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PREFACE

The past year has confirmed the usefulness of *The Investment Treaty Arbitration Review’s* contribution to its field. The biggest challenge for practitioners and clients over the past year has been to keep up with the flow of new developments and jurisprudence in the field. There was a significant increase in the number of investment treaty arbitrations registered in the first years of this decade. These cases have come or are now coming to their conclusions. The result today is more and more awards and decisions being published, making it hard for practitioners to keep up.

Many useful treatises on investment treaty arbitration have been written. The relentless rate of change in the field rapidly leaves them out of date.

In this environment, therefore, *The Investment Treaty Arbitration Review* fulfils an essential function. Updated every year, it provides a current perspective on a quickly evolving topic. Organised by topic rather than by jurisdiction, it allows readers to access rapidly not only the most recent developments on a given subject, but also the debate that led to and the context behind those developments.

This third edition adds new topics to the *Review*, increasing its scope and utility to practitioners. It represents an important achievement in the field of investment treaty arbitration. I thank the contributors for their fine work in developing the content for this volume.

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Part V

DAMAGES
Chapter 20

THE DISCOUNTED CASH FLOW
METHOD OF VALUING DAMAGES IN ARBITRATION

Jeff D Makholm¹

I INTRODUCTION

The discounted cash flow (DCF) model is a widely used and effective method for valuing enterprises. As such, it is useful for assessing damages associated with enterprise lost profits in international arbitration. The strengths of the DCF model relate to its straightforward simplicity, the way in which it embraces the income and growth prospects for an enterprise, and the way it incorporates the market’s assessment of investment risk in particular parts of the world. Particularly for cases involving infrastructure assets, such as regulated enterprises or those supporting competitive oil and gas or transportation markets, the DCF model is popular among tribunals as an objective method that focuses on the essential underlying elements that spur such arbitrations – the interruption of stable, going-concern profitability.

Being so computationally straightforward, a paradox in the use of the DCF model is that it was invented only comparatively recently. In creating the DCF model, economist Myron Gordon sought to bring together economic theory and the longstanding rule-of-thumb practices of financial analysts of the late 1950s: what he called the ‘imprecise’ finance literature. That is, he grounded those financial practices with a theoretical economic foundation. The resulting DCF model he described soon came to the attention of administrative regulatory agencies, courts and arbitral tribunals as a usefully objective and tractable tool for deriving enterprise value and the cost of capital when used with objective market, industry or enterprise data.

II THE DCF AMONG ITS PEERS FOR ENTERPRISE VALUATION

In cases where courts or arbitral tribunals must value an enterprise in a dispute, it is widely accepted that there are three available methods of doing so. The first looks to the cost of the enterprise’s assets. The second is based on the market value drawn from the arm’s-length sale of similar enterprises. The third charts the expected income from the enterprise as a going concern brought back to the present – of which, the DCF model is the principal method.² All three have useful attributes under the right circumstances.

Valuation based on the first of the DCF’s peers – the cost of the assets involved (either recorded-book cost or replacement cost) – has some applicability to regulated enterprises,
but it is sharply limited when assessing the going-concern value of infrastructure assets. Both book value and replacement value of business enterprises make allowances for depreciation as a matter of course. There has always been an unresolved tension between economists' and accountants’ views of the role of such depreciation. To economists, the periodic charges for depreciation do not reflect the current value of the property. Rather, such charges reflect an allocation of the costs for investment decisions already made. In other words, such depreciation charges:

> refer to an expenditure that has already taken place, and are merely a special method of writing history. Depreciation accounting enables the business firm to make several ledger entries, instead of one, when a capital expenditure occurs.\(^3\)

As such, depreciation charges are only useful in determining the value of enterprises if future profitability is somehow a function of those depreciation charges – as is the case with regulated enterprises for which consumers’ prices are derived from investment costs, including depreciation. But even then, the accounting basis for setting charges would have to be well established for such regulated enterprises, which is generally not the case for regulation outside of North America – and certainly not the case for unregulated enterprises anywhere.\(^4\)

For the second DCF peer, valuations based on market prices depend on comparability in arm’s-length sales. As awards in court or before arbitral tribunals are designed to assess an objective value for an enterprise, a market price is generally only applicable to demonstratively similarly situated enterprises. Such would be the case for a dispute related to land or housing where reasonable markets exist involving related transactions of sufficient numbers to create a usable sample of comparative transactions. But the nature of international arbitration involves cross-border disputes with unique firms for which comparable transactions can be rare or non-existent (either because of the site-specific nature of the investments or the unique nature of the international market served).

