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ΜΕΤΑΠΤΥΧΙΑΚΟ **ΛΟΓΙΣΤΙΚΗΣ & ΧΡΗΜΑΤΟΟΙΚΟΝΟΜΙΚΗΣ**
MSc IN **ACCOUNTING & FINANCE**

ΤΙΤΛΟΣ

AN EMPIRICAL TESTING OF ALTERNATIVE SPECIFICATIONS OF THE ACCOUNTING VALUATION MODEL.

ΟΝΟΜΑΤΕΠΩΝΥΜΟ

ΚΑΤΣΑ ΕΙΡΗΝΗ

Εργασία υποβληθείσα στο

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Αθήνα

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Εγκρίνουμε την εργασία της

ΚΑΤΣΑ ΕΙΡΗΝΗ

ΔΗΜΟΣΘΕΝΗΣ ΧΕΒΑΣ ΥΠΟΓΡΑΦΗ

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ΒΕΒΑΙΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

«Δηλώνω υπεύθυνα ότι η συγκεκριμένη πτυχιακή εργασία για τη λήψη του Μεταπτυχιακού Διπλώματος Ειδίκευσης στη Λογιστική και Χρηματοοικονομική έχει συγγραφεί από εμένα προσωπικά και δεν έχει υποβληθεί ούτε έχει εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού ή προπτυχιακού τίτλου σπουδών, στην Ελλάδα ή στο εξωτερικό. Η εργασία αυτή έχοντας εκπονηθεί από εμένα, αντιπροσωπεύει τις προσωπικές μου απόψεις επί του θέματος. Οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης διπλωματικής αναφέρονται στο σύνολό τους, δίνοντας πλήρεις αναφορές στους συγγραφείς, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο».

ΚΑΤΣΑ ΕΙΡΗΝΗ

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Contents

Abstract

This study provides an empirical study in market-based accounting research. This study uses portfolio analysis to evaluate an empirical accounting-based firm valuation model developed in the UK, Spanish and Greek market. Our aim is to evaluate the determinants of market value and, in particular, whether accounting-based valuation models can be estimated that not only have in-sample explanatory power. This requires models to be estimated on one sample, and tested for effectiveness on a different sample. We developed a deflating model the full equation using the sales as the deflation term. Using the criteria of bias and accuracy to capture effectiveness, we suggest which country provides the most effective models in this context.

1. Introduction

It is widely acknowledged that a major breakthrough in academic studies of financial accounting took place in the 1960's when accounting researchers began to focus on identifying the links between accounting information and the workings of capital markets. Value relevance studies, which have attracted significant attention from accounting researchers over the last decade, investigate the empirical association between stock market values (or changes in values) and various accounting numbers for the purpose of assessing those numbers' usefulness in equity valuation. Underlying these tests is the idea that stock markets are at least efficient with respect to publicly available information and, as a consequence, the existence of a (partial or otherwise) correlation between an accounting item and market prices suggests it is 'value relevant'. Implicit in this idea is that market prices are sensible estimators of firms' intrinsic values, at least with respect to the information contained in publicly available information.

Value relevance studies often employ valuation models to structure their tests, and to make inferences concerning the coefficients of the accounting amounts in the estimation equation. As implied by the previous paragraph, some studies test whether the coefficient on the accounting amount being studied is significantly different from zero with the predicted sign. Rejecting the null hypothesis of no relationship is interpreted as evidence that the accounting amount is relevant and not totally unreliable. Other studies test whether the estimated coefficient on the accounting amount being studied is different from those on other specified amounts recognized in financial statements. Rejecting the null that the coefficients are the same is interpreted as evidence that the accounting amount being studied has relevance and reliability that differs from the specified amounts.

As two important strands of capital market accounting research after the 1960's, market based accounting research and fundamental analysis have been conducted to shed some light on how financial statements are useful for the purpose of company valuation. Market-based accounting research considers financial statements as a reflection of past financial transactions, believes that the underlying value of a firm can be measured by its stock price and, hence, examines how accounting data reflects or correlates with the intrinsic value of the firm, or change in the value of the firm. Contrastingly, some researchers focusing on fundamental analysis view financial reports as an important source of information for estimating the underlying or intrinsic value of a firm, and try to use the information to develop portfolio investment strategies to earn excess returns from the market.

As a point of departure for empiricism in market-based accounting research, the Ohlson modelling approach (Ohlson 1995 and Feltham and Ohlson 1995), particularly the framework of linear information dynamics (LID), has been seen as a guide for cross-sectional valuation researchers in structuring the relationship between accounting data and firm value (Bernard, 1995). In the US, empirical studies by Dechow Hutton and Sloan (1999), Myers (1999), and Callen and Morel (2001) provide ambiguous empirical support for the Ohlson model (Ohlson 1995). Testing the Feltham-Ohlson model (1995), Callen and Segal (2005) find their empirical results discouraging and suggest indicate that the Ohlson model is of limited empirical validity (Callen and Segal, 2005, p3). Nonetheless, Ohlson's LID is still considered as a useful framework for empirical research.

Value relevance studies, which have attracted significant attention from accounting researchers over the last decade, investigate the empirical association between stock market values (or changes in values) and various accounting numbers for the purpose of assessing those numbers' usefulness in equity valuation. The Ohlson model is widely adopted in prior research as a basis to structure value relevance studies. The first stream of research discussed within this chapter is the literature that uses the Ohlson model as the basis for their analysis of value relevance of accounting items, and we focus on those studies conducted in the UK context.

When regressions are run on cross-sectional data, a series of econometric problems occur due to the fact that the samples contain firms of different size. This is studied by some authors and referred to generally as the scale effect, a common feature of capital market-based accounting research. These problems can include a variety of econometric issues such as coefficient bias, R bias, heteroscedasticity and, overall, incorrect inferences. Prior literature tends to either leave the nature of the scale effect studied ambiguous or only study one possible scale effect, Barth and Clinch (2009), however, analyse five forms of scale effects: (i) multiplicative scale; (ii) additive scale (omitted scale-related variables); (iii) scale-varying parameters; (iv) survivorship; and (v) scale-related heteroscedasticity; and provide a more ambitious and comprehensive analysis than prior studies, with substantially increased clarity of focus.

However, Barth and Clinch (2009) raise a number of important issues with respect to solving econometric issues endemic to much capital markets research. Their methodology of using simulated data to draw conclusions about optimal estimation approaches is open to discussion, however. The second stream of studies reviewed in this chapter are then related to scale and scale effect, and we identify the gap in prior studies and, hence, propose to use an alternative metric of out-of-sample valuation errors to evaluate various model specifications.

Furthermore, Akbar and Stark (2003b) in the UK suggest that firm value can be modelled as a linear function of value-relevant accounting variables, particularly, book value, earnings, research and development expenditure, dividends and capital contributions. They also argue that empirical results in the US do not automatically carry over into the UK (Akbar and Stark 2003b, p1230). Further literature review is then provided focusing on fundamental analysis studies, as we propose to evaluate firm valuation models using this approach, (i.e., investigate whether cross-sectional valuation models developed in the UK context can be used to develop investment strategies, and generate positive abnormal returns).

2. Literature Review

2.1. The Valuation Process

Financial reporting supports investors during decision making process. Assessing the value of firms is one of the primary economic decisions investors make. Valuation is the process of measuring the current worth of an asset or a company and its business units. It contributes to identify sources of economic value creation as well as destruction within the company. Any deviation from the 'true' value constitutes a sign that this stock is undervalued or overvalued. This deviation depicts an opportunity to sell or buy this share or hold it (Barth, 2004).

According to Fernández (2001), valuation is essentially useful for a range of purposes.

Sales

The valuation is essential in case of a potential sale or purchase. Profits of the company, which are likely to be earned during the coming years, are projected in order to be determined the fair price for the business.

