A new paradigm for damage claim valuation?

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Estimating damage claim values is at the heart of any litigation proceeding. The Traditional Discounted Cash-Flow approach (hereafter, "Traditional DCF") is the most standard approach used to value a damage claim, therefore the approach courts generally rely on. However, in the 2019 Tethyan Copper Company Ltd v Republic of Pakistan arbitration, the ICSID Tribunal awarded the claimant US $7 billion using a new valuation approach referred to as "Modern DCF", whereas the valuation using the Traditional DCF approach was negative.[2]

The striking difference between these valuation results raises questions for practitioners: How does Modern DCF approach work? What drives the difference between the two approaches? Has the Modern DCF approach sound economic foundations and can it therefore be considered in other proceedings? If so, in which cases may the Modern DCF approach prove more suitable than the Traditional DCF approach to provide an accurate valuation of a damage claim? This opinion addresses these questions.[3]

How does Modern DCF work?

The traditional DCF approach models a damage claim as a stream of uncertain cash-flows received at different points in time. Each cash-flow corresponds to the difference between the profit that the claimant earned, or can effectively expect, at a given point in time and the profit that it could have earned, or could have expected to earn, at the same point in time, absent the respondent's sanctioned conduct. The value of the damage claim at the evaluation date (the Net Present Value, hereafter, "NPV") is then determined by discounting the stream of expected cash-flows with a single discount rate, the hurdle rate.

In contrast, the Modern DCF approach first adjusts each cash-flow for risk and then discounts for the time value of money. Where the main source of cash-flow risk comes from changes in prices of a traded asset, e.g. commodity prices in Tethyan Copper Company Ltd v Republic of Pakistan, the Modern DCF derives the risk-adjustment leveraging on two fundamental results from Option Pricing Theory. Modern DCF valuation was developed in the academic literature in the 80's and 90's to value mining assets and real estate development programs, and has also been used to value internet companies. Modern DCF is also often referred to as "Real Option" pricing.[4]

The first fundamental result from Option Pricing Theory is that there must be no "arbitrage opportunity" in the market: no possibility of taking an action that requires no investment, involves no risk, and yet delivers positive returns. This result imposes a strong link between market prices of traded assets and damage claim values.

To see this, consider the following simplified example from the mining industry. In year 1, gold is priced at EUR 2,000 per ounce; in year 2, the price will change. Suppose there are two possible end-of-period prices in year 2: price increasing to EUR 2,600 per ounce, or price decreasing to EUR 1,800 per ounce. Both prices are equally likely. The expected level of gold prices in year 2 is mid-way between these two, at EUR 2,200, implying an implied rate of return equal to 10%.[5] The risk-free rate is assumed to be 0%.

Consider a damage claim corresponding to the breach of a contract (hereafter the "Contract") to sell to the claimant one ounce of gold at a predetermined price (say EUR 2,000) in year 2. This contract implies that in year 2 the claimant would have had to buy from the respondent one ounce of gold at the predetermined price EUR 2,000 that it could have resold in the market. The Contract would thus have generated for the claimant a positive cash-flow of EUR 600[6] in case of a high gold price or a negative cash-flow of EUR 200[7] in case of a low gold price.

Such a risky cash-flow can be replicated as follows. In year 1, the claimant can buy one ounce of gold and borrow an amount of EUR 2,000 to finance the purchase of gold. In year 2, she sells the ounce of gold at market price - either EUR 2,600 or EUR 1,800 depending of the state of the world - and repays the loan of EUR 2,000. Hence, the claimant will either earn EUR 600 in case of a high gold price or will have to pay EUR 200 in case of a low gold price. This is exactly the cash-flow generated by the Contract.

[1] The views expressed in this report are those of the authors Frédéric Palomino, Senior Vice President, and Guillaume Duquesne, Vice President, who are employees of Compass Lexecon.
[2] Tethyan Copper Company Pty Limited v. Islamic Republic of Pakistan, ICSID Case No. ARB/12/1, Award (July 12, 2019). Retrieved from https://jusmundi.com/en/document/decision/en-tethyan-copper-company-pty-limited-v-islamic-republic-of-pakistan-award-friday-12th-july-2019
[3] This opinion does not aim at discussing which one of the two approaches was better suited in the Tethyan Copper Company Ltd v Pakistan dispute.
[4] The Real Option approach was first developed by Brennan and Schwartz to value natural resources, see Brennan & Schwartz (1985) "Evaluating Natural Resource Investments" and "A New Approach To Evaluating Natural Resource Investments". For a more general treatment of real options see Dixit & Pindyck (1994) "Investment under uncertainty".
[5] 10% = (0.5x2,600+0.5x1,800)/2,000 – 1.
[6] 2,600 -2,000 = 600.
[7] 2,000 -1,800 = 200.