Apart from site-specificity, which reasonable observers can probably judge for themselves, economists have long studied whether the technologies inherent in particular businesses permit reasonable comparisons for regulation, damage assessment, or the evaluation of organisational efficiency.\(^5\) The literature points to the problems inherent in making comparisons across enterprises in the private sector. Market comparisons between private enterprises are sharply limited in situations where input choice or ‘environmental factors’ (a broad category including differing countries, institutional environments and industrial histories) cannot be controlled. Any direct comparison of sales prices among enterprises assumes that they all can attain the same level of production given their factor endowment – that is, that they belong to the same production function. While such an

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assumption may hold for some public sector enterprises (such as public schools, for example) or for particular private sector applications (such as the ubiquitous Starbucks coffee shops), it does not generally hold for the type of assets involved in international arbitration.6

The inherent difficulties associated with cost or market price for direct comparisons of damages in arbitration are thus reasonably straightforward – which is a principal reason why the income approach represented by the DCF method is so evidently popular among tribunals. To be sure, the DCF method also draws upon market benchmarks – in particular, the cost of capital specific to the type of enterprise and its location in the world (i.e., risk indexes drawn from the competitive capital markets). However, the principal innovation of the DCF method is how it uses that market information to tie finance to an underlying economic theory.

III ORIGIN OF THE DCF MODEL

In an era of intense interest and research into stock valuation models and methods, and highly sophisticated markets in financial instruments, it is useful to reflect briefly on the comparatively backward nature of the field of business valuation in the 1950s. For the purpose of either determining the value of enterprises or the related cost of equity capital for such enterprises, there was no overlap between the methods developed by stock analysts (and actuarial analysis by insurers) and neoclassical theoretical economic inquiry.

In 1962, Gordon produced his theoretical work on the value of corporations reflecting his published research in the late 1950s.7 His book constituted both a deconstruction of economists’ various theories of investing and a straightforward presentation of a new method of valuing business enterprises. Prior to Gordon, economists had only highly abstract theoretical models of firm investment flowing from Keynesian theories of income determination. They had to rely on ‘business practices’ to investigate problems of investment and financing. Gordon offered something better: a theoretical foundation for explaining the value of a corporation that could, in turn, be used to find the cost of capital without resorting to ad hoc business methods. Gordon’s success made him famous. The ‘Gordon growth model’ is part of all modern finance courses and textbooks.

The economic theories of the era embodied the assumptions that the future is certain and the firm can borrow freely at a given rate of interest.8 When trying to bring uncertainty into their theoretical analyses, economists became irretrievably bogged down in particular complicated cases that did little more than provide ‘a very able statement of the generalization found in the unprecise literature of finance’, as Gordon wrote.9

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What Gordon was after was a cogent tie between neoclassical economic theory and the generally accepted notions that a firm’s value is a function of its investment. As he wrote:

under neoclassical theory, the objective of the firm is to maximize its value, the value is a function of its future income, and the future income is a function of its investment. The task of the theory is to provide information on the nature of these two functions.\(^\text{10}\)

As is often the case in economics, advances in theory are often less like Darwin’s ‘gradualism’ and more like the late evolutionary biologist Stephen J Gould’s ‘punctuated equilibrium’—with episodic evolutionary leaps. Gordon’s theoretical discovery was such a leap, taking one page of not-too-difficult mathematics to tie maximising value, to future income, to future investment. The result was the first statement of the DCF model in the economic literature: \(^\text{11}\)

\[ P_0 = \frac{(1-b)Y_0}{k-rb} \]

\textit{Equation 1}

Where:

- \(P_0\) = price of a share of common stock,
- \(b\) = the fraction of income retained in future period (i.e., not paid out as dividends),
- \(Y_0\) = income per share,
- \(k\) = required return on investment, and
- \(r\) = expected return on investment.

Gordon recognised that for his theory to be of any practical use, it had to have some means for establishing \(k\), an enterprise’s cost of capital. Solving for his model for the cost of capital gives the following:

\[ k_e = \frac{D_0(1+g)}{P_0} + g \]

\textit{Equation 2}

Where:

- \(g\) = \((r) \times (b)\),
- \(P_0\) = price of stock,
- \(D_0\) = previous dividend paid,
- \(k_e\) = cost of equity, and
- \(g\) = expected dividend growth rate.