Public offerings

The valuation serves the purpose of comparing the estimated value of the company to the price offered to the public and

Compensation schemes

The valuation is used as a tool for quantifying the performance of the executives. Via this method, it is likely to separate the value created by the executives and consequently to compensate them based on this value creation.

Identification of value drivers and strategic planning

Company's management, via the valuation process, has the chance to identify and stratify the main value drivers which have impact on value. This identification enables management to analyze how each value driver affect performance and which are the true value drivers of value. This process facilitates the decision of what customers and business lines to maintain, grow or abandon and the strategy making process.

Decision related to the continued existence of the company

The valuation of a company or a business unit is a part of the decision making process concerning the sale of the company, the purchase of other companies or the merge with other entity. In case of acquisitions, valuation is useful for the both sides.

The bidding firm has to determine the fair value for the target firm before the bid and the target has to define an ideal value for itself.

Several value definitions serve as the foundation for the variety of valuation models available to the comparison of equity valuation methods, such as intrinsic value, going-concern value, liquidation value, and fair value (Pinto et al., 2010).

2.1.1.Intrinsic Value

The intrinsic value of any asset is the value of the asset given a hypothetically complete understanding of the asset's investment characteristics. The intrinsic value suggests that an asset's market price is the best available estimate of its intrinsic value.

2.1.2. Going-Concern Value and Liquidation Value

In estimating value, a going- concern assumption is the assumption that the company will continue its business activities into the foreseeable future. If the company was dissolved and its assets sold separately this would be known as liquidation value.

2.1.3. Fair Market Value and Investment

Fair market value is the price at which an asset would change hands between a willing buyer and a willing seller when neither the buyer nor the seller is under any pressure to buy or sell respectively. Please note that fair market value implies that both buyer and seller are informed of all material aspects of the underlying investment.

When a buyer considering acquiring a company takes into account specific synergies, tailor made requirements and expectations for the said company, then the value considered is referred to as investment value (Pinto et al., 2010).

2.2 Overview of Valuation Methods Literature

2.2.1 Introduction

In general the value of a company stock equals the discounted cash flows generated from the company in the future. Valuation methods can be generally grouped into the following three categories: income approach methods, market approach methods and cost approach methods. Income approach methods forecast future cash flows of a stock, and discount them at a given rate in order to get the stock's present value (Damodaran, 1996).

Market approach methods determine the value of a stock by comparing variables such as earnings, cash flows, book value or sales to similar companies in the sector. Finally cost approach methods estimate the value of a stock based on the accounting net asset value of the company (Pinto et al., 2010).

Depending on the assumptions used, the above mentioned methods might lead to different results. Therefore, we should use more than just one valuation method to estimate the firm value because there is a great deal of uncertainty in relation to value estimation as it involves predicting future returns of the company, and if the different methods give similar results it implies that the estimated value is reasonable (Benninga et al., 1997).

2.2.2 Dividend Discount Model

The Dividend Discount Model ("DDM") is a stock valuation tool that is used to determine stock prices as the present value of future expected dividends discounted back at a certain rate. The simplest DDM model is the DDM with no growth, where the discount rate (r) equals the rate of return demanded by investors investing in other stocks at the same risk level, P_0 is the value of the stock and DIV_1 is next year's dividend. The DDM with no growth can be stated as (Brealey et al., 2009):

$$P_0 = \frac{DIV_1}{r}$$

A more advanced DDM is the DDM with constant growth. This model assumes that a company's dividend payouts grow over the years. Because it is too time consuming to forecast dividends for every single year in the future, the calculations are simplified by forecasting dividends for the next period, and then forecasting a single growth rate with which the dividends will grow in all the following periods. It is assumed that there is an infinite number of periods in the model and the dividend growth rate (g) has to be less than the discount rate (r) (Brealey et al., 2009). The DDM with constant growth can be written as (Brealey et al., 2009):

$$P_0 = \frac{DIV_1}{r - g}$$

If the growth is not constant the formula above cannot be used. Additionally, for mature industries, growth is fairly stable and constant growth DDM is a good model. It is common in practice to forecast dividends for a limited number of years and then to calculate a terminal value at the horizon; this corresponds to the DDM with non-constant growth (Penman, 1998). In order to use the DDM with non-constant growth, it is necessary to set the investment horizon (H). Until the investment horizon the dividends should be estimated for each period individually and after the investment horizon the company's growth is expected to settle down. In order to estimate the stock price, the dividends until the investment horizon year are discounted back to present value and at the end the terminal value is added. The terminal value is the estimated present value of the stock price at the horizon. The formula for the DDM with non-constant growth is (Brealey et al., 2009):

$$P_0 = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \cdots + \frac{DIV_H + P_H}{(1+r)^H}$$

It is often claimed in the literature that the DDM does not perform very well when company value with a finite horizon has to be estimated. The calculation of terminal value is considered to be problematic in the financial literature, and many different formulas for calculating terminal value have been developed over the years. Whilst using alternative valuation models such as discounted cash flow model or residual income model often results in a firm value that is similar to the firm value estimated using the dividend discount model, it is the different ways of calculating terminal value that cause the largest variations. Terminal value basically consists of an estimate of all future cash flows, or in the case of DDM, all future dividends, and these are discounted back and summed up to a single number (Penman, 1998).

2.2.2.1. Advantages and disadvantages of the DDM

There are various issues related to the use of the present value of expected future dividends as an estimate for the company value (Hand et al., 2005). In short dividends are often positively priced even when they should not be due to the financial situation of the company, and when these dividends are used to estimate the firm value the result is often wrong. In contrast some researchers find a positive relation between firm value and dividends (Akbar et al., 2003). The results of their analysis show that dividends are based on information about future expected cash flows and can be used to estimate the firm's value. However the DDM contains little market valuation information and the firm value estimated using the DDM is therefore subject to error (Michaud et al., 1982).

Dividends are not a good measure to estimate firm value, because the company can obtain loans to finance the dividend payouts, and in this case dividends do not represent the earnings the company generates. The dividends are irrelevant to the calculation of the firm value. The firm value depends on the firm's earnings and level of investment. If an investor is interested in acquiring a firm, the investor is free to determine the level of the dividends in the future and the firm value calculated based on future expected dividends does not make sense in that case. The firm value importance to the acquirer is based on the expected earnings of the firm and its investment opportunities, which will provide additional earnings in the future (Miller et al., 1961).

2.2.2.2. Evaluation of the DDM

The DDM is a type of discounted cash flow model as mentioned earlier. The essence of the DDM is the fact that it uses dividends as the proxy for cash flows. Using dividends to estimate firm value is widely criticized in the literature mainly because dividends are more often than not determined by the management, so they can be subject to manipulation and are therefore not as reliable as other proxies for cash flows. Additionally, using the DDM to estimate the value of private companies is problematic since private companies do not pay out dividends in the same way as public companies.

2.2.3 Free Cash Flows Models

2.2.3.1. Discounted Cash Flows

A company's value can be determined by dividing the expected cash flows into two periods as stated below (Copeland et al., 2000):

$$\begin{aligned} Value = &\text{ PV of cash flows } \mathit{during} \text{ the explicit forecast period} \\ &+ \text{PV of cash flows } \mathit{after} \text{ the explicit forecast period} \end{aligned}$$

The explicit forecast period is the period, in which detailed forecasts of a company's cash flows are made for a given period up to a specific year, the horizon year (H) or terminal value year (Damodaran, 2000). The second part of the formula is the continuing value (terminal value or horizon value), which is the value of the firm after the explicit forecast period. The continuing value can be determined in two ways: one way is to assume that the firm will be liquidated in the horizon year and estimate the value of its assets in that year. The other method is to use the constant-growth formula, by assuming that the firm is going concern, i.e. it will continue to grow up to infinity after the horizon year (Brealey et al., 1991).

