

## Valuation Tools for Determining the Value of Assets: A Literature Review

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**Abstract** *The scope of this paper is to present a literature review upon the historical evolution of the tools and methods used for valuation tools where risk and uncertainty are considered, as these features have significant impact on the value of the investment. This article aims to review the literature behind the valuation theory and to foster a debate on the existing gap between current financial and real option methods used for corporate value measurement. In this paper, different valuation models are addressed along with discussions based on applicability and constraints. This paper divided the valuation approach to traditional and modern valuation approach based on the applicability of the methods. Additionally, this paper discusses the gaps between finance theory and strategic planning. This article concludes that by integrating theoretical requirements for modeling, risk and uncertainty, the path from financial based option theory to real option pricing theory could be adjusted.*

**Key words** Valuation tools, valuation approaches, financial valuation, real option model, DCF model

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### 1. Introduction

Growth business requires new capital investment, and therefore, over the time scholars have attempted to develop theories, models, and framework meant to provide investors and decision maker with supportive valuation tools which can help in making better decisions, and gaining the maximum value of their investments (Boor, 2012). Finance theories have been developed during the last four decades. Although theorists from the corporate finance field have significantly contributed to valuation models, decision makers and investors have struggled with understanding what limits the value of a company and how to assess this value. Thus, a wide range of financial theories and methods were developed as a prerequisite for making decisions (Roos, 2012). Despite being different in terms of perspective, these methods are highlighting the fundamentals that set the value of a firm. According to Keown (2002), valuation is seen as having a central role in finance and nearly everything in finance could be classified under a subcategory of valuation. This article aims to foster a debate on current corporate valuation methods used to understand and measure the value of a company. Freeman (2009) argued that real and nominal discounted cash flow analysis should not be viewed as being equivalent and grounds his findings by using more real rather than nominal discounting. In this paper the discounted cash flow (DCF) model will be discussed based on the fact that the value of assets is the discounted present value of the expected cash flow of the assets article (Torrez *et al.*, 2006).

Several papers approached the market risk premium and the variance of market portfolio returns relationship using various proxies for the market portfolio (Chou *et al.*, 1992; French *et al.*, 1987; Merton, 1980). Another two models studied in this article and accosted by financial analysts are the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Models (APM), in order to create a linkage between risk and equity returns. In this paper the neo-classical model of investment will be also integrated and discussed. The model takes into consideration the interest rates, capital asset costs and tax policies when relating to the desired capital stock. The asset pricing model applies to modeling risk, but Chiang and Doong (1999) conclude that the literature of corporate finance has not specified the stated variables that characterize the uncertainty. Moreover, in the same paper the authors foster a debate on whether stock excess returns

could be explained through real or financial volatility. Tobin's q Model, Sales Accelerator Models and Cash Flow Models of Investment are also reviewed and discussed in this paper. These methods are used to measure and explain the relation between investments and the value of the company. Another analyzed aspect by theorists is the growth potential of a company's value. Therefore, the Economic Rents (ER) and Excess Market Value (EMV) concepts are explained. The Economic Rents refer to the economic profit generated from operational activities and EMV reflects the valuation of the market, which is attributed to an expected ER (Torrez et al., 2006).

The real option theory was investigated in-depth by Damodaran, Boer and Mun in 2002. In addition to offering a description of the real options methods used in valuation, the authors showed in which situation and under which conditions the real option valuation should be applied. The last part of the article focuses on illustrating and analyzing different methods which allow analysts to measure value by taking into consideration the company's ability to react to economic changes. These methods are defined in the recent literature as Real Option Valuation (ROV), also known as Real Options Analysis (ROA). In addition, as an extension of these methods, the Real Option Game Theory is particularized in this paper.

## 2. Literature review

The literature of corporate finance recognizes three approaches to valuation (Lee, 1996; Reilly and Schweih, 1999). The first - discounted cash-flow valuation, the analysis is related to discounting expected cash-flows at a risk discount rate in order to estimate corporate value. The second approach is known as relative valuation where the value of an asset could be determined by analyzing asset price in relation to other variables as book-value, earnings or cash-flow. The third and the most researched in the past decade was contingent claim valuation that uses option pricing models (OPM) to estimate the value of assets with the characteristics of an option (Wang and Halal, 2008). In this paper different valuation models are discussed along with discussions based on applicability and constraints.

### Traditional valuation approach

For many years, investors used the discounted cash flow model as **valuation methodology** to value new investment, firms, or asset considering the issue of time value of money. Discount Cash Flow model (DCF- model) is one of the most applicable models when it comes to valuation of assets of firms. According to Boer 2002, Discount Cash Flow model (DCF-model) consists of four main parts which are: net present value, internal rate of return, and risk weighted cost of capital. According to Bragg (2013) the two most-used tools for evaluating an investment are the net present value (NPV) and the internal rate of return (IRR).