\(^{10}\) Gordon, 1962, p. 43.

\(^{11}\) Gordon cited Gordon, M., and Shapiro, E., ‘Capital Equipment Analysis: The Required Rate of Profit,’ \textit{Management Science}, Volume 3, Issue 1, 1956, as the first appearance of the theory. Gordon noted that other writers claimed the equation reflected a standard actuarial formula. He also noted that those formulae had no economic content and did not deal with the future values of \(b\), and particularly \(r\).
Here, the rate of profit investors require on a share of stock is equal to the dividend yield at which it is selling (the first term on the right hand side of the equation) plus the rate of growth in the dividend (the second term).

IV WHY THE DCF METHOD WORKS

As outlined by Gordon when he first presented the theory, the key theoretical advance of the DCF model was that it did not presume that investors knew more than they could reasonably know. They had only broad notions of how investment conditions would change in future years. That is to say, the DCF worked because it simplified the future by not overstating the kind of information that investors use to make decisions in the market. Specifically, the values of $r$ and $b$ (the expected return on investment and the retention rate) are not dated – Gordon assumed them to be constant. Without such an assumption, any investment model would quickly become empirically unmanageable – the very problem that had vexed those earlier economists trying to link economic theory with finance. But as Gordon correctly observed, investors rarely have any clear notion of how such variables change over time – and in any event it is reasonable to conclude, without specific information to the contrary, that retention ratios and expected returns are stable for going concerns. Established corporations commonly follow a policy of paying a stable fraction of their earnings as dividends. Also, investors will only have, at best, a broad idea as to any future change in the expected return on investments.

With such an assumption, the value of a share of stock is merely a function of the current dividend and the rate of growth of those dividends (which is a product of $b \times r$). Indeed, Equation 1 can be written out to include the whole future income stream discounted by a constant expected cost of capital, $k_e$, as follows:

**Equation 3**

$$P_0 = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_n}{(1+k_e)^n} + \ldots$$

Alternatively:

**Equation 4**

$$P_0 = \frac{D_0 (1+g)}{(1+k_e)} + \frac{D_0 (1+g)^2}{(1+k_e)^2} + \ldots + \frac{D_0 (1+g)^n}{(1+k_e)^n} + \ldots$$

This is the form of the DCF model (for which Equation 1 is merely a mathematically reduced form) that populates the values supporting damage estimates before arbitral tribunals. This particular DCF model values a share of stock according to a discounted stream of future dividends growing at a constant rate, $g$. Although the basic Gordon model uses dividends to compute a share value, dividend payments are not necessary for such an analysis – cash flow or earnings can be used instead as these are more reflective of the value that investors place in the future profitability of the enterprise. But that assumption of a constant rate can be changed if data on near-term expected growth differs from long-term growth. For example, corporate business plans may specify near-term income growth, $g$, reflecting particular business conditions known by management – after which, a long-term growth rate deals with future years.
V THE STRENGTH OF THE DCF MODEL IN PARTICULAR INDUSTRIAL AND INSTITUTIONAL SETTINGS

The attraction of such a theory for administrative agencies and arbitral tribunals soon revealed itself. Gordon himself describes how he was retained in 1966 to provide evidence before the US Federal Communications Commission (FCC) on the cost of capital of AT&T. The FCC appreciated the straightforward simplicity of such a theoretical model that rendered AT&T’s cost of capital as the sum of a measurable dividend yield and a growth rate. The agency was highly complimentary regarding Gordon’s analysis, structuring its findings to be consistent with it, and encouraging further study of the DCF model.\(^{12}\) As a result of that first application to regulated enterprises, the DCF model has dominated tariff proceedings in the US and Canada to find the cost of capital for regulated firms.\(^{13}\)

Used to derive the price of a share of stock, \(P_0\), as in Equation 4, the DCF model has become the principal ‘income-based’ method for valuation. In such a form, the model has wide-ranging applicability in a number of contexts. It is useful to assess the loss of a business in its entirety and lost profits within an ongoing concern. It is also useful for both measuring direct damages (e.g., for the loss a particular productive asset) and indirect damages (e.g., flowing from changes in risk – affecting return – or prospective growth rates). Essentially, the DCF model is a framework within which to apply financial and operating information, both from the enterprise in question and from the surrounding markets (including capital markets). The accounting and operational data used to populate the model in any particular setting depends on what is available, and if none is readily available, the obvious alternative is to use the shortest and most objective path to developing useful proxies. Such work is conceptually straightforward but, often enough, complex and subject to dispute in such settings as international arbitration, where objectivity is of paramount importance.