The principle of absence of arbitrage opportunity implies that the damage claim value (or the price of the Contract) is equal to the cost of this identical portfolio (or replicating portfolio): namely the gold price in year 1 net of the borrowed amount, EUR 2,000. This is because if the claim value deviates (e.g. is higher) than this cost, one can create an arbitrage position in year 1 by selling the Contract, buying one ounce of gold and borrowing an amount of EUR 2,000: such a riskless position leads to a positive cash flow in year 1 – the price of the Contract – but generates no cashflow in year 2. Table 1 below shows cashflows of the arbitrage position.

Table 1 : Cashflows of the arbitrage position (EUR)

Arbitrage position	Year 1	Year 2	
		Low gold price	High gold price
Sell Contract in year 1	Price of the Contract	+200	-600
Buy one ounce of Gold in year 1 and sell it in year 2	-2,000	+1,800	+2,600
Borrow in year 1 and repay the loan in year 2	+2,000	-2,000	-2,000
Net revenue	**Price of the Contract > 0**	**0**	**0**

The second fundamental result from Option Pricing Theory is that absence of arbitrage opportunity is equivalent to "risk-neutral pricing", which derives asset valuation under the assumption that investors do not ask remuneration for risk.[8] This result provides a simple tool to estimate damage claim values, without having to determine the replicating portfolio.

We can illustrate risk-neutral pricing using our previous example. An investment in gold in year 1, when the gold price is EUR 2,000 per ounce, should deliver the risk-free rate as a return between year 1 and year 2 in a risk neutral economy: i.e. there is no remuneration for risk. This has a strong implication for the likelihood of observing high and low gold price in year 2 in such a risk neutral economy. The risk neutral probability of the gold price reaching a value equal to 2,600 in year 2 therefore becomes $p^*= 0.25$, and the probability of getting 1,800 is then equal to $1-p^*$: 0.75.[9]

Accordingly, the Modern DCF estimates risk adjusted cash-flows as the expected cash-flows in this risk neutral economy. In our example, using these risk neutral probabilities to value the Contract, we obtain that the damage claim value is (still) equal to the gold price in year 1 minus the predefined price EUR 2,000 in the Contract.[10] With these risk neutral probabilities, the Modern DCF approach can actually value in year 1 any damage claims whose value depends on the gold price in year 2.

Illustrating the Modern DCF approach using Tethyan Copper Company Ltd v Republic of Pakistan

In a simplified version of the case, suppose the ICISD Tribunal had only to assess the lost value of a gold mine with a lifetime of two years, and the gold price evolves as in our example, i.e.: in year 2, the market price is either EUR 2,600 or EUR 1,800 depending of the state of the world. The decision to develop the mine is irreversible, such that after development it is not possible to disinvest and recover the expenditure. Suppose that (a) development and extraction can be started immediately, requiring an investment outlay of EUR 23 million, and (b) there is no variable extraction cost. The mine production profile is known ahead of time: production in year 1 is expected to be 1,000 ounces in year 1, and 10,000 ounces in year 2. Risk over the value of the project is closely related to the dynamics in gold prices.