#### 2.1. Net present value

The net present value (NPV) is a beloved methodology to evaluate a project investment for firm investment purpose. The NPV can be recognized by looking for the differences between the present value of cash inflows and outflows (Ross *et al.*, 2012). The net present value (NPV) includes the initial cash flows such as the cost of an asset with all other cash flow. This valuation method can answer a question such as: How much value is created from undertaking an investment? Or how much this investment worth considering the time value of money. In order to calculate the NPV we have to predict the future cash flows and the required return for projects, and the final stage is to find the PV of the cash flows and deduct the first investment to get the NPV of the assets or investment (Bragg, 2013) However, NPV has been criticized from different scholar, for example, Myers (1984), Pindyck (1991), and Trigeorgis (1993) all have discussed and agreed that NPV is ignoring the flexibility of real asset investment. The DCF-model use future cash flow and discount it at a present value and relate also to dividends and accounting earnings. The basic model of DCF takes the following form (Roos *et al.*, 2012):

$$P = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} \dots \dots \dots + \frac{CF_\infty}{(1+r)^\infty} \quad (1)$$

Where  $r$  is the discount rate,  $P$  is the stock price;  $CF$  shows the expected cash flows for a certain period. Researcher such as Kenneth (1982), and Fama and French (1988) have used the dividend yield concept to show how much they influence the returns in a small period of time. A literature review of Torrez et al (2006) has summarized and discussed the role of researchers such as Fama and French (1988) in analyzing a higher period of time. However, Torrez *et al.* (2006) argued that the Fama and French (1988) paper concluded that by aggregating earnings as a cause for returns, explanatory power increasing over varying time periods. A few years later, Strong and Walk in 1993 have proposed a model that explains the existing model by comprising new procedures. Strong and Walk model has also have been criticized as the model lacks in expounding the causes of cross sectional variations or the factors that influence these changes, but it shows a higher explanatory value than the preceding findings (Wilson 1986, 1987) and (Adsera and Viñolas, 2003). There are different academic studies which focused on analyzing cross-sectional the earnings response variations coefficient for example from 1989, Collins and Kothari put forward the view that the coefficient should be treated as cross-sectional and temporal constant. Based on these grounds, there are ascertained that between the ERC and the persistence of earnings is a positive relationship and that there is a negative relationship between ERC and interest rate and risk premium measured by CAPM. Additionally Easton and Zmijewski (1989) provide confirmatory evidence for the positive relationship between the ERC and the persistence of earnings likewise for the negative correlation between ERC and risk premium. In 1990 Board and Walker have conducted research on 193 companies over a period of 13 years; they have found out that inflation levels influence the earnings/returns relationship and that the cross sectional and inter-temporal variation is significant.

After these findings, the DCF model is applied to different stages of a company: start-up, maturity, declining. When the cost of capital is seen as a constant, the theory argues for different growth rates in different stages and suggests a new-built model for DCF (Torrez *et al.*; 2006):

$$P_0 = \sum_{t=1}^{n_1} \frac{CF_t}{(1+r)^t} + \sum_{t=n_1+1}^{n_2} \frac{CF_t}{(1+r)^t} \quad (2)$$

For many years Discount Cash Flow model (DCF- model) has been used as traditional valuation tool for relatively safe stocks, but this method will not be useful for valuing companies with significant growth opportunities and higher risk level (Myers 1984). This gap can be seen as gap between finance and strategic planning.

## 2.2. Dividend model

Dividend Growth Model is considered as an extension to DCF models and is built based on several assumptions. Researchers developed a new valuation model within the area of DCF models - Dividend Growth Model- which is based on the assumption that: 1) the cost of capital cannot be higher than the growth rate of the company, 2) companies use their cost of capital as a discount rate and 3) this model has a constant rate.

$$P_0 = \frac{D_0(1+g)}{k-g} = \frac{D_1}{k-g} \quad (3)$$

With the condition that  $k > g$  and where  $g$  is the growth rate of the company and  $k$  is the cost of capital. General formula:

$$P_0 = \frac{D_0(1+g)}{(1+k)} + \frac{D_0(1+g)^2}{(1+k)^2} + \dots + \frac{D_0(1+g)^\infty}{(1+k)^\infty} \quad (4)$$

In the above formula  $P_0$  is the value of the stock in period zero,  $D_l$  is the value of the dividend in period  $l$ ,  $g$  is the growth rate and  $k$  is the cost of capital of the company.

In (1999) Baker and Powell argued that this model is not useful for the firms that has low growth or does not pay any dividends. However, other scholars such as Al-hares *et al.* (2012) studies the relevance of dividends in measuring or estimating the cost of capital and how the cost of capital will be influenced by the growth rate of the dividends.