The DCF model has particular applicability in industries characterised by the dedication of capital to certain sorts of going concerns relating to regulated or competitive markets – those industries where the assumptions of constant retention ratios and growth rates work well. Such businesses include regulated utilities and oil and gas companies with capital facilities that support competitive markets (such as liquefied natural gas (LNG) terminals, refineries, port facilities or airports) where long-lived infrastructure investments, in particular locations with specific supply and demand conditions and risks, require a valuation method that takes into account a long-term payoff for unique arrangements of assets.


\(^{13}\) Alfred Kahn gives the derivation of this model. See: Kahn, Alfred E., *The Economics of Regulation; Principles and Institutions*, John Wiley & Sons, Inc., New York (1970), Volume 1, Appendix A, pages 58-60. The persistent popularity of the DCF model for determining the cost of capital for US regulatory agencies contrasts with the way in which the capital asset pricing model (CAPM), of economists Franco Modigliani and Merton Miller, dominates regulation in much of the rest of the world. See: Makholm, J.D., ‘Mysterious Cost of Capital for Energy Utilities’. *Natural Gas and Electricity*, Vol. 34, No. 3 (June 2017), pp. 28–32.
VI USE OF THE DCF MODEL WITH DIFFERENT INDUSTRIES AND COUNTRY RISKS

The DCF model takes all future income streams, whether growing at a constant rate or not, and brings them back to a particular point in time by which to measure value and damages. Because international arbitration customarily deals with relationships between countries of varying levels of market investment risk, it is important to obtain an objective $k_y$ representing the risk to which capital is exposed in any particular industry and country.

Both industry risks and ‘country risks’ are readily available from reliable and objective published sources for the purpose of deriving the cost of capital. For instance, there are useful sources regarding the capital structure and capital costs (both for debt and equity) for the analysis of both broad and specific classes of businesses available in the United States (the broadest capital market). In addition, there are also usable objective sources that can place capital costs drawn from OECD countries into those regions with measurable country risk, which are available from the Stern School of Business at New York University.

VII THE DCF FOR REGULATED ENTERPRISE VALUES AND DAMAGES

The DCF model is particular useful for regulated enterprises, which are supposed to have the stable parameters of earnings retention and growth that the DCF model specifies. Credible regulation is the foundation for a system of investor-owned public service providers. Governments can conscript capital in the form of taxes for use by their own publicly owned utilities. Private owners of public service companies (like utilities and toll road concessions), however, can only attract investors’ capital on reasonable terms by showing that it is realistically safe from loss and will be repaid with a reasonable rate of return through a transparent system of regulated prices. Because of this inherent exposure, regulatory institutions for such companies tend to be highly credible in the eyes of the investors.

Privatisation has been one of the more important economic developments of the past two decades, as governments try to improve utility services and end the drain on public funds. The privatisation trend effectively began in the United Kingdom in 1979. Between 1979 and 1992, 39 UK companies were privatised by share sales. Numerous countries followed Britain’s lead. Between 1988 and 1993, roughly 2,700 state-owned enterprises in more than 95 countries were transferred to private interests, raising more than US$270 billion. Privatisation has been one of the more important economic developments of the past two decades, as governments try to improve utility services and end the drain on public funds. The privatisation trend effectively began in the United Kingdom in 1979. Between 1979 and 1992, 39 UK companies were privatised by share sales. Numerous countries followed Britain’s lead. Between 1988 and 1993, roughly 2,700 state-owned enterprises in more than 95 countries were transferred to private interests, raising more than US$270 billion.

