the interest rate and the length of time before you invest.

And the option holder does not lose from increased uncertainty if things turn out wrong but gains if they turn out right. More uncertainty increases the likelihood of larger positive payoffs, and therefore the value of an option, as larger down-sides can be avoided.

In what kind of situations should you use real options? A useful taxonomy classifies real options by whether they are proprietary or shared, whether they are simple or compounded (options on options) and whether the option-decision expires or can be deferred.

As you move from proprietary, simple, expiring options (like routine maintenance of capital equipment) along the spectrum towards shared, compounded, deferrable options (like entering a new geographic market) the impact of these value-drivers is just as large, but harder to trace.

This is because numerical real options analysis draws heavily on analogies with financial instruments. Indeed, sometimes real options have an exact value that NPV will never give you. But the less your real option looks like a financial instrument, the harder it is to value.

Remember, though, that real options are not just about "getting a number". The rigour of thinking about strategic decisions as real options can help you make better decisions. Isn't this rigour just best-practice, decision-tree NPV analysis? No, not really.

Real options focus on “dynamic complexity”: the evolution of a few complex factors over time that determine the value of investment and cash flows. These are factors about which decisions can be taken at any time over a period.

Decision-tree analysis tends to consider great detail in the cash flow models and many uncertainties, but relatively little in the way of dynamic decision making; “detail complexity” if you like. There are a large number of these factors with decisions made at discrete time periods.

It would be foolish to argue that “dynamic complexity” is generally more important than “detail complexity”. Just as it would be foolish to argue that real options are anything but a complement to best-practice NPV. But real options can distil your strategic thinking into focussing on a few, key dynamic processes, where a decision-tree would overflow the largest boardroom whiteboard. In this sense, they integrate these two aspects of your investment decision making in one tractable framework.

To wrap up: valuing irreversible investment opportunities under uncertainty using NPV does not take account of managerial options and treats capital assets as passively held. A real options approach can help by valuing these managerial intangibles and preventing mistakes. Valuing real options borrows complex tools but don’t let this obscure the simple intuition. Where appropriate, real options will help you make better decisions.