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MASTER OF MANAGEMENT IN FINANCE AND INVESTMENTS

THESIS

Company Discounted Cashflow and Accounting Based Valuation models on JSE listed firms in South Africa

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ABSTRACT

The study contributes to the debate on which of the share valuation models between the accounting based and discounted cashflow based valuation models produce an intrinsic share value that is equal to the observed share value. The literature on accounting based valuation models been individual models separately and on general basis with no specific studies on the JSE was done. In this study we focus on the two models, comparing which is superior in producing values close to those observed in the market. The study is based on all firms listed on the main board of the Johannesburg Securities Exchange (JSE) over the period 2004 to 2013.

The results show that it is not a given conclusion that the accounting based models are superior to the discounted cashflow models. Individual techniques within the accounting based models perform differently with some performing much worse than the discounted cashflow models. The study demonstrates that the valuation models do not produce intrinsic values that are equal to the observed prices, though there were results showing some models producing values that are much closer to the observed values.

DECLARATION

I, Vuyo Mafata declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in this or any other university.

Vuyo Mafata

Signed at …… On the …… day of …… 2015

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Chapter 1

1.1 Introduction

This chapter formally introduces the thesis and discusses the problem statement which rationalises the study. The chapter is organised as follows. Section 1.2 presents the context of the study. Section 1.3 discusses the research problem to be investigated. Section 1.4 outlines the specific objectives of this research. Section 1.5 discusses the research questions to be answered in addressing the research problem. Section 1.6 discusses the gap in the literature that gave rise to the need for this research. Section 1.7 discusses the research methodology. Section 1.8 outlines the structure of the research. Chapter summary concludes this Chapter.

1.2 Context of the study

Deriving a value of a share is not an exact science, and this fact is reflected in the different valuation methods and its comparison with the actual share price (Nel, 2009). According to Graham and Dodd in Gleason, Johnson and Li (2013) an analyst's judgement on a value of a share would be more dependable if he or she was able to determine some objective value independent of the value placed on a share by the market. This value could then be used to compare the intrinsic value obtained from the independent valuation to the current price of that share. Investors tend to place reliance on the signals that analysts provide when making decision on whether to buy or sell a specific share.

There are different techniques or models that are used to value a share prior to making an investment decision. A good share valuation model should be simple and understandable, be testable, be precise in explaining current prices against historical data and be helpful to investors in isolating the market consensus estimate of future company performance (Wilcox, 1984).

According to Brennan (1991) and Gleason et al (2013) there are two underlying valuation models to value shares. In the first model, the value of a firm's equity is expressed either as the present value of the expected future divided stream to current shareholders with Gleason et al (2013) referring to this valuation model as

discounted valuation. The second model uses the accounting information to arrive at a value of a share. Gleason *et al* (2013) refers to the second valuation method by using examples such as relative valuation models, where accounting information such as price to earnings, price to book and value ratios are compared.

In this study, the two valuation approaches would be referred as the discount cashflow models and accounting information models respectively. Intrinsic value of a share is used for many reasons and one of them is for evaluating prices that could be used for mergers and acquisitions. According to Heifer and Vishny (2003), Rhodes-Kopf, Robinson and Viswanathan (2005) and Gao (2010), misevaluation is used as a significant driving force in mergers and acquisitions where they stimulate managers to undertake acquisitions. It is the investment horizon of managers that will dictate the need for valuation and the result of the valuation. Managers who have a longer horizon tend to focus on the firm's long term value and they use the overvaluation to acquire target firms in order to preserve some temporary over valuation for long run shareholders (Gao, 2010).

Usually there are differences between the intrinsic values of share and their observed prices as quoted on the Johannesburg Securities Exchange. This difference is often referred to as valuation error caused by the behaviour and actions of investors. Kumar (2009) and Odean (1999) argue that investors can be over confident of the private information or overestimate their ability to process their private information to arrive at a share value. The purpose of this research is to compare the performance of discounted cash flow and accounting information valuation models in determining the intrinsic value of a share and then compare the determined intrinsic value to the observed (market) price of share prices quoted in the Johannesburg Securities Exchange. Furthermore, the research identifies the model that results in the lowest valuation errors.

1.3 Research Problem

There is a plethora of research on various valuation models and on how the models compare with each other in terms of accuracy in predicting the future performance of a share. Heinrichs, Hess, Homburg, Lorenz and Sievers (2013) studied the impact of

accounting accrual on the divided discount model (DDM), discounted cashflows (DCF) and the residual income model (RIM) resulting in the production of the extended versions of the models with smaller valuation errors. Jiang and Lee (2005) compared DDM and the RIM's volatility implications of these models and found that RIM is more attractive than DDM in determining value of a firm. Alford (1992), Gleason, Johnson and Li (2010), Nel (2009), also performed some research in the area of stock valuation where the focus was not on determining the methods that minimise the valuation errors but rather on other aspects of share valuation. The determination of whether the market prices of Johannesburg Exchange listed firms are equal to the intrinsic value of these firms, has not been performed.

In addition to limited research in area of valuations in South Africa, there also seem to be reliance by investment analyst to place substantial value on accounting information when making investment decision. In the recent past, the world witnessed catastrophic governance scandals that have, one way or another, been linked to the manipulation of financial statements. Enron is one example where financial reporting irregularities caused erroneous valuations of as well as of those off affected firms due to the contagious effects of the irregularities (Akhigbe, Madura and Martin, 2005). Akhigbe *et al* (2005) argues that a scandal where one firm misleads the public with misleading financial statement, it does not only affect that company, but it has a contagion effect on other companies that does business with the affected firm, Enron was a typical case.

Despite this problem, investors continue to place substantial value in accounting information when making investing decisions. Accounting information is useful in creating and distributing wealth of a firm and is often used as an indicator in making investment decisions (Tsay, Lin and Wang, 2008). The problem is, we do not know whether the accounting based valuation models perform better than other models in terms of predicting the future share price.

1.4 Research Objectives

The specific objectives of this research are as follows:

- To establish whether the discounted cash flow models give an intrinsic value that is equal to, less or more than the observed share prices for JSE listed companies;
- To establish whether the accounting based models give an intrinsic value that is equal to, less or more than the observed share prices for JSE listed companies;
- To determine which of the two types of share valuation models results lower valuation errors when compared to observed prices in the Johannesburg Securities Exchange;
- To recommend the share valuation model that should be used to determine intrinsic value of shares for firms listed in the Johannesburg Securities Exchange.

1.5 Research Questions

The specific research questions to be answered are as follows:

- Do the discounted cashflow models provide an intrinsic value that is equal to, less or more than the observed share prices for JSE listed companies?
- Do the accounting based models provide an intrinsic value that is equal to, less or more than the observed share prices for JSE listed companies?
- Which of the two types of share valuation models gives lower valuation errors when compared to observed prices in the Johannesburg Securities Exchange?
- Which share valuation model should be used to determine intrinsic value of shares for firms listed in the Johannesburg Securities Exchange?

1.6 Gap in the Literature

There has been research undertaken on valuation models and to determine which models perform best. These studies include the research by Dowelani (2012), Nel (2009) as well as Penman and Sougiannis (1998). The literature however has indicated limited research that has been done to compare the models for South African JSE listed companies to determine the how close the intrinsic value obtained using these models reflect the market value of the share.

1.7 Research Methodology

The study uses the share price and accounting data obtained from *Bloomberg* and *INET BFA* databases. All companies listed in the JSE that have dividend data for the full period between 2004-2013 will be included in the study.