Argentina brought regulated utilities into the world of international arbitration in a major way. In the first part of the 1990s, Argentina privatised government-owned businesses in many sectors of the economy (e.g., telecommunications, electricity, natural gas, petroleum, air travel, highways, railways, ports and water supply) for proceeds estimated to be well over

14 Sources include: The Ibbotson Cost of Capital Yearbook, published by Morningstar, a provider of independent investment research in North American, Europe, Australia and Asia up until 2014, when it was superseded by the Duff & Phelps Cost of Capital Yearbook (also published by Morningstar).
US$22 billion. In January 2002, Argentina unilaterally suspended the US-dollar terms and called for a renegotiation of terms in all privatised concession contracts, leading directly to rapid default on the dollar obligations of the country’s privatised businesses. By November 2004, 74 cases were pending before the World Bank’s International Centre for Settlement of Investment Disputes (ICSID), of which, 30 involved claims against the Argentine government by oil, gas and utility companies looking to be compensated for losses incurred subsequent to the emergency law. The awards in those Argentine cases tended to use the DCF model for damages.

VIII THE DCF MODEL IN ROAD TRANSPORT INFRASTRUCTURE DISPUTES

Latin America has a strong history of toll road privatisations, starting in 1991 in Chile. Many toll road concession projects followed in Argentina, Brazil, Chile, Colombia, Mexico and Peru (countries with significant private participation programmes). Many of these toll road privatisations have resulted in investment disputes (except in Chile, which uniquely adopted advanced economic bidding rules that tended to minimise such disputes).

Toll road disputes are tied to future toll and cost uncertainties, for which objective measures of traffic and growth are available from published sources. As a result, the DCF analysis, charting bid expectations against out-turns both in terms of costs and traffic, is the most practical method to get to the source of damages.

IX THE DCF MODEL IN OIL, GAS, LNG AND PIPELINE DISPUTES

Oil, gas and related transportation infrastructure involve moving fuels to market. Whether the production and transport infrastructure have value in their respective markets is a conceptually straightforward (although often empirically complicated) function of comparing costs to product values over a useful time horizon. Some of those fuels (like crude oil) have liquid spot and futures markets that depend on the question of the underlying value of the enterprises that support such markets.

The value of oil, gas and LNG in such volatile fuel markets depends critically on location, as well as the availability and type of transport, which in turn is tightly tied to geography. In that respect, the cost of moving fuels from origins to destinations is a critical feature of DCF investments, and is also well documented in the economic literature on the subject of the geographic driver of industry costs. DCF analysis of damages related to the production of such fuels readily adopts the costs for transport, reasonable projections for production costs and the readily identifiable markets is those fuels themselves – both from spot and futures markets if they exist (such as Brent or West Texas Intermediate for crude oil, or Henry Hub for gas).

X CONCLUSION

There have been a number of recent assessments of the DCF model available to the audiences of legal practitioners in the field of international arbitration. Some look closely at the accounting inputs needed for the model and others on the particular facts of the model’s use in specific cases. While such reviews are useful, they do not reflect what, to economists, is the ultimate underlying attraction of the model among the various methods of deriving value. That ultimate attraction is that the DCF model links together finance and economic theory in an uncertain world in a highly effective way. Far from being unduly abstract or restrictive as a model of investment behaviour, the DCF model has a demonstrated track record among administrative agencies, courts and arbitral tribunals. The method reasonably ties market expectations with measurable features of current markets, yet makes no aggressive claims about what is known about future business conditions. Its underlying economic assumptions strengthen the DCF model’s use by international tribunals for whom objectivity is of paramount importance.
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Dr Makholm concentrates on the issues surrounding the privatisation, regulation and operation of resource and infrastructure industries, including those that operate networks (such as oil and gas pipelines, electricity transmission and gas distribution systems, telecommunications, and water utility systems) and those operating at specific sites, such as oil refineries, electricity generation plants, oil and gas storage facilities, gas treatment plants, mines, sewage treatment plants, and airports. Disputes for such industries include the broad categories of valuation, pricing, market definition (including assessments of market power and mergers), and the components of reasonable regulatory and business practices.

On such issues, among others, Dr Makholm has prepared expert testimony, reports and statements, and has appeared as an expert witness on more than 250 occasions in LCIA, AAA, International Chamber of Commerce and ICSID cases, high courts in a number of countries (including US District courts), regulatory commissions and parliamentary panels.

In Who's Who Legal: Arbitration, the ‘superb’ Dr Makholm was singled out for his work as an expert witness. Who’s Who Legal: Consulting Experts (Quantum of Damages) reported that Dr Makholm ‘is extremely knowledgeable and well thought of as an expert witness’.

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