To use the constant-growth formula, the analyst needs the FCF for the first year after the horizon year (year H+1), a long-run growth rate (g) and the Weighted Average Cost of Capital (WACC) as the discount rate (r), thus the formula for the PV at the terminal year is (Brealey et al., 1991):

$$PV_H = \frac{FCF_{H+1}}{r - g}$$

Several researchers claim that continuing value calculations often account for more than half of the total firm value, and that a small change in the perpetual growth rate leads to major changes in firm value (Brealey et al., 1991). The large impact of the continuing value can be due to the fact that a firm‘s cash outflows in the explicit forecast period are caused by investments that are expected to generate cash inflows after the explicit forecast period (Copeland et al., 2000).

2.2.3.2 Calculating the company value

Finally, the value of the firm can be determined as the discounted free cash flow up to a terminal year (H) plus the forecasted value of the firm at the terminal year, as presented below (Penman, 2010):

$$PV = \frac{FCF_1}{1 + WACC} + \frac{FCF_2}{(1 + WACC)^2} + \cdots + \frac{FCF_H + P_H}{(1 + WACC)^H}$$

Once the enterprise value is estimated, the equity value can be calculated by subtracting net debt and minority interest from the company value. As mentioned earlier, the DCF analysis involves predicting free cash flows for the next five to fifteen years. For this reason, it is necessary to make assumptions about a company‘s future situation (Koller et al., 2005). Predicting the future always involves uncertainty and risk but methods such as scenario analysis, sensitivity analysis, decision trees and simulations can help in analyzing the uncertainty related to the valuation results, as well as ensure whether the assumptions used are realistic. Sensitivity analysis will be used in this dissertation in order to analyze the effect of different assumptions about both macroeconomic growth and discount rates (Damodaran, 2007).

2.2.3.3. Evaluation of the DCF method

This section includes an evaluation of the method's strengths and weaknesses. One of the advantages of the DCF method is that it is intuitively easy to understand; the value of a company depends on its future cash flows. This method focuses on cash flows, which is a real measure that is simple to explain. The DCF method also works regardless of a company’s accounting principles. When analyzing a company using this method, the analyst performs a useful exercise by identifying a company‘s value drivers as well as examining its growth and risk. In general, the DCF method is perceived to be the best method for company valuations, but only if the company is profitable (Russell et al., 2007).

The limitations of the DCF method include its large dependency on the discount rate (WACC or Cost of Equity) and terminal value assumptions; this is because small changes in these values have a considerable impact on firm value as stated earlier. For this reason, the DCF method can be easily manipulated by the analyst in order to achieve a given result. Additionally, it requires a lot of information to determine a company’s future cash flows, growth rates and discount rates. Similar to any other analytical tools, the DCF must be used with caution.

2.2.3.4. Free Cash Flows to Firm

One of the discounted cash flows methods – “the free cash flows to the firm” consists of valuing the whole firm including all its claimholders which leads to the calculation of the enterprise value. The Free Cash Flows to the Firm model can be set up by using four steps. In the first step, the company‘s free cash flows to the firm is calculated for each year as follows (Penman, 2010):

EBIT * (1- tax rate) + Depreciation – Increase in Working Capital – Capital Expenditures

Thereafter the second step involves estimating the weighted average cost of capital (“WACC”) and discounting the free cash flows using this discount rate so as to determine their net present values (NPV). Additionally, the terminal value is identified in the third step, and the determination of the company value is performed in step four. Finally in order to reach the equity value the net debt and any non operational assets have to be subtracted from the Enterprise Value.

2.2.4 Residual Income Models

2.2.4.1 Overview the Residual Income Model (or “Economic Profit”)

According to Ohlson, due to the dividend policy irrelevance concept, the value of a firm should not be calculated based on dividends, but based on a more fundamental variable which do not depend on dividends. Earnings are a good replacement for dividends because earnings do not depend on dividends and could be used to estimate company value. Residual income is the amount by which a company's net income exceeds the required return on the firm's equity. The Residual Income Method ("RIM") can be derived from the Dividend Discount Model ("DDM") by using among other things the clean surplus relation. The clean surplus relation states that the current book value equals beginning book value with an addition of current earnings and a subtraction of current dividends. Mathematically the clean surplus relation is defined as (Ohlson, 1991):

$$B_t = B_{t-1} + E_t - D_t$$

Where, B is the book value for the current and previous period (t and t-1 respectively), E is the earnings for period t and D represents the dividends for period t. The residual income model is given by (Ohlson, 1995):

$$P_0 = B_0 + \sum_{t=1}^{\infty} \frac{RI_t}{(1+r_e)^t} = B_0 + \sum_{t=1}^{\infty} \frac{E_t - r_e B_{t-1}}{(1+r_e)^t}$$

The RIM calculates the firm value by adding two parts: the book value as of the valuation date, plus the present value of forecasted residual income. Where B_t is the book value in period t, RI_t is the residual income in future periods which equals $E_t - R_e B_{t-1}$, and R_e is the required rate of return on equity. In other words, residual income is net income minus a charge for the use of shareholders' capital. The residual income model, unlike other valuation models, puts emphasis on accounting data instead of financial data. All the numbers except for the required rate of return on the firm's equity are accounting numbers, which can be obtained from the firms' financial statements. The book value used in the model is a sum of the book value of owners' equity and the book value of operating net assets, which can be obtained from the balance sheet. And the residual income is based on operating earnings which can be obtained from the income statement (Skogsvik, 2002).

2.2.4.2. Advantages and disadvantages of the Residual Income Model ("RIM") or Economic Profit ("EP")

The residual income model moves the focus away from the well-known dividend discount model and instead the value of the firm is calculated as a sum of current book value and present value of expected future abnormal earnings. The fact that the RIM is based on book value and abnormal earnings is a major advantage because it is believed that these variables contain more important information in relation to firm value than dividends alone, which are used in the DDM (Xiaoquan et al., 2005). Additionally, by estimating earnings instead of dividends, it is necessary for the analysts to investigate the factors explaining the firm‘s performance which leads to a deeper understanding of the company‘s activities. Furthermore, the RIM does not use dividends to calculate the firm value and as such it can easily be applied to companies, which do not pay out dividends on a regular basis (Bernard, 1995).

One of the disadvantages of using earnings in firm valuation is that future earnings are affected by external events, which cannot be predicted at the time of estimation. Thus, valuations based on earnings can result in imprecise value calculations. The dividends are present in the RIM, they are just defined broadly as the difference between earnings and changes in book value and these dividends include both regular dividends and other types of cash payouts (e.g. share repurchases) to the shareholders (Penman, 2007).

The fact that the RIM relies on accounting numbers can both be seen as an advantage and a disadvantage. It is an advantage that the already recognized book values can be used in the valuation model. On the other hand, accounting numbers can be manipulated and this will affect the calculated firm value. For this reason, it is important to evaluate the quality of the numbers in the financial statements before applying them in order to obtain a useful result (Rees, 1997).

Even though the RIM is sensitive to accounting manipulation, there are some types of manipulation it is actually protected from. If accrual accounting is used to create earnings by for example recording lower book values at present and recognizing higher income in the future, it looks like the company is earning more, but in reality no additional value is created. In the RIM, this type of accounting will not result in a higher firm value because the beginning book value will be used in the calculation (Skogsvik, 2002). An important observation in relation to the RIM is the fact that it is not correct to treat the required rate of return on the firm‘s equity as a constant if the firm‘s capital structure is expected to change over time. However, applying different rates of return to the model based on the expected capital structure makes the model much more complicated (Penman, 2007).