This study is mainly quantitative and comparative where the intrinsic value of the share is determined using the discounted and accounting based valuation based methods. Subsequently, the intrinsic value using the two methods is compared to the market value to assess the percentage valuation error. The method that has a significantly lower error is deemed to be efficient and should be adopted by investors when they make their investment decisions.

1.8 Structure of the Research

The study is subdivided into five chapters which aim to develop answers to the four research questions and the research objective stated above. Chapter Two presents literature review which provides detailed discussion about the different valuation methods and how the performance of these methods is measured. Chapter Three outlines the research method applied in the study and discusses the tools applied to test the data. Once the data is analysed, Chapter Four reports and discusses the results of the study in detail. Chapter Five summarises the findings and make conclusions as well as recommendations for further work.

Chapter summary

The introductory chapter provided a description of an intrinsic value of shares and outlined at a high-level two approaches to determining an intrinsic value of a share. It gave the context of the study and indicated the research objectives, research questions to be answered in determining the ideal valuation method for JSE listed shares. The next chapter, the literature review, will look at theoretical foundations for the research in order to develop the required background and context to assist in answering the research questions. It will discuss the fundamental share valuation methods in detail.

Chapter 2: Literature Review

2.1. Introduction

This literature review provides a discussion on how the discounted cashflow and accounting based share valuation models are used to estimate the intrinsic values of a share. It reflects on the past studies that focused on different valuation models as well as on the comparison of those models. Section 2.2 presents a background to share valuation and fundamental analysis as a tool to analyse investments. Section 2.3 discusses the discounted cashflow models and other share valuation methods used to determine the intrinsic value of a share. Section 2.4 presents literature on the performance of the different valuation methods and the resulting valuation errors. Chapter summary concludes the chapter.

2.2. Fundamental Analysis

From an investors' perspective, there are two sides of an investment analysis - fundamental analysis and technical analysis (Morris, Rudd and Flanegin, 2005). While there are arguments that none of the two is better than the other, technical analysis is viewed as more of following a crowd in investment decisions, and fundamental analysis is described as a practice that relies heavily on the analysis of current and past financial statement data to identify when an underlying firm value differs from prevailing market prices (Arbabanell and Bushee, 1998).

Bernstein (1975) argues that fundamental analysis is an indispensable, rational and useful approach to reaching investment decisions. He adds that in fundamental analysis, the analysis of financial statements is a key procedure in arriving at the valid investment decisions.

Security analysis and its special branch, the financial statements analysis are more rigorous and demanding procedures that draw on a knowledge of a number of disciples requiring considerable preparation and effort (Bernstein, 1975). In order to arrive at a fair price of a business or share price of a business, it's earning capacity and its financial condition must be evaluated. Bernstein (1975) argues that one way

to carry out this valuation is through the analysis of the financial statements of the firm in order to determine prospects for its future earnings power and the risks the proposed investment will be exposed to given its financial condition and capitals structure.

Investors, analysts and managers embark on a valuation exercise for a number of reasons. First, to make a decision on whether to buy, hold or sell an equity stake in a firm (Beynon and Clatworthy, 2012). Second, to know and understand the factors that influences the value of the company as well as how their decisions will impact on these factors (Stubelji, 2010). Third is to know how much wealth has been created by managers of the firm in order to assist with further capital raising (Pirie and Smith, 2008).

2.3. Valuation Models

One approach to separate ultimate winners from losers is through the identification of a firm's intrinsic value and/or systematic errors in market expectations, where undervaluation is identified by using analysts' earnings forecasts in conjunction with an accounting based valuation model (Piotroski, 2000). There are many different valuation models that are used in practice and these include Cash flow discounting models (e.g., Dividend discount models and free cash flow model); Earnings based models (e.g. EBITDA), Relative valuations models (e.g., P/E multiple, PER, P/EBITDA .) and value creation models (e.g., EVA).

2.3.1. Discounted Cash flow Models

According to Rappaport (1986), the discounting of future cashflows is the most widely used method of share valuation. Cogliati, Paleari and Vismara (2011) further add that discounted cashflows are widely used to price initial public offerings. The cashflows considered in a valuation method comprise the dividends that the firms pay as well as the proceeds from the sale of shares.

2.3.1.1. Dividend Discount Model

The divided discount model (DDM) is a valuation model that is based on the principle that the selling price of a share is based on the expected dividends (Rappaport,

1986). A fundamental principle in the valuation of shares is that the value of a share equals the sum of its future cashflows, where the cashflow are adjusted for risk and the time value of money (Jordan, Miller Jr and Dolvin, 2012, Carlson, 1999 and Reilly, 1995). DDM equates the firm's price to the discounted value of its expected dividends (Fairfield, 1994). According to Carlson (1999), an investor is willing to pay more for a share if there is expectation of more earnings in the future. There are variations of DDM models and these include constant growth models, non-constant growth models, linear models, supernormal models.

Schreiner (2007) indicates that, because the shareholder's payoffs consist of dividend and cash obtained from liquidation of shares, the firm's value should be based on the stream of dividends expected to be paid in future as well as the cash paid at the end the forecast horizon. Using the DDM, the intrinsic value of a firm can be represented as the present value of expected future dividends discounted at their risk adjusted expected rate of return (Schreiner, 2007). Gordon (1962) further enhances this valuation method by making assumptions about the growth of the dividends over time, which result in the Gordon's Growth Model (GGM). According to Schreiner (2007) the GGM is a special case of the DDM which assumes that the cost of equity remains constant through time and dividends grow geometrically at a constant rate.

DDM has a number of weaknesses identified by various researchers such as Nel,(2003) and Heinrichs, Hess, Homburg, Lorenz and Sievers, (2013). First, although the dividend discount model is a simple and a popular approach, it is based on a number of unrealistic assumptions with the main one being that the firm will exist *ad infinitum.* Second*,* the issue of a constant growth assumption of is also questionable (Nel 2013). Third, is that both models assume that valuation takes place under ideal conditions, referred to as a clean surplus situation. Valuation models should also include the dirty surplus and other corrections for non-ideal situations (Heinrichs, Hess, Homburg, Lorenz and Sievers, 2013).

In order to cater for dirty surplus correction, the dividend portion of the dividend discount model (DDM) must include all cash transfers between equity owners of the firm (Heinrichs *et al*, 2013). Using only the cash dividends, one omits a substantial portion of the cash transfers that is cash from the increase or repurchases of capital.

2.3.1.2. Free Cash flow Methods (FCF)

The free cashflow model assumes that the firm's share value is equal to the present value of future free cashflows, that is, those cashflows that are available to be paid out to shareholders (Nel, 2009 and Gardner, McGowan and Moeller, 2009). The value of a firm is the free cashflow to equity divided by the sum of the required rate of return for equity less the growth rate of the firm earnings (Gardner, McGowan and Moeller, 2009). According to Nel (2009) there is a need to differentiate between two types of free cashflow methods; the free cashflow to equity model (FCFE) and the free cashflow to the firm model (FCFF).

The free cash flow to equity model can be expressed as cash flow that is available after all reinvestment needs and debt repayment have been accounted for (Nel 2009). Nel (2009) expresses the free cashflow to equity (FCFE) mathematically as follows:

$$\mathrm{Po} = \sum_{t=1}^{n} \frac{\mathrm{FCFE}}{(1 + \mathrm{ke})^{\mathrm{t}}} + \frac{\mathrm{TVn}}{(1 + \mathrm{ke})^{\mathrm{N}}}$$

Where $\mathbf{V_0}$ can also be expressed as $\mathbf{P_0}$ and it is the intrinsic value of the share, $\mathbf{K_e}$ can also be expressed as k and it is the risk adjusted discount rate or the rate of return earned on share, $\mathbf{TV_n}$ is the terminal value of the share after the end of the period under review.

