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Market-based real asset valuation

Several organisations in a variety of industries are considering market-based valuation (MBV) as an alternative to the standard single-discount-rate discounted cash-flow (DCF) method for estimating real asset value.

MBV is the application to real assets of the derivative asset approach to valuation originally developed by Black, Scholes and Merton in the early 1970's. Derivative asset valuation was applied first to equity options (hence the term, "real options", that is sometimes used to describe particular versions of this overall approach to real asset valuation). More generally, MBV 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 that has taken place over the last three decades, and won the Nobel Prize for Scholes and Merton in 1997.

The MBV 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.

MBV identifies the underlying sources of cash-flow uncertainty, such as input and output prices. It adjusts, using Black-Scholes-Merton techniques, these underlying uncertainties for risk, basing the adjustments as closely as possible on financial market information (hence the term, "market-based valuation"). In particular, uncertainties that are not correlated with the overall economy are not adjusted for risk at all, because they have no impact on investors with well-diversified portfolios. This includes any uncertainty that is relevant only for the asset being considered, like the amount of oil in an oil field, the grade of a metal deposit, or the therapeutic efficacy of a potential pharmaceutical. Because risk adjustments are required only for economy-wide uncertainties (like commodity prices), which usually affect a large number of assets, they can (and should) be specified by the senior management involved to maintain consistency of valuation across assets.

The conventional DCF approach also identifies the primary sources of cash-flow uncertainty, but summarises the value implications of these uncertainties with a single aggregate risk-adjusted discount rate. This rate is usually specified by senior management, and used in the valuation of a broad class of assets, if not all assets that the organisation considers, independent of the structure of the underlying uncertainties and the effects of cash-flow structure on transforming those underlying uncertainties into cash-flow uncertainties.

This seemingly small difference has important implications for valuation.

By risk adjusting the determinants of cash-flow uncertainty at source, the MBV method can explicitly recognize:

1) that different assets face different combinations of underlying uncertainty;
2) that these uncertainties are resolved over time in potentially complicated ways; and
3) that different asset structures transform these underlying uncertainties into different patterns of cash-flow uncertainty.

The MBV method values individual assets 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 asset, and that all assets have the same level of uncertainty. Using these methods to determine asset value is similar to undertaking an appraisal programme for a potential oil field development based on an assumption, without further investigation, that the well productivity of the field will be the production-weighted average of that for all the other fields currently under production by the organisation involved. This would generally be a career-limiting move.

There are many situations in which the ability to recognize and value unique cash-flow uncertainties may be important. Three important classes of situations involve:

1) *The tradeoff between costs now and later*. Examples of this include:

    a. the choice in the mining industry between developing an underground ore-body by sinking a vertical shaft (more cost now) or using a inclined circular ramp (more cost later);

    b. the choice in the petroleum industry between building and operating new gathering and processing facilities for a field (more cost now) or renting facilities owned by others (more cost later);

    c. the choice in many industries between using high/low quality equipment with low/high maintenance requirements; and

    d. the choice at most industrial sites between investing now to reduce future de-commissioning costs or paying higher de-commissioning costs later.

    The discount rate used in the DCF method should be appropriate for the risk in the net cash flow of an average asset. However, in many industries, costs are usually less risky than net cash flows. If this is the case, DCF methods will undervalue the future cost savings that result from greater current spending and bias the asset design process inappropriately toward high future cost designs.

2) *The production capacity choice.* The constant DCF discount rate is appropriate only for uncertainty that grows at a constant rate. In most markets, short-term shocks are dissipated by long-term forces of supply and demand. This is revealed empirically in forward and future markets, where the volatility in long-term forward prices is much less than in short-term forward prices. In such markets, price uncertainty grows at a decreasing rate the further we look out. The corresponding discount rate for price risk should decrease as we look further into the future. Using a constant rate will undervalue longer-term cash-flows and inappropriately favour shorter production profiles and higher production capacity.

3) *The effects of different tax regimes on locational choice.* Different tax jurisdictions can have not only different tax rates, but different definitions of the tax base, particularly in natural resource extraction industries. This means that not only will taxation levels vary by jurisdiction, but the risks associated with taxes will differ asset by asset and jurisdiction by jurisdiction. The use of a constant DCF discount rate to value assets across jurisdictions will bias any locational choice in favour of those jurisdictions that do

not assume much risk through their taxes when compared to those where the risk in the taxes is higher.

There are still significant barriers to the use of MBV methods because of the organisational costs that accrue with any change in analytical framework.

However, MBV has the potential to correct many of the deficiencies associated with DCF methods and provide an explicit explanation of asset value drivers.

Moreover, many engineering-based industries are searching to make their valuation models more realistic. This includes a desire for:

1) the use of more detailed techniques of modelling uncertainty and asset structure; and
2) more detailed professional validation of these models.

The use of MBV will help to move this programme forward.

These two reasons alone are sufficient for decision-makers to consider a serious investigation of market-based valuation and the potential benefits that might be gained through better asset selection, design and management decisions.

This is a revised version of a column, "Valuing resource extraction assets with real options", written by Dr. Laughton and his colleagues, Michael Samis and Graham Davis, and invited for publication as part of a monthly series entitled "Voices from Industry" in the CIM Bulletin (May 2005 p.82).