Voices from Industry

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Valuing resource extraction projects using real options

Several resource extraction organizations are considering real option (RO) valuation as an alternative to the standard discounted cash-flow (DCF) method for estimating project or real asset value. RO, in this context, is the application to real assets of the derivative asset approach to valuation originally developed by Black, Scholes and Merton in the early 1970s. Derivative asset valuation was applied first to equity options, but, more generally, it shows how to value complex assets as combinations of simpler assets. As such, it has been an essential part of the transformation of financial markets and risk management over the last three decades, and won the Nobel Prize for Scholes and Merton in 1997.

The RO and DCF methods of valuation are actually quite similar. Both examine cash flows, focusing on the effects of cash-flow timing and uncertainty on value, and both can be used to determine the value of management flexibility (although DCF rarely is). Where these methods differ fundamentally is in how they determine the effect of cash-flow uncertainty on value.

RO valuation identifies the underlying sources of cash-flow uncertainty, such as input and output prices and deposit characteristics. It adjusts, using Black-Scholes-Merton techniques, each of these underlying uncertainties for risk, basing the adjustment on financial market information as much as possible. In particular, uncertainties that are not correlated with the overall economy, such as project-specific geological and technical uncertainties, have no risk adjustment because they do not affect well-diversified investors. Therefore risk adjustments are required only for economy-wide cash-flow determinants (like commodity prices), and can (and should) be specified by the senior management to maintain valuation consistency across projects.

The conventional DCF approach also identifies the primary sources of cash-flow uncertainty, but summarizes the value implications of this uncertainty with a single risk-adjusted discount rate. This rate is typically used to value all (or a broad class of) projects, independent of the underlying structure of uncertainties involved and the effects of project structure on transforming those underlying uncertainties into cash-flow uncertainties.

This seemingly small difference has important implications. By risk adjusting the determinants of cash-flow uncertainty at source, the RO method can explicitly recognize that different projects face different combinations of underlying uncertainty, that these uncertainties are resolved over time in potentially complicated ways, and that different project structures transform these underlying uncertainties into different patterns of cash-flow uncertainty. The RO method values individual projects according to their unique uncertainty characteristics, without a loss of consistency and under the control of senior management. In contrast, the DCF method, with its single aggregate risk-adjusted discount rate, assumes, usually incorrectly, that cash-flow uncertainty grows at a constant rate over the life of each project, and that all projects have the same level of uncertainty. Using a single DCF discount rate to value a wide range of projects is similar to doing a copper mine feasibility study with the assumption that its grade is equal to the average grade of all the other copper deposits owned by the company.

There are many situations for which this difference may be important. Two important classes involve:

The tradeoff between costs now and later—Examples of this include the choice between developing deeper underground reserves by sinking a shaft (more cost now) or driving a decline ramp (more cost later), and between building and operating a smelter (more cost now) or renting smelting facilities (more cost later). The discount rate used in the DCF method should be appropriate for the risk in the net cash flow of an average project. However, mining industry costs are usually less risky than net cash flows. If this is the case, DCF methods will over-discount and thus undervalue future cost savings that result from current spending, and bias the design process inappropriately toward high future cost designs.

The production capacity choice—Most industrial commodities are traded in markets where short-term shocks are dissipated by long-term forces of supply and demand. Price uncertainty in these markets grows at a decreasing rate, and the risk discount rate should decrease as we look further into the future. Therefore, the DCF approach, with its constant discounting for risk, relatively undervalues longer term cash flows, and introduces a bias in the design process in favour of shorter production profiles and higher production capacity.

The organizational costs that accrue with any change in analytical framework are a significant barrier to the use of RO. However, it has the potential to correct many of the deficiencies associated with DCF methods and provides an explicit explanation of project value drivers. Moreover, it is aligned with the renewed interest for more realism and more detailed professional validation, in mine valuation models. These reasons alone are sufficient to consider a serious investigation of real options and the benefits that might be gained from better project selection and design decisions.