In a free cash flow to the firm model, an assumption is made that the firm has no debt and doesn't enjoy tax benefits from interest expenses. Nel (2009) expresses the free cashflow to firm (FCFF) mathematically as follows:

$$\mathrm{Po} = \sum_{t=1}^{n} \frac{\mathrm{FCFF}}{(1 + \mathrm{WACC})^{\mathrm{t}}} + \frac{\mathrm{TVn}}{(1 + \mathrm{WACC})^{\mathrm{N}}}$$

Where $\mathbf{V_0}$ can also be expressed as $\mathbf{P_0}$ and it is the intrinsic value of the share, **WACC** is the weighted average cost of capital and $\mathbf{TV_n}$ is the terminal value of the share after the end of the period under review.

Gardner, McGowan and Moeller (2009) define the Free Cashflow to the firm as the net income minus the net capital expenditure, minus the changes in working capital, plus the net changes in long term debt position of the firm.

2.3.2. Accounting Valuation Models

Brennan (1991) argues that the use of accounting data to explain the prices of shares has a long history and that the focus is on the earnings of a firm. Given the failure of the dividend discount model to explain the share price fluctuations, alternative models of share valuations have been explored (Jiang and Lee, 2005). Subramanyam and Venkatachalam (2007) compare the dividend based model and accounting information models and conclude that difference is in the earnings used in the model and cashflows, with the earnings being more in line with the accounting standards hence being better than cashflow based models.

Below is the discussion of accounting valuation models used to value shares and these models include relative valuation (also known as multiples) model, residual income model and economic value add model.

2.3.2.1. Relative Valuations

Relative valuation methods (also known as valuation multiples) provide an estimate value of an asset by using comparable assets price/ratio as benchmark in relation to common variables such as earnings, bookvalue and sales (Nel, 2009, Reilly, 1995 and Schreiner 2007, Lie and Lie, 2002). In a relative value approach, a benchmark multiple has to be identified for comparison purposes. The value of the share would then be calculated as a product of a specific multiple, which can be price-earnings ratio and a specific value driver, which can be earnings per share (Nel, 2009). Yoo (2006) argues that multiples approach is a widely practiced valuation technique due to its simplicity and for not requiring a multi-year forecasts. D'Mello, Lahey and Mangla (1991) argue that relative valuation model is a useful tool during period of low inflation and high productivity due to its simplicity and easy availability of information required in the model.

There are various relative valuation models that are used to determine intrinsic value and some are presented by Schreiner (2007). First is the price to earnings multiple (P/E) derived from the Dividend Discount Model. Second is price to bookvalue

multiple (P/B) derived from the Residual Income Model and lastly is the enterprise value to earnings before interest and tax multiple (EV/EBIT) derived from the discounted cashflow model. According to Craig, Johnson and Joy (1987), P/E ratios play an important role in investment analysis with Cheng and McNamara (2000) arguing that they are the most popular valuation methods in the investment community. The P/E valuation estimates a firm's share value by capitalising the earnings of the firm at the P/E multiple for a set of comparable firms (Alford 1992, Cheng and McNamara 2000). In the calculation, the price of a share is derived as a product of earnings and P/E of comparable firms. According to Cheng and McNamara (2000), the P/E valuation method captures the risks and growth of a share hence its ability to ensure that the firm is compared to firms of comparable risk and growth characteristics, particularly when the firm's value is not easily observable.

Saunders (1996) describes the price to bookvalue (P/B) ratio as the P/E ratio multiplied by the return on equity (ROE) while Cheng and McNamara (2000) further adds that it estimates the firm's stock by capitalising bookvalue at a benchmark P/B multiple determined from a set of comparable firms. According to Cheng and McNamara (2000) the P/B ratio represents the firm's excess return as a result of a firm's superior results and that it provides a better explanation to the variation in returns.

This model however, is not without criticism. Nel (2009) argues is that the value drivers are based on historical accounting data such as earnings which may be manipulated, especially with documented accounting malpractices by various firms.

2.3.2.2. Residual Income Approach

Jiang and Lee (2005) state that as a result of problems with the dividend discount model, the residual income model has become popular. The recent prominence of this models was due to its ability to procure a constructive role for accounting data in equity valuation (Ohlson, 2006). Beynon and Clatworthy (2012) argue that the residual income model is easier to implement and is far more accurate than the cashflow and dividend based models. Residual Income model is defined as the difference between accounting earnings and the previous period bookvalue multiplied by the cost of equity. Ohlson (1995) defines residual income as follows:

$$RI_t = NI_t - r_{equity} . B_{t-1}$$

Where NI_t is the net income for the period ending at time t, r_{equity} is the cost of equity and B_{t-1} is the book value of common equity at time t-1. The residual income derived from the model is the amount that the net income of the firm exceeds the capital charge on the book value of equity. The residual income model, moves away from cash generating focus of the discounted cashflow models (Schreiner 2007 and Ohlson 2005).

According to Jiang and Lee (2005) and Myers (1999) the residual income model assumes an accounting identity and introduces a clean surplus relationship where the change in book value of equity is equal to the difference between earnings and dividends. Jiang and Lee (2005) lists the following benefits of the residual income model. One, cash dividends tend to be too smooth to be sole determinant of volatile share prices, while the earnings used in the residual income model explain the volatile share prices because they are also relatively volatile. Two, high growth firms usually do not pay dividend and in these circumstances the residual income model is more applicable. Three, residual income model allows an analyst to be able to use a broad measure of dividends, which is the differences between the bookvalues and actual dividends and four, it focuses the attention away from wealth distribution to wealth creation.

Schreiner (2007) argues that there are two major problems with the practical implementation of the residual income model as a measure of a firm's ability to create value. First, the clean surplus relation only holds if equity related capital transactions are value neutral and measured by their market value. Second, it anchors on the book value by deriving the intrinsic value of a firm as its bookvalue of equity plus a premium for expected growth in the bookvalue of equity. Emphasis on book values is only justified if they are approximate to market values and in some industries it's not possible to have book values that approximate market value.

2.3.2.3. Economic Value Add (EVA)

Economic Value Add (EVA) is a revised version of the residual income model that can be used to determine the value of a firm (Kumar and Sharma, 2011). Kumar and Sharma (2011) argue that the main difference between the residual income model and EVA is in how economic profits and economic capital are calculated, with the certain adjustments being made into accounting profits. These adjustments are explained by De Wet (2005) as adjustments required to the net assets and operating profits. Economic value add is based on the premise that in order for a company to create wealth for its owners, its earnings on its invested capital must exceed the cost of its capital (Nel, 2009). With EVA, the return earned on share must exceed the weighted average cost of capital as well as the capital invested and can be expressed mathematically as follows (Nel, 2009):

$$\mathrm{P}_0 = \sum_{t=1}^{n} \frac{\mathrm{EVA_t}}{1 + \mathrm{WACC}}$$

Where $\mathbf{P_0}$ refers to the intrinsic value of the share being valued and **EVA** representing the excess return on the investment measured as Return on Investment less Weighted Average Cost of Capital (WACC). de Wet (2005) argues that EVA is superior valuation model because it considers both the cost of equity and cost of debt, thus, it is said to be a measure of economic profit. EVA is calculated as

$$EVA = (\mathrm{ROIC} - \mathrm{WACC}) \text{ x } \mathrm{IC}$$

Where **ROIC** is the return on invested capital and **IC** is the invested capital at the beginning of the year. EVA is performance measure that measures the market value of a firm (MVA). In the calculation of EVA, the difference between ROIC and WACC is called a return spread and a positive spread means that the company is generating surplus returns above its cost of capital and leads to higher MVA (de Wet, 2005). In order to compensate for growth, de Wet (2005) refers to an MVA model that includes a constant growth rate:

MVA = EVA/ (WACC-Constant growth rate)

There are some criticisms against EVA as a measure of value. First, markets are more likely to react to profits than to EVA as there is a positive correlation between NOPAT and EVA (de Wet 2005). Second, the difference between the residual income and EVA are not significantly large to warrant the adjustments made.