When applying the RIM, the forecast horizon should also be considered like in the other valuation models. The RIM can be constructed in a way that is similar to the DDM model, where residual earnings are forecasted for a number of years and discounted back and a terminal value is added at the end to capture the continuing value from residual earnings at the terminal year. The formula for the residual income model with a continuing value calculation can be stated as (Penman, 2007):

$$V_0 = B_0 + \sum_{t=1}^{\infty} \frac{E_t - r_e B_{t-1}}{(1+r_e)^t} + \frac{\frac{RI_{t+1}}{r_e}}{(1+r_e)^t}$$

Where g is the growth rate and should always be less than the Cost of Equity (r_e). There is often more weight on the terminal value in the DDM and the DCF model as compared with the value calculated up to terminal year. But in the RIM when the continuing value term is added, there is more emphasis on the value created up to the terminal value, which can be estimated with more certainty than the value at the terminal value. Because of this feature the results from the RIM are more certain compared to the results obtained using the DDM and the DCF. Additionally, previous research undertaken by various authors have compared the performance of the DDM, RIM and the DCF model and concluded that the RIM gives more accurate value estimates and explains more of the variation in stock prices (Xiaoquan et al. 2005).

It can be difficult to apply the RIM in practice because it contains expected abnormal earnings, which can be difficult to estimate. It is therefore important to use valid forecasts to predict reliable future abnormal earnings. Additionally, it might not be enough to look at book values and expected abnormal earnings to calculate firm value in practice, additional factors such as financial management of the firm, dividend payouts, debt levels and capital expenditure should also be considered. Other factors that can affect company value should also be investigated in addition to the value calculated using the RIM. Therefore the RIM is not sufficient on its own to capture the actual value of the company.

2.2.4.3. Evaluation of the Residual Income Model ("RIM") or Economic Profit ("EP")

Based on the analysis performed in this section, it can be seen that the RIM is a relatively new model compared to the other popular valuation models such as the DDM and the DCF model. One of the important features that distinguish the RIM from the other valuation models is the fact that it is based on accounting numbers. Whether the use of accounting numbers is an advantage or a disadvantage is widely discussed in the literature, and there is no final conclusion on the discussion because there are both pros and cons (Ohlson, 2001).

2.2.4.4. Economic Value Added

We will also encounter in the literature another approach to calculate the value of a company using a residual income method that yields similar results. One example coming from several competing commercial implementations of the residual income concept is economic value added ("EVA"), trademarked by Stem Stewart & Company. In this second approach, which takes the perspective of all providers of capital (both debt and equity) we subtract a capital charge (the company's total cost of capital in money terms) from the company's after-tax operating profit. More precisely, EVA is computed as:

EVA = NOPAT - (WACC * IC)

Where: NOPAT: company's net operating profit after taxes, or in an equivalent way:

EBIT * (1 – Tax Rate).

WACC: weighted average cost of capital,

IC: Invested Capital which is total debt plus total equity

The resulting EVA flows are discounted at the weighted average cost of capital from year 1 to perpetuity and the initial invested capital at year 0 (the valuation date) is added back as presented in the formula below:

$$P_0 = IC_0 + \sum_{t=1}^{\infty} \frac{EVA_t}{(1+WACC)^t} = IC_0 + \sum_{t=1}^{\infty} \frac{NOPAT_t - (WACC * IC_{t-1})}{(1+WACC)^t}$$

Because of the above adjustments made under EVA, a different numerical result will be obtained, in general, than that resulting from the use of economic profit (or residual income model).

2.3 Comparable Company Multiples

2.3.1 Overview of Comparable Company Multiples

Valuation using multiples is a broadly used supplementary method to the well-known discounted cash flow method (Benninga et al., 1997). The popularity of this method is mainly caused by its simplicity. In general, multiples are the average price divided with a certain performance measure; therefore many different multiples can be calculated for a firm. The primary ratio which is generally used to estimate value is the price/earnings (P/E) ratio and two other ratios which are commonly used are the price/book value (P/B) ratio, and the price/sales (P/S) ratio (Yoo, 2006).

The accuracy of ten different multiples have been tested through an empirical study of 8621 companies, and the P/B ratio generates more exact and unbiased results than the other multiples including the P/E and P/S ratios. The P/E ratio can generate imprecise results because it is systematically affected by the capital structure of the company, and, furthermore, the earnings used in the ratio are affected by non-operating revenues and expenses (Lie, 2002). The P/S ratio gives the least accurate results. An analysis related to the performance of P/E and P/B ratios in relation to valuation based on 30,310 observations of company data over 20 years concludes that a combination of these two ratios gives the most exact results, however if one ratio has to be chosen then the P/E ratio is found to be superior to the P/B ratio (Koller et al., 2005).

Besides the abovementioned multiples that focus on the price (i.e. the equity value), there are also those, that focus on enterprise value. A commonly used enterprise value multiple is the enterprise-value-to-EBITDA (EV/EBITDA), where EBITDA stands for earnings before interest and taxes, depreciation and amortization. Investors often associate increasing P/E with company growth, however, it is more correct to draw conclusions about a company's growth based on increases in the EV/EBITDA multiple because it also considers the return on invested capital (ROIC). Additionally, it is recommended to use the EV/EBITDA multiple because it is independent of capital structure, and can thus be easily applied to comparable companies that have different capital structures. The sales multiple can be used when the valued company has small or negative profits, however they recommend using the EV/S ratio instead of theP/S (Koller et al., 2005).

Valuation using multiples often requires several average ratios in order to be applicable in practice. If the multiples are calculated based on historical numbers, then it is advised to use several multiples for valuation in order to improve the accuracy of the result. If the multiples are calculated based on a mixture of historical data and forecasted earnings then no improvements in the estimated firm value is observed, and it is thus enough to limit the valuation procedure to multiples that are based on forecasted earnings. That means that forecasted earnings should be used rather than historical data whenever possible.

There are at least two approaches to multiples valuation; one is the fundamentals approach, where the multiples are related to the fundamentals of the firm such as growth rates in earnings or cash flows, and the second one is the comparable approach, where multiples are estimated from the comparable firms. Selecting comparable firms based on risk levels or earnings growth is supported by the literature, but better results are achieved when the comparable firms are chosen based on the industry, and especially when the industry is defined narrowly (Yoo, 2006).

The procedure of multiples valuation starts with selecting comparable firms. There are two main goals in the selection of comparable firms' process which are: selecting firms that are very similar to the valued company and selecting a relatively large sample of firms in order to get unbiased average multiples. Once the sample is in place, it is necessary to choose the relevant bases for multiples and then calculate the average ratios for the peer group. The estimated average ratios are then multiplied by the valued firm's actual accounting numbers, whereby a value estimate is obtained (Cheng et al., 2000).

2.3.2 Advantages and disadvantages of multiples

It is beneficial to apply multiples, because they are easy to relate to and quick to calculate compared to other valuation methods. However, multiples are also easy to misuse and manipulate, particularly when the comparable approach is used, because the analyst can choose which firms to compare to in order to obtain a desired result. Additionally, valuation using multiples requires a large number of comparable firms being traded in the market, and that these firms are priced correctly, which is not always the case (Damodaran, 1994).

Moreover, in the multiples method, the firm value is not obtained through the analysis of the firm like it is in for example the DCF model, but through a comparison to similar companies, which can easily lead to errors in the estimated value. One weakness of the multiples method is that it represents an approximation rather than exact value estimation (Yoo, 2006). Taking the weaknesses of the multiples method into account, it can be used, not as a primary method to value a company, but as a secondary method to verify that the result obtained from the primary valuation model is realistic (Copeland et al., 2000). Valuation using multiples is a very limited method because it is often only earnings from the current year or the next year that are considered in the valuation. Forecasted future earnings for several years should be used for value estimation, because they contain more value-relevant information than historical data (Liu et al., 2002).