### 2.3. Capital asset pricing model

This model is started with Markowitz (1952) article about portfolio theories, and it illustrates the relationship model that occurs between cost of capital and the expected return:

$$E(R_i) = R_f + \beta_i [E(R_M) - R_f] \quad (5)$$

In the above formula the  $E$  is an expectation,  $R_i$  is the return on equity,  $R_M$  is the return on the market,  $R_f$  is the risk-free rate for assets and  $\beta_i$  measures the risk of equity.

The Capital Asset Pricing Model has been studied by different finance scholars, for example, Sharpe (1964), Linter (1965) and Black (1972) and in contrast to DGM models uses a more realistic estimation of cost of capital. Even so, like many scientific models, the CAPM has its drawbacks. First, the Risk-free Rate ( $R_f$ ) is accepted as being the attorney in short-term government securities which are changing daily, creating volatility. Secondly, the Return on the Market ( $R_M$ ) is drawn from the past and may not be representative for the future return on the market. Leachman and Francis (1996) argue that preceding researchers have neglected the impact of foreign asset returns on the domestic risk premium and therefore examine the importance of volatility in national equity markets. Another issue is that CAPM is built on assumptions and one of those is that investors can borrow and lend at a risk-free rate.

### 2.4. Weighted Average Cost of Capital

Weighted Average Cost of Capital (WACC) is grounded on the idea that says that in certain conditions organization's value is not influenced by capital structure or dividend policy. 1950s, after a new debate is fostered on the idea that the valuation of a firm is not dependent on the capital structure and dividend policy of a company (Miller and Modigliani 1958 and 1963).

The formula for this model is illustrated below:

$$K_{tot} = K_e + (1 - t) \frac{D}{E} (K_e - K_d) \quad (6)$$

Where  $K_{tot}$  is the total cost of capital,  $K_d$  is the cost of debt capital,  $K_e$  is the cost of equity capital,  $D$  is the debt value,  $E$  is the equity value. From this expression, the weighted cost of capital for a company that is not incurring debt could be calculated as follows:

$$WACC_e = WACC_{tot} \left( 1 + \frac{D}{E} \right) \quad (7)$$

A company's operation could be financed by debt or equity or a combination of these two. Miller and Modigliani (1958, 1963) are trying to establish a relationship between the capital structure of a company and its market value

### 2.5. Arbitrage Pricing Theory

The Arbitrage Pricing Theory (APT) as arguing that the systematic risk is not the only factor which influencing value return, however there are other researchers provide evidence in this sense. The APT is a substitute for the Capital Asset Pricing Model (CAPM) in the sense that both APT and CAPM is drawing a linear relation between expected returns on assets and other variables, only that CAPM includes a single factor of systematic risk (Beta) (Ardalan, 1999). By arguing that the returned value depends on several

variables, in 1976, Ross develops a model where Beta is excluded from the CAPM. In 1996, Fama and French settled a new multifactor model in relation to the one developed by Ross. This model predicts returns well than CAPM and has the following structure:

$$R_i - R_f = \alpha_i + \beta_i(R_M - R_f) + s_i(SMB) + h_i(HML) \quad (8)$$

Where  $R_M$  is the market return,  $R_f$  is the risk-free rate.

The above model suggests that the return on a portfolio in excess of a risk-free rate is dependent on three factors: 1) the excess on the market ( $R_M - R_f$ ), 2) the difference between the return on a small stock portfolio ( $SMB$ ) and 3) the difference between a high-book-to-market stocks portfolio and the return on a low-book-to-market stocks portfolio ( $HML$ ).

### 3. Modern approach

#### 3.1. Real Option Valuation Theory and Models

The Real Option model as valuation tool is designed to measure the value of the options in investment analysis. These options are often made on the basis of real assets rather than financial assets. An option represents an asset which the holder can decide to buy or sell before or at its expiration date. There are two types of options recognized in finance literature: call options and put options. A call option gives the right to the holder to buy an asset at a fixed price. A put option entitles the holder with the right to sell the asset at a fixed price. The value of an option is determined by a set of variables: the present value of expected cash-flow, investment cost, life of the option or time to disappear, uncertainty of cash flow and risk free rate of return (Oktay and Yiğit, 2012).

Compared with financial theory based methods, real option valuation model includes also market changes and uncertainty. When the investment option is being divided into stages the risk is limited and manageable in terms of investment decisions and the time value of real options it is not missed in real option calculations. Many finance researchers suggest a close integration of real options and financial based methods for corporate valuation (Roos, 2013). Real options originated from financial options, but real option valuation is a complex subject. During the past decades, a lot of industries and companies have applied these methods. Among these methods, Roos (2013) presented the Binomial Option Pricing Model, Black-Scholes Model and Jump Process Option Pricing Model was assessed.