2.4 Difference between intrinsic value of a share and its market price

The different valuation methods discussed above assume that the intrinsic value of a share will be equal to its market value. However, this is not always the case; there are deviations that occur, mainly because of the irrational behaviour of investors, also known as noise trading.

2.4.1. Valuation Errors

Dowelani (2012) argues that the extent of the deviation of the intrinsic value of a share price from its observed price is known as a valuation error. It is this valuation error that is used to evaluate the performance of valuation models (Dowelani, 2012; Penman and Sougiannis, 1998). According to Dowelani (2012) the value of the valuation error will give the extent of the error, with an error closer to zero showing the closeness of the intrinsic value to the market value.

Francis, Olsson and Oswald (2000) compared the accuracy of the dividend discount model and the discounted cashflow model. In their research they conclude that all valuation models should arrive at the same conclusion with regard to the intrinsic value of a share. In order to further explore the valuation error concept, Dowelani (2012) explains three key concepts that assist in understanding the result of various valuation models. First, accuracy which describes the closeness of the estimated intrinsic value from the observed share price. Second, bias which describes the signed valuation error found by dividing the difference between the intrinsic value and the observed share price with the observed share price. Last, explainability which refers to how well the valuation model used explains the observed price.

Various studies set out to find the appropriate valuation methods that minimises the valuation error. Penman and Sougiannis (1998) in their study argued that when the two valuation methods are compared, the valuation methods based on forecasting

the generally accepted accrual practice earnings usually yields lower valuation errors than those based on the dividends or even cash flows. In addition Rappaport (1986) found that an accrual accounting flow in a valuation model can produce valuation errors if the pay-out ratio is not carefully assessed. Yoo (2006) finds that when a combination of multiples techniques is used to perform valuations, it results in a reduction in valuation errors on each of the simple valuation techniques.

Rie (1985) argues that valuation models are flawed, are weakly related to the subsequent returns and do not work equally well for all the firms. According to Rie (1985), analysts would try and adjust for the identified weaknesses by second guessing the models and providing inputs that could lead to their desired results. Rae (1985) further argues that in order to improve the accuracy of the valuation model, one has to reduce the magnitude of input errors as well as to adjust the model for predictions in order to reflect the influence of errors on return expectations. In the DDM, one of the key reasons for the valuation error is the mismatch between the estimated cashflows and the cost of capital or discount rates (Reilly, 1995).

Bernstein (1984) investigated the overreaction of the stock market and argues that investors who follow the news rather than perform own valuations are likely to have valuation errors while the followers of various valuation models tend to have superior results in their valuations. The study examined the reasons behind the reaction of stock markets to earnings information and how in the long term the investors will be faced with uncertainty when estimating the present value of future cashflows. This suggests that a valuation with the long term view is likely to produce unreliable results compared to one that has a short term view.

Brown and Cliff (2005) argue that there is an existence of a systematic mispricing in the market due to absence of precise valuation models which makes valuation difficult. He differentiates between two types of investors, fundamental investors and speculators who each tend to have certain biases in their valuation of shares. Fundamental investors, described as those who make rational decisions, have properties that make up unbiased estimates of asset intrinsic values. Speculators, described as those who are swayed by excessive optimism, they tend to overvalue assets during times of high sentiment about the market and undervalue the assets when they have a low optimism or sentiment about the market.

Cheng (2005) looks at the role of analysts' forecasts in valuations and argues that reliance on forecasts produces noisy estimates, sometimes referred to biased estimates. Cheng (2005) further shows that central to the valuation of equity is the forecasting of future earnings of a firm, which seems to be problematic because forecasted earnings are unlikely to fully capture the expected earnings in all future years. In support of the argument that forecasting produces biased estimates, Bjurggen and Wiberg (2008) argue that there are doubt with the presumption that capital markets provides unbiased estimates. The discounted cashflow valuation methods utilises the projected cashflows and s the market value of firm should equal the sum of all projected cashflows, however because markets are no efficient, errors are often made in the estimation process. Errors could lead to over or underestimation of the cashflows used in the valuation (Esner and Krumholz 2013, Bjurggen and Wiberg 2008).

Cogliati *et al* (2011) look at estimation errors from the point of view of estimated cashflows for firms going public and argue that cashflows are also an important part of valuing new shares using the discounted cashflow models.

Cost of capital used in both the discounted cashflow model and residual income models plays a major role in the valuation process. Elsner and Krumholz (2013) argue that costs of capital estimates are prone to estimation errors when biased estimators are used to estimate the cost of capital. They also found that when valuation is done using cost of capital adjusted for errors, the calculated firm value will be closer to the true value while the opposite results in systematic deviations from the true value.

2.4.2. Comparative analysis of the valuation models

Lie and Lie (2002) embarked on a study of the different multiples used to estimate value of a firm to identify the one with the least biased estimates. They looked at the mean and median statistics obtained from the study of selected firms. These are statistics which give the extent to which the valuation estimates are biased. The study focused on active companies obtained from Standard and Poor's with data for the period 1998 and 1999. There were ten multiples chosen for the study namely P/E, forecasted P/E, enterprise value/sales, enterprise value/bookvalue, enterprise value/EBIDTA, enterprise value/EBIT, adjusted enterprise value/sales, adjusted

enterprise value/bookvalue, adjusted enterprise value/EBIDTA and adjusted enterprise value/EBIT. The medians from the study indicated that various multiples yielded negative biases. However, the study found that, firstly, the enterprise value/book value generated more precise and less biased estimates than sales and earnings based multiples. Secondly, EBIDTA multiple yielded much better and accurate estimates than the EBIT multiple and thirdly, accuracy and bias differs by the size of the firm, profitability and extend of intangible value the firm possess.

Stubelji (2010) undertook a study of the Slovene publicly traded companies looking at a valuation model based on the expected earnings and growth opportunities. He argues that the intrinsic value obtained from a valuation model is the internal value of a firm and it is the right or real value of a firm. The sample for the study was 20 Slovene publicly traded firms with data obtained from the balance sheet and income statement of these firms. In the study a simple model was used and resulted in estimated values of the firms being lower than the market values because of the small earnings and growth opportunities among Slovenian firms. Stubelji (2010) concludes that internal values obtained from these firms cannot be relied upon because of low earnings and growth opportunities. The market values in the Slovene stock exchange are high as result of speculative practices and few investment opportunities in the Slovene market.