The value estimated using multiples, which is based on earnings is not essential to investors, because in reality it is cash flows that matter and not earnings. Using multiples from comparable companies can thereby be misleading because companies can have similar levels of earnings, but different levels of cash flows, which lead to different company values, but this is ignored by the multiples approach. However, in situations when earnings do reflect the actual cash flow level of the company, the earnings multiple performs well. In order to make the valuation using multiples more accurate it is suggested to include the investments required to generate the earnings and the risk associated with these investments into the equation (Copeland et al., 2000).

The value calculated using the multiples method is more accurate for large companies. This is explained by the fact that large companies generate their earnings from a higher number of different projects, which gives more diversification in their earnings, so that on average extraordinary profits and losses offset each other. Additionally, multiples analysis gives more accurate results for older firms than for young firms. Using the firm's own historical multiples provides the best results for public firms, however, because this data is not available for private firms, multiples obtained from comparable firms is a good tool to value private firms.

2.3.3 Evaluation of the multiples method

Based on the literature review, it can be concluded that valuation using multiples is a simple method that can be used to obtain approximate firm values, and verify the results obtained using other valuation methods. There seems to be a disagreement in the literature about which ratio performs best. According to some sources the P/E ratio gives the best results and according to other sources the P/B ratio is the most accurate. However, the fact that the P/S ratio performs worse to the P/E and P/B ratios is proved in various analyses. Moreover, using the EV/EBITDA multiple deals with differences in capital structure of the comparable companies, and using EV/S multiple deals with firms that present negative profits (Koller et al., 2005).

The multiples method is most often applied by estimating the ratios from the comparable firms. There is much discussion in the literature about how to identify the comparable firms, but many authors conclude that choosing the comparable firms based on industry provides satisfying results. It appears that multiples valuation is most effective when it is applied to large, old companies and when the multiples are calculated using forecasted earnings (Fernández, 2001).

2.4 Comparison of Valuation Methods

In this final section of the valuation methods' overview we will present research that has been conducted related to the comparison among various valuation methods.

Penman and Sougiannis (1998) admit that "dividend, cash flow and earnings approaches are equivalent when the respective payoffs are predicted to infinity", but they claim that for finite horizon analysis "accrual earnings techniques dominate free cash flow and dividend discounting approaches" (Penman et al., 1998).

Ehrbar (1998) uses a very simple example with perpetuities and shows the equivalence between EVA and DCF (Ehrbar, 1998). Stewart (1999) shows the equivalence between DCF and EVA with an example using a constant discount rate (Stewart et al., 1999). Velez-Pareja (1999) reported that when using relatively complex examples and book values to calculate Economic Value Added (EVA), the results were inconsistent with Net Present Value (NPV) (Velez-Pareja, 1999). Tham (2001) reported consistency between the Residual Income Model (RIM) and the Discounted Cash Flow model (DCF) (Tham, 2001). Lundholm and O'Keefe (2001) show the equivalence between DCF, EVA and RIM with an example with a constant cost of equity (Lundholm et al., 2001). Fernández (2002) shows examples where there is mathematical equivalence among the DCF, the RIM and EVA. He uses a constant value for the cost of levered equity capital and in another example constant debt (Fernández, 2002). Fernández also shows that by discounting Economic Profit (EP) and EVA we arrive at the same equity value as the discounting the equity cash flow or the free cash flow.

Lundholm and O'Keefe (2001) assert that the superiority of the residual income model over the cash flow model is often mistaken. They argue that even on studies or theory applications the models should still be equivalent for every company in each year. As well as also that "the fact that the price estimates frequently differ between the two models illustrates the difficulty in consistently applying the same input assumptions to the different models." (Lundholm et al., 2001).

Fernández (2002) shows that the eight most commonly used methods for valuing companies by cash flow discounting or residual income discounting always give the same value. Kimand Ritter (1999) and Liu, Nissim and Thomas (2002) find that forward looking multiples (e.g. forecasted earnings) perform better than trailing multiples (e.g. reported earnings), and earnings multiples perform better than book value multiples or sales multiples (Kim et al., 1999; Liu et al., 2002).

3. The Research Model

In this chapter, we discuss the research models used to evaluate firm valuation models in the following empirical chapters. This thesis consists of two empirical equations. Section 2 explains the process of model development.

A frequently employed benchmark model in value relevance studies is that the market value of equity can be represented as a linear function of book value of equity and earnings, together with a constant term to capture the effects of omitted variables. This leads to the first empirical specification in equation (1) below:

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + \varepsilon_{it} \quad (\mathbf{1})$$

where MV_{it}, BV_{it} and E_{it} are market value of equity, book value of equity and earnings, respectively, and ε is the regression error term.

In addition to examining the properties of the model in equation (1), we then employ an extended model, which combines variables found significant in Rees (1997) and Akbar and Stark (2003):

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + a_4 D_{it} + a_5 CC_{it} + a_6 CE_{it} + \varepsilon_{it} \quad (\mathbf{2})$$

where, in addition to the definitions above, RD_{it}, D_{it}, CC_{it} and CE_{it} are research and development expenses, dividends, capital contributions and capital expenditures, respectively[1].

As in Akbar and Stark (2003), one way of justifying the model in equation (2) is that market value can be represented as the present value of future expected net shareholder cash flows, and the variables follow on LID process. The basis of the model development process is z_t , a vector of variables:

$$z_t = \begin{bmatrix} BV_{it} \\ E_{it} \\ RD_{it} \\ D_{it} \\ CC_{it} \\ CE_{it} \end{bmatrix} \qquad (\mathbf{3})$$

[1] These accounting variables are found to be associated with market value in prior empirical research: RD (Green, Stark and Thomas, 1996, Stark and Thomas, 1998, Citron, 2001, Akbar and Stark, 2003a, Dedman, Mouselli, Shen and Stark, 2009, and Shah, Stark and Akbar, 2009), D (Rees, 1997, Akbar and Stark, 2003a, Dedman, Mouselli, Shen and Stark, 2009, and Shah, Stark and Akbar, 2009), CC (Akbar and Stark 2003a, Dedman, Mouselli, Shen and Stark, 2009, and Shah, Stark and Akbar, 2009) and CE (Rees 1997, and Dedman, Mouselli, Shen and Stark, 2009).

where BV_t represents book value at time t, E_t represents earnings plus research and development expenditures at time t, RD_t represents research and development expenditures at time t, D_t represents dividends at time t, and CC_t represents capital contributions at time t, and CE_t represents capital expenditures at time t.

Then, it is assumed that the stochastic evolution through time of z_t, can be modelled in the following way:

$$z_t = \Omega z_{t-1} + \varepsilon_t \qquad \textbf{(4)}$$

where Ω is a (6 by 6) matrix of time-invariant parameters and ε is an (6 by 1) vector of mean zero random variables. If market value can be represented as the present value of future expected net shareholder cash flows, Ohlson (1989) then suggests that corporate value can then be modelled as a linear function of the variables in z_t,. Thus, market value, MV, can be expressed as the extended model in equation (2)[2].