The ROV allows measuring the value of the company and its projects in uncertainty conditions. Option pricing theorists have got down the debate since 1972 when the Black and Scholes introduced the real options valuation model. The Black-Scholes model is nonetheless employed in the process of real and financial options valuation. Trigeorgis (1995, 1996) was the one who systematized the knowledge in the real options area by highlighting the possibilities of valuation, by referring to the work of previous economists: Robert Merton, Fisher Black and Myron Scholes. Lia and Rugman (2007) expanded the knowledge about applications of real options theory to foreign direct investment (FDI) concept and in 2008, Nagaie and Akamatsu provide a framework for analyzing real option problems by saying that these could be unified through a system of generalized linear complementary problems (GLCPs). The real option framework applicability to the multi-period- problem is analyzed by Berling in 2008; through his research he has concluded that the issue of systematic risk is typically negligible (as for the single-period problem). He mentions that systematic risk is not important for optimal inventory control, but might be interesting to analyze if uncertainties regarding holding and shortage costs could influence it. Based on a literature review of financial options and real options, Oktay and Yiğit (2012) struggle to give an answer for dealing with the dilemma of which method should be used to value investments. Oktay and Yiğit (2012) are illustrated in their academic research paper the option valuation models as: Binomial tree, Black and Scholes Model and Simulation methods.

In 2014, Hsiao and Chen develop a pricing model of two-stage optimal decisions that allows abandonment and re-investment in a project. The model is different from the DCF and NPV, because it is taken into consideration the market uncertainty and it is useful to managers when they hold to take an optimal policy for a project. According to Mun (2002) analysts should be aware that real options analysis

requires using a model of DCF, but there must be uncertainty involved in the evaluation process; if decisions are affected by uncertainty, real options could be applied in order to guarantee the failure risk. In accession to that, it is really significant to deliver flexibility in terms of reaching decisions and modifications in parliamentary procedure to employ the concept of material alternatives.

### **3.2. Real Option Game Theory**

Consequent to the fact that game theory offers an abstract model for managing sites that involve complex choices, and real option theory is utilized in investment decisions, researchers as Azevedo and Paxson (2014), developed a new model termed Standard Real Option Game (SROG). This module takes place between two companies that apply the option to invest, it treats the value of the investment as a variable that has a known process and where time is set as being infinite and continuous. Two investment games are known: Pre-Emption game (PE) and War-Of-Attrition game (WOA). Among the finance literature that fostered a debate inside the real option game theory are: Smets (1993), Dixit and Pindyck (1994), Grenadier (1996) and Huisman (2001).

Huang *et al.* (2013), demonstrate that the pre-emptive investments (e.g. Patents, acquisitions, new technology implementation) are pro-cyclical. Smit and Trigeorgis (2006) illustrate how real options valuation and game theory, principles could be applied to analyze investment opportunities that take decisions under uncertainty. The integration between real options and game perspective is relevant for industries facing high capital investment costs in different phases of a task. For investors what matters is the conception of value and real options combined with game theory analysis helps bringing value, by integrating finance theory and strategic planning. Smit and Trigeorgis conclude that properly utilized a combination between real options and game theory could be a necessary and important tool in corporate valuation. The literature on investment and evaluation has been ruled by three theories: Tobin's q Model, Sales Accelerator Models and Cash Flow Models of Investment. These methods and concepts are used to assess and explain the relation between investments and the value of the company and assume optimization behavior on behalf of the decision maker. The neo-classical model of investment was itemized in Irvin Fischer's book "theory of Interest" in 1930 and by Jorgensen (1963). The neo-classical theory is derived with the function of dynamic optimization of capital stock by bringing into consideration interest rates, capital assets and taxation policies.

### **4. Conclusions**

During the past years a flock of different models and theories of corporate valuation was approached and the objective of this research paper was to summarize and analyze the development of these examples. Although, the methods employed to assess and examine the value of a firms differ in terms of the theoretical premise, level of assumptions or applicability, each method or model has contributed to a foregoing discussion on evaluation. This article summarizes different valuation models and concludes that by integrating theoretical requirements for modeling, risk and uncertainty, the path from financial based option theory to real option pricing theory could be corrected. Empirically could not be said that one method of the evaluation is the correct one, but different participants in the financial market are instructed to employ the methods which they see as being most appropriate and desirable for the specific of their clientele. Moreover the literature suggests using more than one theory, mainly because many all of them rely on various assumptions and conditions in order to demonstrate the relationship between the hypothesis and the proposed framework, model or method. Through this research paper, it can be reasoned that the gap between finance theory and strategic planning could be bridged by using existing theory related to finance correctly. In accession to that, a promising line of research is to try to reveal hidden assumptions of the real option pricing theory and take a generally deeper understanding of strategic options. A combination between real options and game theory could be a necessary and important tool in corporate valuation. A deeper research on Real Option Game and the conditions in which this method could be applied fosters for debate.

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