Penman and Sougiannis (1998) compare the valuations based on accrual principles of accounting with the cashflow and divided based models. In their study they found that accrual based valuation models performed much better than the cash flow based models. Even though the accrual based valuations perform much better than cashflow based, the study found that it is not the case with firm that have high book value of equity to price as well as low book value of equity to price and earnings to price of shares.

Jiang and Lee (2005) argue that the dividend discount models fail to explain the volatility of share prices due to issues such as appropriate measures of dividends, determinants of discount factors and rationality of investors. They introduce residual income models as alternatives and test the volatility implications on the model by using the West inequality tests and model dynamic relations between stock prices and fundamentals is tested by VAR-based cross equation restriction tests. In their

study the residual income model was not rejected by either of the tests and performed better for firms with high book value if equity to price and earnings per share ratio. The DDM was log linearized and put through similar tests and was rejected by the West volatility test however the DDM with a clean surplus relation was not rejected by the West test but reject by the cross equation tests. They conclude that the DDM might be able to explain volatility but is unable to explain the dynamic behaviour of stock prices.

Francis et al (2000) compared the performance of the DDM, Cashflows and the abnormal P/E valuation models in the determination of an intrinsic value of a share. The mean and the median of signed valuation and absolute errors were obtained using a regression analysis. Francis et al (2000) found that the abnormal P/E valuation model was more accurate than other models. The value obtained from the abnormal P/E was closer to the intrinsic value of the shares.

Alford (1992) studied the effect of set of comparable firms on the accuracy of the price-earnings (P/E) valuation method. The study covered the periods 1978, 1982 and 1986 with the sample consisting of 1636 in 1978, 1591 firms in 1982 and 1471 firms in 1986. The firms were chosen based on the risk, earnings growth and industry. Alford (1992) analysed the absolute valuation error to measure accuracy of the valuation model and the signed error for bias. Friedman test was used as non-parametric test to describe the performance of the model.. Alford (1992) found that the accuracy and effectiveness is improved when the firms are selected by industry, where earnings and risk are used together to construct portfolios of comparable firms. In conclusion the study found that the criterion for having an accurate valuation is in choosing comparable firms by industry.

In Yee (2008), the investigation was on how noisy estimates from the DCF and multiples methods could be combined into a superior valuation estimate. The study employed a Bayesian triangulation to come up with a conceptual framework that justifies the intuitive heuristics of estimating the value as a weighted average of all available information and assigning greater weight to the more reliable estimates when some estimates are more reliable than others.

Chapter Summary

The literature reviewed in this chapter provided a description of share valuation models used to determine an intrinsic value of shares. The models were sub divided into two broad categories, cashflow models and the accounting valuation models. Cashflow models include the Dividend Discount Model (DDM) and the Free Cashflow Model. The accounting valuation models include earnings based models, relative or multiples valuation as well as residual income models.

The discussion of the valuation models was followed by the review literature that discussed the performance of these models when compared to the actual observed prices. The difference between the intrinsic value and the observed market price is referred to as valuation error, or the noise in the financial data. The cause of the valuation error is ascribed to the actions and irrationality of investors and is also linked to the investment horizon of the investors. The next chapter will focus on the research design and the methodology that will be followed to perform this study on share valuation models.

Chapter 3: Research Methodology

3.1. Introduction

This chapter presents the research methodology used in this study. The chapter serves as a blue print for collection, measurement and analysis of data. The chapter is organised as follows: Section 3.2 presents data and data sources. Section 3.3 discusses the research design. Chapter summary concludes the chapter.

3.2. Data and Data Sources

The data required for this study includes firm fundamentals used to determine the intrinsic value of the firm using different valuation methods. The firm fundamentals used include projected future cash flows and firm earnings. Other data required include price earnings ratios, earnings per share of each firm, the weighted average cost of capital (WACC) and the required rate of return determined that is used as discount rates in different models.

The market price, accounting and other data required are obtained from *Bloomberg* and *INET BFA*. The research period is between 1st January 2004 and 31st December 2013. All JSE firms listed on the JSE main board over the research period are included in the study. However, firms that do not have the required price or accounting information required to determine their intrinsic value are excluded from the analysis.

3.3. Research Design

This section discusses the operationalization of different valuation methods to determine the intrinsic value. The first part presents the research design using DCF valuation methods and the second part discusses the accounting valuation methods.

3.3.1 Determining the intrinsic value using DCF methods

According to Yee (2008), discounted cashflows is implemented by forecasting expected cash inflows from operations and netting them against cash outflows to creditors and then discounting those cashflows with the discount rate, which

depends on risks such as interest rate and market risks. The discount rate is the minimum return required by investors, estimated mostly using the capital asset pricing model (Schauten, Stegink and Graaff, 2010).

3.3.1.1 Dividend Discount Model

The intrinsic value of a share is determined using the constant growth dividend discount model which is expressed mathematically as (Schreiner, 2007):

$$\mathrm{Po} = \frac{\mathrm{D_{t+1}}}{\mathrm{r} - \mathrm{g}}$$

Where P_o is the intrinsic value of the share, **D** is the dividends expected at time **t+1**, **r** is the rate of return earned on the share also known as the cost of capital and **g** is the expected long term growth rate. For firms that do not have constant dividends, H model which assumes that dividend growth will change from one level to another in a linear manner is used. The H model is expressed mathematically as follows (Hickman and Petry, 1990):

$$\mathrm{Po} = \frac{Do\ (1 - g_L)}{(r - g_L)} + D_o \times \mathrm{H} \times \frac{(g_s - g_L)}{(r - g_L)}$$

Where **H** is t / 2 and t represents the length of the time period over which the growth rate will change from **gS** (short-term, abnormally high-growth rate) to **gL** (long-term, normal-growth rate) in a linear manner. R is required rate of return on equity. However, the problem with the dividend discount model is that it makes unrealistic assumption about the dividend growth as it assumes either constant growth or two phase growth of constant in the short term and linear in the long term. Other problems associated with this model are that ability to forecast dividends in impeded when dividend are low or non-existent, forecast and assumption associated with DDM valuation model opens it up to significant errors (Hickman and Petry, 1990); some firms do not pay dividends until much later in their lifecycle (Jiang and Lee, 2005) and neither volatility risk nor covariance is represented in the model thus assuming investors are risk averse (Shaffer, 2006).

3.3.1.2 Free Cash flow Model

The intrinsic value of a share is determined using free cash flow to equity (FCFE) model. As in Nel (2009), the model is expressed mathematically as follows (Steiger, 2008):

$$\mathrm{Po} = \sum_{t=1}^{n} \frac{\mathrm{FCFE}}{(1 + \mathrm{ke})^{\mathrm{t}}} + \frac{\mathrm{TVn}}{(1 + \mathrm{ke})^{\mathrm{N}}}$$

Where $\mathbf{P_0}$ is the intrinsic value of the share, $\mathbf{K_e}$ can also be expressed as k and it is the risk adjusted discount rate or the rate of return earned on share, $\mathbf{TV_n}$ is the terminal value of the share after the end of the period under review, if there firm has residual value at the end of the period.

Proponents of free cashflow valuation model argue that value of firm does not lie in the financial statements but in the expectations of future cash flows (Pareja and Tham, 2001). Steiger (2008) argues that free cashflow model like other discounted cashflow models is easy to manipulate as it relies on assumptions made by the valuer. It is argued that it cannot be relied on as sole valuation model but should be used in conjunction with other valuation techniques (Steiger, 2008).