We also include a variable capturing 'other information' using the approach of Akbar and Stark (2003a) which minimises data loss in the estimation of this variable, to investigate the impact of "other information" in firm valuation models[3]. We might expect 'other information' (OI) to increase the completeness and reliability of valuation models. As a consequence, we estimate model (1) and (2) with and without 'other information' respectively:

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + \beta\ OI_t + \varepsilon_{it} \quad \textbf{(5)}$$

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + a_4 D_{it} + a_5 CC_{it} + a_6 CE_{it} + \beta\ OI_t + \varepsilon_{it} \quad \textbf{(6)}$$

In some US studies (Dechow, Hutton and Sloan, 1999, Ohlson 2001, Hand and Landsman 2005, Choi, O'Hanlon and Pope, 2006, etc.), the empirical implementation of OI involves using consensus earnings forecasts in the valuation

[2] We also try adding one variable at a time to build up to the extended model from the benchmark model. That is, we also examined the models as below:

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + \varepsilon_{it}$$
$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + a_4 D_{it} + \varepsilon_{it}$$
$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + a_4 D_{it} + a_5 CC_{it} + \varepsilon_{it}$$
$$MV_{it} = a_0 + a_1 BV_{it} + a_2 E_{it} + a_3 RD_{it} + a_4 D_{it} + a_5 CC_{it} + a_6 CE_{it} + \varepsilon_{it}$$

[3] Data coverage in IBES is about 500 firms out of over 1000 on average across the years of observation. FactSet (previously JCF) provides a slightly better coverage of UK companies, but FactSet estimation data only goes back to 1996, while the coverage we require is from 1990 to 2006.

model as a proxy, which can cause a large shrinkage in sample size in the UK context[4]. Akbar and Stark (2003a), hence, develop an alternative proxy for 'other information. Consistent with Ohlson (2001), their proxy is built on the assumption that 'other information' is single dimensional and, although OI_t is not directly observable, we can use previous period's 'other information', OI_{t-1}, as a proxy for OI_t. To estimate OI_{t-1}, we start with the generalized version of models (5) and (6) as below in equation (7):

$$MV_{it} = a_0 + \sum a_i AV_{it-1} + \beta OI_{t-1} \quad \mathbf{(7)}$$

where $\sum a_i AV_{it-1}$ represents the linear combination of the accounting variables in equations (5) and (6), and OI_{t-1} is 'other information' for period t-1. Equation (7) can be restated as:

$$\beta OI_{t-1} = MV_{it-1} - a_0 - \sum a_i AV_{it-1} \quad \mathbf{(8)}$$

which indicates that we can obtain βOI_{t-1}, a multiple of OI_{t-1}, if we can estimate α_0 and the α_i. We can approximate these coefficients by estimating the following cross-sectional regression:

$$MV_{it-1} = a_0 + \sum a_i AV_{it-1} + \varepsilon_{t-1} \quad \mathbf{(9)}$$

and, for each firm, we can proxy βOI_{t-1} by ε_{t-1}.

As a consequence, for year t, βOI_{t-1} is then included in the cross-sectional regression as a proxy for OI_t , as shown below:

$$MV_{it} = a_0 + \sum a_i AV_{it} + \beta_t(\beta OI_{t-1}) + \varepsilon_{it} \quad \mathbf{(10)}$$

With cross-sectional data we often expect heteroscedasticity, and this can result in an underestimation of the coefficient standard errors (and, thus, an overestimation of the t-statistics) when conventional ordinary least squares (OLS) estimation approaches are employed. There are usually two remedies suggested and used for solving the heteroscedasticity problem. The first involves transforming the

[4] Linear information dynamics (Ohlson 1995) suggests $E(RI_{t+1}) = \omega RI_t + \gamma OI_t$. Hence, to estimate 'other information', we need to estimate next period's expected residual income $E(RI_{t+1})$. Ohlson (2001) assumes that $E(RI_{t+1})$ can be treated as observable: $E(RI_{t+1})=E(E_{t+1}) - kBV_t$, where $E(E_{t+1})$ is the consensus earnings forecast.

data to logs, and the second involves deflating the variables by some measure thought to be the source of the heteroscedasticity. Such measures are typically ones that capture the 'size', or 'scale' of the observation. We focus on the second type of solution in this study.

Again we start with the generalized version of models (1) and (2) as below in equation (11):

$$MV_{it} = a_0 + \sum a_i AV_{it} + \varepsilon_{it} \quad (\mathbf{11})$$

Assume equation (11) suffers from heteroscedasticity, which might result from size differences across firms. That is:

$$MV_{it} = a_0 + \sum a_i AV_{it} + S_{it}\varepsilon_{it} \quad (\mathbf{12})$$

where S_{it} represents the source of heteroscedasticity. Generally, S_{it} is likely to be a measure of the 'size' or the 'scale' of the observation. Although heteroscedasticity does not lead to bias in the estimated coefficients, α_0 and the αi, it biases the standard errors of the coefficients, resulting in potentially incorrect inferences because the standard OLS method for calculating coefficient estimate standard errors and, thus, t-statistics, assumes homoscedasticity.

One common solution to such econometric problem in value relevance studies is to deflate both sides of the equation (12) by S and estimate:

$$\frac{MV_{it}}{S_{it}} = \frac{\hat{a}_0}{S_{it}} + \sum \frac{\hat{a}_i AV_{it}}{S_{it}} + \varepsilon_{it} \quad (\mathbf{13})$$

An implication of so doing is that, empirically, the above regression is estimated without a constant term. Instead, the coefficient of the new independent variable, $1/S_{it}$, provides an estimate of the constant term α0 of model (12). If the source of heteroscedasticity has been correctly identified, the error term of model (13) is now homoscedastic.

Now assume the generalized model (11) suffers from both the absence of a correlated omitted variable, related to size, and size-induced heteroscedasticity. Thus, the 'true' model is:

$$MV_{it} = a_0 + \sum a_i AV_{it} + \gamma S_{it} + S_{it}\varepsilon_{it} \quad \mathbf{(14)}$$

S_{it} is presumed correlated with the included independent variables AV_{it}. In this context, as long as the omitted variables in a regression equation are uncorrelated with the included independent variables, OLS regression will produce unbiased estimates, although t-tests on the coefficients of the included independent variables will be less likely to reject the null hypothesis. When the omitted variables, however, are in fact correlated with the included independent variables, OLS regression will produce biased and inconsistent estimates. The remedy is again to deflate both sides of the equation (14) by S_{it}, producing equation (15):

$$\frac{MV_{it}}{S_{it}} = \gamma + \frac{\hat{a}_0}{S_{it}} + \sum \frac{\hat{a}_i AV_{it}}{S_{it}} + \varepsilon_{it} \quad \mathbf{(15)}$$

which, from an empirical point of view, suggests running regression (13) with a constant term. Equation (15) provides a specification mitigating the problems of both omitted correlated variables and heteroscedasticity, on the assumption that S adequately captures both the effects of correlated omitted variables and the source of heteroscedasticity.

Given the above discussion, we investigate the effects of using different estimation equations corresponding to general equations (13) and (15). The equations we estimate are:

$$\frac{MV_{it}}{S_{it}} = \frac{a_0}{S_{it}} + \sum \frac{a_i AV_{it}}{S_{it}} + \varepsilon_{it} \quad \mathbf{(16)}$$

$$\frac{MV_{it}}{S_{it}} = \frac{a_0}{S_{it}} + \sum \frac{a_i AV_{it}}{S_{it}} + \beta \frac{OI_{it}}{S_{it}} + \varepsilon_{it} \quad \mathbf{(17)}$$

$$\frac{MV_{it}}{S_{it}} = \frac{a_0}{S_{it}} + \sum \frac{a_i AV_{it}}{S_{it}} + \gamma + \varepsilon_{it} \quad \mathbf{(18)}$$

$$\frac{MV_{it}}{S_{it}} = \frac{a_0}{S_{it}} + \sum \frac{a_i AV_{it}}{S_{it}} + \gamma + \beta \frac{OI_{it}}{S_{it}} + \varepsilon_{it} \quad \mathbf{(19)}$$

Equations (16) to (19) allow us to make a number of comparisons. We can compare regressing without and with constant term γ by comparing the results for equations (16) and (18), or (17) and (19). We can compare the results with and without 'other information', using equations (16) and (17), or (18) and (19). We can also compare the results between using a simple valuation model, when i = 1, 2 and the model is specified as including BV and E alone as the accounting variables, with the case when i = 1, …, 6 and we include BV_t, E_t, RD_t, D_t, CC_t, CE_t as the accounting variables. Finally, to compare the effect of different 'scale' proxies, S_t, we use five different deflators, as discussed in the previous chapter of literature review - closing book value (BV_t), sales ($SALES_t$), number of shares ($NoSHARES_t$), opening market value (OMV_t) and closing market value (MV_t).