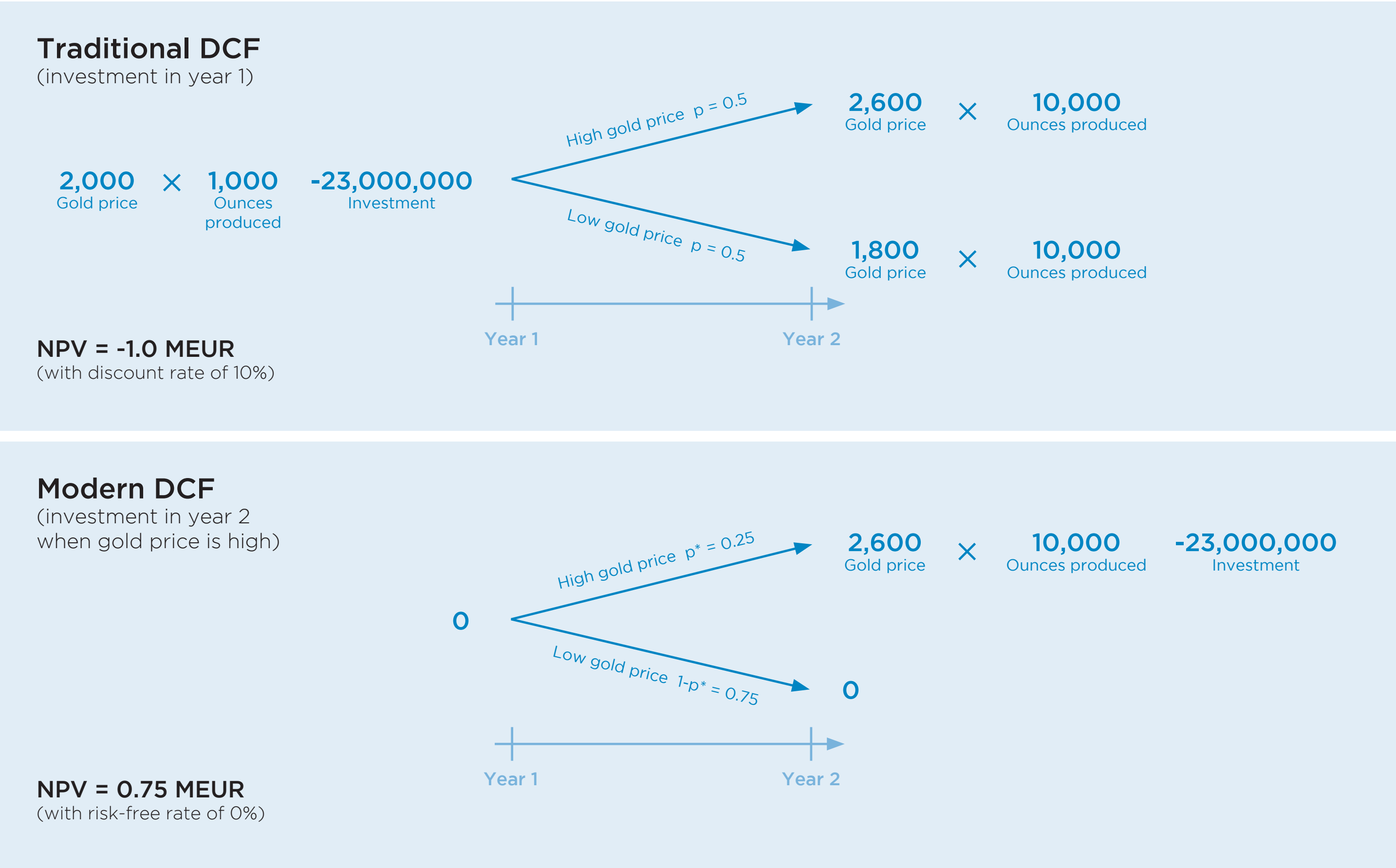
The Traditional DCF leads to an NPV of the expected cashflows which is negative, equal to minus EUR 1.0 million.[11]

However, in practice, capital investments are not usually a "now or never" proposition. The claimant could have waited for a year to see how gold prices develop before making an investment decision. At a high gold price, the value of the mine would equal EUR 26 million in year 2. At that value, it would be profitable to invest EUR 23 million and the NPV would equal EUR 3.0 million. At a low price, the claimant would not have decided to invest, as the value of the project would be only EUR 18 million: a value lower than the fixed production cost, EUR 23 million.

[8] This means that investors only require a rate of return equal to the risk-free rate for investing in a risky project.
[9] p^* is the probability that ensures that the return of the gold price is equal to the risk-free rate, i.e. p^* verifies $p^* \times 2{,}600 + (1-p^*)\times 1{,}800 = 2{,}000$.
[10] $0.25\times(2{,}600-F) + 0.75\times(1{,}800-F) = 2{,}000 - F = 2{,}000 - 2{,}000 = 0$.
[11] As mentioned supra, the expectation of future gold prices has an implied required rate of return equal to 10% which would correspond here to the cost of capital of the mining business, and thus the discount rate to be used in the Traditional DCF. 1,000*2,000 + 10,000*(0.5*2,600 + 0.5*1,800)/1.1 – 23,000,000=-1,000,000.

Accordingly, the value of the mine is positive, equal to the value of an option of investing in case of a high gold price in year 2. This option value is not reflected in the Traditional DCF approach which assumes an investment in year 1. In contrast, the Modern DCF accounts for it and makes use of all available information in the market (here the evolution of the price of gold). The Modern DCF approach leads to a positive NPV of the damage claim value, equal to the expected cash-flow in the risk neutral economy: EUR 0.75 million.[12]

Figure 1 : Valuation of the Tethyan Copper Company Ltd v Republic of Pakistan claim under both the Modern and the Traditional DCF



Why do we see such large differences of valuation between the Traditional DCF and the Modern DCF approaches?