3.3.2 Determining the intrinsic value using accounting valuation methods

3.3.2.1 Relative Valuations

Schreiner (2007) discusses various relative valuation models including price to earnings (P/E), Price to book (P/B) which is derived from the Residual Income Model as well as the enterprise value to EBIT which is derived from discounted cash flow model. Relative valuation using the price to earnings ratio is used in this study and is expressed mathematically as follows (Alford, 1992):

$$\mathrm{P_o} = \mathrm{P/E_t} \times \mathrm{EPS_t}$$

Where $\mathbf{P_o}$ is the intrinsic value of the share, $\mathbf{P/E_t}$ is the industry mean P/E ratio at time t and $\mathbf{EPS_t}$ is the forecasted earnings per share for time t.

The price to earnings valuation model is the only relative valuation model that is used to determine the intrinsic value of a share in this study due to its superiority over others. Hickman and Petry (1990) argue that price earnings multiples are actual market determined prices in terms of today's earnings and dividends as opposed to projected dividends in the dividend discount model, as result the intrinsic value derived from P/E model is expected to resemble its fair market price. In Fairfield (1994), the price to book (P/B) model is an extension of the DDM model in that it uses estimates of abnormal earnings to generate a firm valuation and will therefore

be subject to the same problems of estimation. Enterprise to EBIT and EBIDTA value was found by Liu, Nissim and Thomas (2002) not have performed as well as those that use forwards earnings.

3.3.2.2 Residual Income Model

The intrinsic value of a share is determined using Ohlson (1995) residual income model, which is expressed mathematically as follows:

$$RI_t = NI_t - r_{equity} . B_{t-1}$$

Where $\mathbf{NI_t}$ is the net income for the period ending at time t, r_{equity} is the cost of equity and B_{t-1} is the book value of common equity at time t-1. The calculated Residual Income is used to calculate the value of a firm using the formula (Ohlson, 1995):

$$P_0 = BV_0 + \sum_{t=1}^{m-1} \frac{RI_t}{(1+r)^t} + \frac{TVn}{(1+r)^{m-1}}$$

Jiang and Lee (2005) argue that Residual Income model is a better valuation model than the dividend discount model as it defines dividends more broadly to include cash dividends and cash pay-outs to shareholders such as share repurchases. Jiang and Lee (2005) found that accounting data, such as earnings and book values used in residual income model, provides more useful information about share price movements than dividends alone. Residual Income Model is also subject to some criticisms. Chen and Dodd (2001) argue that accounting earnings are a flawed measure due to its failure to include the total cost of capital and being unduly influenced by accrual-based accounting conventions.

3.3.2.3 Economic Value Add

The intrinsic value of a share is determined using the Economic Value Added (EVA) model as used in Nel (2009) and the model is expressed mathematically as follows (Nel, 2009):

$$P_0 = \sum_{t=1}^{n} \frac{EVA_t}{1 + WACC}$$

Where **P_0** refers to the intrinsic value of the share being valued and **EVA** representing the excess return on the investment measured as Return on Investment less Weighted Average Cost of Capital (WACC). The EVA is calculated as follows (de Wet, 2005):

$$EVA = (\text{ROCE} - \text{WACC}) \text{ x Capital Invested}$$

Where **ROCE** is the return on capital employed by the firm, WACC is the weighted average cost of capital and the capital invested is the net assets of the firm which is made up of net fixed assets and net current assets.

Chen and Dodd (2001) show that EVA is most relevant valuation model as it corrects errors from the accounting earnings as it includes both the total cost of both debt and equity capital, whereas accounting earnings include only interest expenses associated with the cost of debt capital. However in Chen and Dodd (1990) found that while EVA produces better valuation result than Residual Income Model, the differences are not big to justify a change in the model a firm may use to value shares.

3.3.3 Calculation of valuation error

The absolute valuation error is used to determine how accurate the intrinsic values calculated using different valuation methods are. The absolute valuation error is calculated by as follows (Dowelani, 2012):

$$\text{AVE}_{i,\,y} = \frac{[\text{V}_{i,\,y} - \text{P}_{i,\,y}]}{\text{P}_{i,\,y}}$$

Where **$AVE_{i,y}$** is the absolute valuation error for the firm **i** at time **t**, **$V_{i,y}$** is the estimated intrinsic value for a firm **i** at time **t** obtained from a valuation model and **$P_{i,y}$** is the observed share value for firm **i** at time **t.**

Both the magnitude and the direction of the error are investigated to determine how the different industries respond to different valuation models. When the AVE is negative, the observed share prices are higher than the intrinsic value, implying that the share is overvalued relative to its intrinsic value. When the AVE is positive, the observed share prices are lower than the intrinsic value, implying that the share prices are undervalued relative to its intrinsic values. For the purpose of this study,

the results are divided into those with AVE of 10% or less and those with the AVE of more than 10%. The smaller the AVE, that is less than 10%, the closer the intrinsic value determined using price earnings valuation model is to the observed share prices. Where the AVE is 10% or less, the model can be relied upon to provide an intrinsic value closer actual observed price

The absolute valuation error is then tested for statistical significance in order to determine whether the intrinsic values are significantly different from market values.

Chapter Summary

This chapter presents the research methodology used in this study. It starts by detailing the data used in the research and its sources and then shows how the intrinsic value is determined using different valuation methods. The next chapter presents the research findings.

Chapter 4: Presentation of Results

4.1. Introduction

The absolute valuation error is the difference between the actual observed prices from the Johannesburg Securities Exchange and the actual amount predicted from the models. The valuation models that were used in the study are Free Cashflow, Price Earning and the Economic value add models. These valuation models were chosen due to the availability of the information to perform valuation on all the listed firms.

This chapter is organised as follows. Section 4.2 presents the descriptive statistics. Section 4.3 presents the performance of the valuation measures. Section 4.4 presents the performance of the valuation models by industry according to the JSE Industrial Sector Benchmark classification. Section 4.5 presents the valuation error recorded for each of the valuation model over the period of the study.

4.2 Data Description

Table 1 presents the descriptive statistics on various variables used in the analysis. The industry statistics used in all the valuation methods where computed by dividing the variables used in the valuation methods by the number of firms in each industry. The mean firm earnings over the research period is R 99 945 783 while the median is R40 762. The low median indicates that some sample companies make huge profits while others made significant losses. The highest PE ratio was 20 095,49 and the lowest PE is -9 065 while the highest weighted average cost of capital (WACC) was 238,47 and lowest is -273,73. While the mean change in net working capital (CNWC) was negative, the highest CNWC was R 964 023 529 and the lowest was R-1 342 968 426.

The data used also shows that the standard deviation which shows how spread out the data is, reflects the highest number for earnings and earnings per share and lowest for WACC.

Table 1: Description of data

Measure	Mean	Median	Standard Deviation	Highest	Lowest
Earnings(Rand	99 945 783	40 762	35 581 132	140 754 057	-159 790
EPS	390 718	242	21 724 558	126 731 54	-30 836
WACC	7,87	8,84	10,42	238,47	-273,73
P/E	12,99	7,50	447,22	20 095.49	-9 065.00
CNWC	-1 116 498	0	39 279 700	964 023 529	-1 342 968 436
Capex	30 705	0	753 004	30 825 000	0
New Debt	212 408 28 7	0	11 924 443 632	672 436 708 834	-6 220 000

Table 2 presents the descriptive statistics of different financial measures by industry. A comparison across the industries reflects that the top two industries with the highest earnings were the Oil & Gas and Basic Material sector with the mean earning of R418 million followed by Financials sector with R37 million. The Financials sector recorded the highest mean earnings per share followed by the Oil and Gas & Basic Material and the lowest was the Healthcare sector. The mean weighted average cost of capital for the Telecommunications and Technology sector was the highest followed by Consumer Goods sectors with the lowest being recorded for the Healthcare sector.