With deflated models, we proxy βOI_{t-1} by $S_{it-1}\varepsilon_{it-1}$. Hence, for year t, we use $S_{it-1}\varepsilon_{it-1}$ as a proxy of OI_t, and ε_{t-1} can be obtained by running the appropriate deflated regression with all available data up to year t-1, with ε_{it-1} the firm specific error term.

Following Choi, O'Hanlon and Pope (2006), who suggest that the impact of accounting conservatism is likely to differ between high-intangible and low-intangible sectors, we estimate each specific model specification both on the full estimation sample and after separating the full estimation sample into high-intangible firms and low intangible firms. Choi, O'Hanlon and Pope (2006) follow prior US studies (Francis and Schipper, 1999, Amir, Lev and Sougiannis 1999) in splitting the sample into high- and low-intangible firms, using industrial classifications. In particular, they identify certain industries as "high-technology", such as drugs, publishing, research and development services etc. We find, however, that similar industrial classification data available for UK firms are not as detailed as that of US. Hence, we believe that the market-to-book ratio can be used to fulfil the same purpose of splitting the full sample into high- and low-intangible firms, and firms with higher (upper quartile) market-to-book ratios are assigned to the high-intangible group, and those with lower (lower three quartiles) ratios are assigned to the low-intangible group[5].

Market-to-book ratio is calculated using market value six months after the financial year end date, and book value reported in the annual report forecast period

[5] Market-to-book ratio is calculated using market value six months after the financial year end date, and book value reported in the annual report.

have not been used to obtain the estimates of the parameters, ex-post forecasts provide a true test of the model's forecasting ability" (Ramanathan, 1998, p564). Similarly, Pindyck and Rubinfeld (1998, p203) states that "in an ex post forecast, observations on both endogenous variables and the exogenous explanatory variables are already known with certainty during the forecast period. Thus, ex post forecasts can be checked against existing data and provide a means of evaluating a forecasting model." Ex post forecasts result from estimating the parameters on historical data and using the estimated parameters to predict estimators one period forward. Therefore, ex post forecasting valuation errors are the equivalent of out-of-sample valuation errors referred to in this study. Overall, given that ex post forecasts errors are commonly employed for the evaluation of economic models (e.g., comparing macroeconomic models), there is precedent also from empirical research in other disciplines, and not just accounting, for the use out-of-sample valuation errors to assess various valuation model specifications in our context.

Our procedure for estimating out-of-sample valuation errors follows closely that used by Choi, O'Hanlon and Pope (2006). Implicit in the approach of Choi, O'Hanlon and Pope (2006) is that the coefficients of the linear information dynamics system they estimate are stable over time. As a consequence, and given a particular start date for the data, it makes sense to progressively pool more and more years' of data to estimate coefficients. We adopt a similar underlying assumption – that the accounting-based valuation model is stable over time - and, hence, follow a similar approach of progressively pooling more and more years' of data to estimate the coefficients of the model.

For each year t, we use UK accounting and market data, available up to year t, to run the regressions using the deflated models in equations (16) through (19) above, to obtain the relevant estimated coefficients for year t. These coefficients are then applied to the accounting and market data of year t+1 for each firm j to calculate the estimated market value. To illustrate for equation (17)

$$MV^{est}{}_{j,t+1} = S_{j,t+1}\frac{MV_{j,t+1}}{S_{j,t+1}} = S_{j,t+1}(\frac{a_0}{S_{j,t+1}} + \sum \frac{a_i AV_{j,t+1}}{S_{j,t+1}} + \gamma + \beta\frac{O_{j,t+1}}{S_{j,t+1}}) \quad \textbf{(20)}$$

where, $MV^{est}{}_{j,t+1}$ represents the estimated market value for firm j at year t+1. $MV^{act}{}_{j,t+1}$is then compared with the actual market value for year t+1. The proportional valuation error for each firm for year t+1 is calculated as:

$$\omega_{j,t+1} = \frac{MV^{est}{}_{j,t+1} - MV^{act}{}_{j,t+1}}{MV^{act}{}_{j,t+1}} \quad \mathbf{(21)}$$

and $\omega_{j,t+1}$ is defined as the proportional valuation error ratio for firm j at year t+1. Valuation bias is measured by the mean valuation error and valuation accuracy is measured by the mean absolute proportional valuation error and the mean squared proportional valuation error. For each of the metrics of mean valuation errors, we test the null hypothesis that the mean of that metric is zero, using a t-test. For both measures of valuation accuracy, the lowest value is the most accurate. The best estimation specification is expected to provide the least valuation bias and most accurate value estimates.

When estimating the models on high- and low-intangible assets firms separately, the procedure is slightly different. Taking year 1996 estimation (splitting high- and low in tangible firms) as an example, we split the sample for each year first, then pool the data from 1990 to 1996, run valuation model regressions and the coefficients generated are then applied to year 1997. These steps so far are done with high- and low-intangible assets firms separated. Finally the valuation errors calculated for the sub-samples are combined for year 1997.

4. Data Sampling and Initial Results

4.1 Introduction

The purpose of this thesis is to evaluate cross-sectional corporate valuation models in three different counties: Great Britain, Greece and Spain for the year of 2011 and 2016. In chapter 3, we discuss the research methodology employed in this study. In order to investigate the issues of interest associated with corporate valuation models, accounting and market data of both live and dead listed companies are needed for model estimation purpose and for the calculation of valuation errors, whilst return data needs to be collected to measure the performance of the portfolios formed based on the firm valuation models.

In this chapter, I describe the process of data collection and the measurement of the relevant variables. Section 4.2 identifies the steps followed in collecting the data for all companies. Section 4.3 identifies the procedure of data treatment. Section 4.4 presents the variable definitions.

4.2 Data and sampling

The sample for this study consists of 55 non-financial companies listed on the London Stock Exchange, 41 non-financial companies listed on the Athens Stock Exchange and 49 non-financial companies listed on the Spain Stock Market for 2011 and 2016. Accounting data is from the Datastream database and I feel it is important to emphasize the date of data collection, 25/09/2017, the data of which data is used as the basis of the whole data collection process.

4.3 Variable measurement

The definitions of the variables are presented as follows (variable definitions extracted from the database are presented in Appendix 1):

1. MV_t: market value for a firm of a given calendar year t, is measured six months after the date of its balance sheet. All firms with their balance sheet date within 2011 and 2016 will be considered to be within the same calendar year. For a firm whose financial year is considered to end on December 31, 2011 and on December 31, 2017. The reason for doing this is that all listed firms from three countries have six months to prepare and release their annual accounts. Accordingly, the market value six months after the balance sheet date is used to help ensure that the information in the financial statement for a given financial year is reflected in the market price,

2. BV_t: closing book value at year t is measured as shareholder's equity at year t,

3. E_t: earnings at year t, are measured as net income before preferred dividends at year t,

4. RD_t: research and development expenditures at year t are measured as RD expenses recognized in the income statement at year t,

5. D_t: dividends at year t are measured as the total cash common dividends paid on the company's common stock during year t,

6. CC_t: capital contributions at year t are measured as the negative of the amount a company received from the sale of common and/or preferred stock at year t,

7. CE_t: capital expenditures at year t are measured as the funds used to acquire fixed assets other than those associated with acquisitions at year t,

8. S_t: deflators where, further, Sales is measured by as gross sales and other operating revenue less discounts, returns and allowances.

4.4 Sample characteristics

Tables below show some characteristics of variables used in the regression models for the various samples of Great Britain, Spain and Greece corresponding.