It is now easier to understand what could have driven the difference between the two valuation in Tethyan Copper Company Ltd v Pakistan: the Modern DCF corrects two main limitations of the Traditional DCF approach.

A first limit of the Traditional DCF approach is that it does not properly account for all available information in the market. For example, it assumes that the level of risk is constant across time periods so that discounting cash-flows with a single discount rate would be appropriate. This may in some instances lead to an overestimate of the discount applied to some cash flows. One such instance is where cash-flows are exposed to changes in commodities prices. In particular, when prices exhibit a mean-reversion pattern (e.g. copper), the Traditional DCF approach is likely to underestimate the damages claim value as the risk associated with long-term cash-flows will be too large. As a consequence, these cash-flows will be discounted at too high a rate, leading to an underestimate of the damages claim value. The Modern DCF makes use of all the information available in the market to properly reflect the strong link between market prices of traded assets and damage claim values.

A second limit of the Traditional DCF approach is that it does not account for managerial flexibility, such as options to abandon, expand, or delay investments and production in response to changes in market conditions. As an option always has a positive value, ignoring these options will lead to an underestimate of the damages claim value. Moreover, as in the case of financial options, the larger the uncertainty about the value of a project without the options, the larger the value of those options.[13] When the value of the options is large, the Modern DCF and the Traditional DCF valuations are likely to be very different.

[12] Given the assumption of a zero-interest rate, the risk-adjusted probability of a high price is equal to 0.25. Therefore, the NPV of the project using the Modern DCF approach is equal 0.25*3= EUR 0.75 million.

[13] In the case of financial options, this uncertainty is measured by the return volatility of the underlying asset.

In which cases may the Modern DCF approach prove more suitable than the Traditional DCF approach to provide an accurate valuation of a damage claim?

All the challenges faced in determining the appropriate discount rate in the Traditional DCF approach are transferred to the problem of determining appropriate cash-flow specific risk adjustments in the Modern DCF approach. As explained, this risk-adjustment can be easily derived from option pricing theory in cases where the main source of cash-flow risk comes from changes in prices of a traded asset. In such cases, the Modern DCF can significantly improve the valuation – even more if flexibility matters.

For instance, the Modern DCF will typically suit situations where cash flows correspond to margins generated by a power plant or a gold mine. In the former case, the cash flows are expressed as the unit margin of the power plant multiplied by the volume of electricity produced. The unit margin is equal to the electricity price (output) minus the price of coal for a coal-fired power plant (and the cost of required CO^2 permits) adjusted for the efficiency of the plant. In the latter case, the cashflows are expressed as the unit margin of gold extraction net of extraction costs multiplied by the volume of gold extracted.

The use of the Modern DCF for these real-world examples is generally more complicated than in our example, but the principle is the same. One will have to model the evolution of the price of the traded asset in a risk neutral economy.[14] We will then have to estimate risk-adjusted cash-flows as expected cash-flow in the risk neutral economy using simulations. For example, in a Monte Carlo simulation we would simulate a large number of possible price paths in a risk neutral economy. For each possible price path, we would obtain realized cash-flows. Then, averaging over all the simulated price paths, we would derive risk-adjusted cash-flows and after discounting with the risk-free rate we would obtain the value of the damages claim. This approach remains flexible enough to take into account information that would have been made available to the claimant during the life of the project and actions they could have taken to maximize the value of the project as a result of the information received.

The implementation of the Modern DCF in such real-world examples will critically depend on the ability to properly model the price of the traded assets and, ultimately, on data availabilities.

Conclusion

As illustrated in the Tethyan Copper Company Ltd v Pakistan case, the Traditional DCF and the Modern DCF can provide very different valuation results. From a theoretical point of view, the Modern DCF is certainly more accurate than the Traditional DCF. The main reason for not using the Modern DCF approach – and relying on the Traditional DCF – in practice is its complexity and data availability, particularly the need to properly model the evolution of prices of traded assets. Therefore, the use of one method over another needs to be considered on a case-by-case basis. The additional complexity of the Modern DCF needs to be balanced against the improvement in the accuracy with which it estimates the damage claim value. It may particularly suit situations where sufficient data are available and when the option value is important, driving a large difference between the two approaches.

[14] The two probabilities in our example: a 0.25 chance of the high price and a 0.75 chance of the low price.