The highest mean P/E ratio is in the Consumer Goods sector followed by the Financials and Telecommunication & Technology sectors. The changes in the networking capital (CNWC), Capex and New Debt which are used in the Free Cashflow valuation model are also different in different industries. All industries had a negative mean CNWC, a reflection that on average the current liabilities exceed current assets of most firms in the study. However the Oil, Gas & Basic Materials sector has a high CNWC among all industries and the Financials sector had the lowest with a negative CNWC. Technology and Telecommunication has the highest mean capital spending (Capex) followed by Consumer Services. The last measure is the New Debt which has the highest mean in the Oil, Gas & Basic Material followed by Consumer Goods.

Table 2: Description of data by industry

Measure	Mean	Median	Standard Deviation	Highest	Lowest
Industry 1: Oil, Gas & Basic Materials					
Earnings (Profit)	418 111 344	108	7 527 084 558	140 754 057 849	-15 979 000
EPS	84 635	10,5	2 181 467	57 717 472	-30 836
WACC	8,76	8,99	11,83	228,09	-27,49
P/E	9,51	0	886,96	20 095,49	-6 476,81
CNWC	-2 707 501	0	74 440 987	964 023 529	-1 342 968 436
Capex	51 416	0	1 009 348	25 630 400	0
New Debt	963 635 373	0	25 415 656 068	672 436 708 834	-6 220 000
AVE	4 708,45	-0,91	111 527,19	2 816 156,53	-511 898,66
Industry 2: Financials					
Earnings (Profit)	737 981	4 361	2 308 711	21 028 000	-4 199 000
EPS	158,89	2,6	458,08	6 592,2	-2 245
WACC	5,86	5,74	10,75	238,5	-102,79
P/E	13,43	4,48	319,80	2 148,13	-9 065
CNWC	-1 313 56	0	2 583 258	35 007 000	-30 630 000
Capex	9 050	0	193 749	5 209 623	0
New Debt	224 906	0	1 859 539	34 380 000	-77 776
AVE	-0,78	-0,66	11,49	263,02	-132,59
Industry 3: Consumer Goods					
Earnings (Profit)	720 292	280 325	1 136 919	7 940 000	-284 560
EPS	367,78	165,95	567,54	3 317	-111
WACC	9,39	10,55	6,04	51,99	-12,50
P/E	26,88	10,32	59,11	268,65	-320
CNWC	-96 285	-4 388	294 554	789 000	-1 943 838
Capex	3 343	0	50 706	769 000	0
New Debt	769 183	0	2 474 945	21 008 000	-51 239
AVE	0,54	-0,095	6,83	83,46	-64,09
Industry 4: Consumer Services					
Earnings (Profit)	403 195	146 024	564 817	3 615 434	-241 784
EPS	285,81	129,4	421,36	3 317	-111
WACC	8,94	9,87	4,76	26,15	-1,42
P/E	12,54	11,73	21,89	223,86	-187,90

Measure	Mean	Median	Standard Deviation	Highest	Lowest
CNWC	-66 504	0	398 532	1 505 200	-2 888 000
Capex	27 626	0	390 870	6 820 000	0
New Debt	180 080	0	621 864	5 515 000	-68 289
AVE	0,16	-0,12	3,89	49,02	-30,91
			Industry 5: Industrials		
Earnings (Profit)	37 147 176	56 685	929 378 824	23 512 023 000	-4 196 507
EPS	1 920 341,89	44,15	49 330 180,64	1 267 315 454	-13 004,8
WACC	8,89	9,67	5,46	36,72	-5,58
P/E	11,58	8,12	42,43	943	-87,45
CNWC	-2 287 894	-3 973	39 954 953	2 286 962	-744 685 000
Capex	16 563	0	265 995	5 304 000	0
New Debt	254 914	0	931 922	9 535 000	-199 400
AVE	-118 316	-0,072	4 508 355,134	328,83	-171 791 406,1
			Industry 6: Healthcare		
Earnings (Profit)	457 415	198 284	1 452 948	5 104 000	-9 713 000
EPS	72,38	18,25	114,61	465,4	-135,6
WACC	2,87	7,39	31,84	33,50	-273,73
P/E	9,82	10,80	22,50	101,48	-121,57
CNWC	-77 738	-3,5	226 768	904 000	-86 960
Capex	0	0	0	0	0
New Debt	2 354 856	0	7 013 325	45 227 200	-952 000
AVE	0,43	-0,084	4,44	50,13	-4,89
			Industry 7: Telecommunication and Technology		
Earnings (Profit)	1 808 624	52 400	5 699 094	37 479 000	-11 499 000
EPS	164,47	32,5	338,12	1 727,2	-89,5
WACC	10,44	11,13	5,56	25,97	-12,90
P/E	13,34	9,15	35,26	234,5	-233,79
CNWC	-45 512	-1 025	615 783	2 905 000	-4 835 000
Capex	192 656	0	2 436 930	30 825 000	0
New Debt	587 865	0	2 878 621	26 298 000	-188 149
AVE	-0,26	-0,15	4,66	20,88	-61,38

4.3 Performance of valuation measures

The performance of the three valuation models (FCF, EVA and P/E) are presented in table 3 below. Observed values in the tables below represents the average values of the shares as quoted on the Johannesburg Securities Exchange.

Table 3: Performance of valuation models

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
Free cash flow (FCF)	64 358.72	4 900.70	59 458.02	574.65%
Economic Value Add (EVA)	-4 468 897.55	4 881.71	-4 473 779.26	-222627.20%
Price to Earnings (P/E)	5 287.11	3 971.58	1 315.53	2.68%

Table 3 above shows that the mean intrinsic value obtained using the price to earning (P/E) valuation model was closer (absolute valuation error = 2.68%) to the mean observed price of the shares in the JSE compared to the other two models over the research period. The economic value add model was the worst performer with a negative mean intrinsic value (absolute valuation error =-222,627%). This worst performance is due to the fact that a number of firms in the Financials and the Industrials sectors had a negative economic value add.

The majority of Financials and Industrials sector firms made capital investments over the 2004-2013 periods and this coincided with the low net operating profits and net operating losses for most firms during this period. These two factors, the capital investments and the net operating profits after tax are the main components in the determination of Economic Value Add. A high capital investment and low net operating profits or net operating losses lead to a negative economic value add.

The indications are that using the free cashflow model and the Price to Earnings model, the JSE is undervalued while the economic value added model implies that it is overvalued with the intrinsic value that is much lower than the observed value of shares.

4.4 Performance of valuation models by industry

Below is the presentation of the performance of the three valuation models (FCF, EVA and P/E) in various JSE industries.

4.4.1. Oil, Gas & Basic Materials

Table 4 presents the performance of the three valuation models is compared in the Oil, Gas & Basic Materials sector to determine how each of the shares performed.