Table 1: Descriptive Statistic for variables in Great Britain

	2011							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S (bil)**
AVERAGE	4,53	1,37	0,48	0,65	0,09	1,43	0,48	**1,47**
MEDIAN	0,82	0,25	0,20	0,00	0,02	0,73	0,06	**0,82**
MAX	181,58	57,83	14,60	12,96	3,86	37,15	9,26	**11,10**
MIN	0,00	0,00	0,14	0,00	0,00	0,57	0,00	**0,15**
STAN. DEVIATION	25,06	7,76	1,94	2,13	0,52	4,91	1,45	**1,96**

	2016							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S**
AVERAGE	4,61	1,47	0,55	0,66	0,14	1,54	0,54	1,58
MEDIAN	0,87	0,30	0,25	0,04	0,06	0,80	0,10	0,90
MAX	190,70	60,76	15,37	13,65	4,09	39,04	9,76	11,70
MIN	0,04	0,04	0,19	0,04	0,04	0,64	0,04	0,20
STAN. DEVIATION	25,83	8,15	2,04	2,14	0,54	5,15	1,52	2,06

Table 2: Descriptive Statistic for variables in Spain

	2011							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S (bil)**
AVERAGE	2,89	2,37	0,95	0,95	0,83	0,21	2,42	2,41
MEDIAN	1,30	0,98	0,27	0,32	0,21	-0,02	0,57	1,47
MAX	16,14	13,09	8,47	14,05	7,59	2,71	22,72	14,70
MIN	0,00	0,00	0,00	0,00	-0,03	-0,11	-0,15	0,27
STAN. DEVIATION	3,60	3,21	1,57	2,19	1,41	0,52	4,24	2,80

	2016							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S**
AVERAGE	3,02	2,48	0,99	0,99	0,85	0,20	2,53	2,51
MEDIAN	1,35	1,02	0,26	0,33	0,20	-0,04	0,58	1,53
MAX	16,93	13,73	8,88	14,74	7,96	2,83	23,84	15,42
MIN	-0,01	-0,01	-0,01	-0,01	-0,05	-0,13	-0,17	0,27
STAN. DEVIATION	3,78	3,37	1,65	2,29	1,48	0,55	4,45	2,94

Table 3: Descriptive Statistic for variables in Greece

	2011							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S (bil)**
AVERAGE	1,15	2,25	0,95	0,61	0,48	-1,13	0,94	0,46
MEDIAN	0,45	0,85	1,19	0,02	0,01	-0,43	0,51	0,43
MAX	22,85	45,65	1,33	11,40	9,12	-0,01	15,09	1,20
MIN	0,02	0,01	-6,29	0,00	0,00	-22,83	0,00	0,03
STAN. DEVIATION	3,52	7,04	1,18	1,90	1,50	3,52	2,30	0,28

	2016							
	MV	**BV**	**E**	**RD**	**D**	**CC**	**CE**	**S**
AVERAGE	1,32	2,59	1,10	0,69	0,55	-1,30	1,08	0,53
MEDIAN	0,52	0,98	1,37	0,01	0,01	-0,49	0,59	0,49
MAX	26,28	52,50	1,53	13,11	10,49	-0,01	17,36	1,38
MIN	0,02	0,01	-7,24	0,00	0,00	-26,25	0,00	0,03
STAN. DEVIATION	4,05	8,09	1,35	2,16	1,73	4,05	2,65	0,32

5. Results

All sample firms are ranked from the valuation model where market value is regressed on book value, earnings, dividends, research and development expenditures, capital contributions, capital expenditures.

One common approach to mitigate scale-related econometric problems is to deflate the equation with a size-proxy – scale factor, while, there are a few choices of deflators. Easton (1998) suggests that closing book value is a suitable deflator, while Barth and Clinch (2009) argue that Easton (1998) does not demonstrate that deflating by book value produces superior results and that part of the estimation problem constitutes the omission of size-related variables from the simple regression of market value on earnings and book value. They attempt to eradicate this problem by adding in net shareholder cash flows (that is, dividends less capital contributions) to the valuation model (as would be suggested by Ohlson, 1989). Lo and Lys (2000) argue that opening market value is the best deflator on a theoretical basis, and also that its use produces a 'theoretically' more appealing coefficient for dividends (that is, one that is negative) in a regression of market value on earnings, book value, dividends and capital contributions. We used the sales as deflator. All the values have divided by the sales, so as to avoid the heteroscedasticity.

Table 4

	SPAIN (2011)	GREAT BRITAIN (2011)	GREECE (2011)	SPAIN (2016)	GREAT BRITAIN (2016)	GREECE (2016)
Constant	3112.15*	1587.56*	4157.11*	6005.08*	3775.8*	2515.6*
BV	0.73*	1.05*	2.07*	1.45*	2.78*	3.11*
E	-0.05	-0.22*	-0.10	-0.02	-0.04	-0.47*
RD	9.25*	5.21*	7.66*	6.15*	9.96*	3.53*
D	7.25*	8.05*	6.87*	3.78*	6.11*	4.56*
CC	-0.21	-0.06	-0.39*	-0.42*	0.01	-0.79*
CE	0.98*	1.25*	2.05*	2.34*	0.08	4.15*
R^2	66.7%	58.9%	70.1%	71.4%	69.6%	60.4%

Using sales as deflator , *p-value<0,05

Table 4 reports a set of results from the six regressions. The value of deflated market value is predicted for Spain, Greece and Great Britain on 2011 and on 2016.

Judging by the averages for each portfolio, firms in highest market value, when they have the highest book-to-market (BV_MV) ratios and lowest levels of income (E_BV), are the most RD intensive (RD_MV), have the highest dividend yields (D_MV), the highest levels of capital contributions (CC_MV) and capital expenditures (CE_MV), and also are firms with low EP ratios.

Our study, therefore, compares a benchmark model of market value regressing on book value and earnings against an extended firm valuation model, built on Rees (1997) and Akbar and Stark (2003a), where corporate value is modelled as a linear function of accounting variables found to be associated with company value in the UK (book value, earnings, research and development expenditures, dividends, capital contributions and capital expenditures).

Conclusion

As stated in the introductory chapter of the thesis, a specific research question drives the research in this thesis. The issues include: (i) is it better to use an expanded model rather than one in which the base explanatory variables of market value are earnings and book value;

To summarize our findings, we would argue that a valuation model specification that is estimated without a constant term in the deflated extended model provides the best specified model. As expected, the results suggest that an extended model including the main accounting variables found to be associated with market value in the all the countries. Although firms in the higher deciles tend to have higher abnormal returns than firms in the lower deciles, the difference between the two extreme portfolios (or the hedge returns) are statistically insignificant. As a consequence, accounting-based valuation models do not seem to provide superior estimates of intrinsic value to market values.

The first limitation of this study could be the valuation models employed in the empirical analysis. It is simply impossible to develop a valuation model that can be defended unequivocally. One possible limitation of the valuation models adopted in this research could be their property of linearity. As a consequence, this potential source of model misspecification could result in erroneous conclusions. Nonetheless, most studies within the field adopt linear relationships between market value and accounting variables which, at least, makes the results of this research comparable to prior studies.

For the empirical study concerning fundamental analysis of firm valuation models, one limitation is associated with the performance evaluation of the investment strategies, where there are alternative methods of risk control, such as using benchmark models that are developed on the basis of firm-specific factors, for instance, market capitalization and 191 book-to-market value. Investigation into alternative risk control methods is necessary for the literature of performance evaluation.

Last but not the least, we measure earnings as net income in this study, which essentially assumes that all earnings components carry the same coefficient for equity valuation. Prior studies have shown that decomposition of earnings before RD into two components – earnings before RD and extraordinary/exceptional items and extraordinary/exceptional 192 items - can add information for loss reversal models (Jiang and Stark, 2009a). Given this predictive power for future earnings, we could also consider using a measure of a component of core earnings, such as earnings before RD and extraordinary/exceptional items, together with extraordinary/exceptional items, to see whether this further decomposition will improve the bias and accuracy of accounting-based valuation models.

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