Table 4: Performance of valuation models in Oil, Gas & Basic Materials

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error cents)	Absolute valuation Error (%)
		N = 69		
Free cash flow (FCF)	418 934,82	13 687,21	405 247,61	3588,85%
Economic Value Add (EVA)	536 221,36	13 674,44	522 546,92	9420,32%
Price to Earnings (P/E)	3 014,76	8 945,16	-5 930,40	-64,90%

The Oil, Gas & Basic Materials sector comprised of 69 shares on the JSE. The mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the Free Cashflow and Economic value add while the Price to earnings models shows an over valuation of the shares. However, the P/E models produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 64,9% compared to 3,558.85 % for Free Cashflow and 9,420.32% for the EVA model. A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10%. Table 5 shows that the P/E model has the highest percentage of firms with a mean absolute valuation error of less than 10% followed by the FCF model, though Only 11% of the sample comprises of companies from Oil, Gas and basic materials.

Table 5: Mean AVE per valuation model for Oil and Gas & Basic Material

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	4%	96%
EVA Model	1%	99%
PE Model	11%	89%

4.4.2. Financials

Table 6 presents the performance of the three valuation models in the Financials sector.

Table 6: Performance of valuation models in Financials

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
	N = 99			
Free cash flow (FCF)	5 967,38	2 791,34	3 176,04	115,85%
Economic Value Add (EVA)	-9 524,27	2 728,86	-12 253,13	-468,38%
Price to Earnings (P/E)	-7 406,04	2 795,91	-10 201,95	-370,92%

The financials sector comprised 99 shares in the JSE and the mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the Free Cashflow while the Economic value add and the Price to earnings models shows an over valuation of the shares. The financials sector had a negative EVA and earnings leading to a negative intrinsic value for the two models. The Free Cashflow model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 115,85% compared to -468,38 % for the Economic Value Add and -370,92% for the Price to earning models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others as presented in Table 7.

Table 7: Mean AVE per valuation model for Financials

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	6%	94%
EVA Model	1%	99%
PE Model	30%	70%

4.4.3. Consumer Goods

Table 8 presents the performance of the three valuation models in the consumer goods sector.

Table 8: Performance of valuation models in Consumer Goods

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
	N = 23			
Free cash flow (FCF)	6 838,41	5 796,77	1 041,64	30,14%
Economic Value Add (EVA)	1 357,61	5 796,77	-4 439,16	-74,98%
Price to Earnings (P/E)	26 149,55	5 470,37	20 679,19	329,89%

The Consumer Goods sector comprised 23 shares on the JSE. The mean intrinsic value of this sector shows that shares are undervalued relative to its market values when using the Free Cashflow and price to earnings models while the Economic

value add shows an over valuation of the shares. The Consumer Goods sector like the Financials sector, had firms with a negative EVA leading to a negative intrinsic value. The Free Cashflow model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 30,14% compared to 74,98 % for the Economic Value Add and 329,89% for the Price to earning models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others as presented in Table 9.

Table 9: Mean AVE per valuation model for Consumer Goods

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	12%	88%
EVA Model	1%	99%
PE Model	56%	44%

4.4.4 Consumer Services

The performance of the three valuation models in consumer services sector is presented in table 10 below.

Table 10: Performance of valuation models in Consumer Services

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
	N = 38			
Free cash flow (FCF)	3 956,26	3 986,96	-30,70	7,28%
Economic Value Add (EVA)	1 176,90	4 003,65	-2 826,75	-68,21%

Price to Earnings (P/E)	6 421,37	3 418,65	3 002,72	51,35%

The Consumer Goods sector comprised 38 shares on the JSE and the mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the price to earnings models while the Economic value add and Free Cashflow models shows an over valuation of the shares. The Free Cashflow model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 7,28% compared to 68,21 % for the Economic Value Add and 51,35% for the Price to earning models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others in Table 11.

Table 11: Mean AVE per valuation model for Consumer Services

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	11%	89%
EVA Model	2%	98%
PE Model	67%	33%

4.4.5. Industrials

The performance of the three valuation models in Industrials sector is presented in table 12 below.

Table 12: Performance of valuation models in Industrials

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)

	N = 64			
Free cash flow (FCF)	4 329,05	2 755,38	1 573,67	48,52%
Economic Value Add (EVA)	-31 812 973,76	2 766,90	-31 815 740,66	-1566980,78%
Price to Earnings (P/E)	2 907,71	2 359,93	547,77	29,64%

The Industrials sector comprised 64 shares on the JSE and the mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the free cashflow and price to earnings models while the Economic value add show an over valuation of the shares. There were some firms in the industrials sector with a negative EVA leading to a negative intrinsic value. The Price Earnings model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 29,64% compared to 48,52 % for the Free Cashflow and 1566980,78% for the Economic Value Add models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others in Table 13.

Table 13: Mean AVE per valuation model for Industrials

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	8%	92%
EVA Model	2%	98%
PE Model	52%	48%

4.4.6 Healthcare

The performance of the three valuation models in the Industrials sector is presented in table 14 below.

Table 14: Performance of valuation models in Healthcare

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
		N = 8		
Free cash flow (FCF)	6 662,05	2 886,27	3 775,77	170,22%
Economic Value Add (EVA)	739,33	2 888,10	-2 148,77	-75,67%
Price to Earnings (P/E)	2 521,70	2 531,18	-9,48	1,50%

The Healthcare sector comprised 8 shares on the JSE and the mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the free cashflow while the Economic value add and Price Earnings show an over valuation of the shares. The Price Earnings model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 1,50% compared to 170,22 % for the Free Cashflow and -75,67% for the Economic Value Add models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others in Table 13.

Table 15: Mean AVE per valuation model for Healthcare

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	5%	95%
EVA Model	1%	99%
PE Model	79%	21%

4.4.7. Technology and Telecommunications

Table 16 presents the performance of the three valuation models in the technology and telecommunication sector.

Table 16: Performance of valuation models in Technology and Telecommunications

Valuation model	Mean Intrinsic Value (cents)	Mean Observed Value (cents)	Valuation Error (cents)	Absolute valuation Error (%)
		N = 16		
Free cash flow (FCF)	3 823,05	2 400,97	1 422,08	61,70%
Economic Value Add (EVA)	719,98	2 400,97	-1 680,99	-69,05%
Price to Earnings (P/E)	3 400,75	2 279,86	1 120,89	42,18%

The Technology and Telecommunications sector comprised 16 shares on the JSE and the mean intrinsic value of the sector shows that shares are undervalued relative to its intrinsic values when using the free cashflow and price to earnings while the Economic value add show an over valuation of the shares. The Price Earnings model produced an intrinsic value that is much closer to the observed value with an absolute valuation error of 42,18% compared to 61,70 % for the Free Cashflow and 69,05% for the Economic Value Add models.

A comparison of how close each of the observed value were to the intrinsic value shows that the price to earnings models had much higher percentage of firms with absolute valuation error of less than 10% compared to others in Table 13.

Table 17: Mean AVE per valuation model for Technology and Telecommunication

Sector	Percentage of Firms with AVE < 10%	Percentage of Firms with AVE >10%
FCF Model	9%	91%

EVA Model	3%	97%
PE Model	52%	48%

Overall, the industry results show that the P/E model is a superior valuation model to the other two valuation models. In all the industries, the P/E model produced intrinsic values that are much closer to the observed values quoted on the JSE for most of the firms. Table 18 below shows the summarised performance of each model in different industries.

Table 18: Summarised Results of industries on valuation models

Industry	FCF	EVA	P/E
Oil and Gas & Basic Material	Undervalued	Undervalued	Overvalued
Financials	Overvalued	Undervalued	Undervalued
Consumer Goods	Overvalued	Undervalued	Undervalued
Consumer Services	Undervalued	Undervalued	Overvalued
Industrials	Undervalued	Undervalued	Overvalued
Healthcare	Undervalued	Overvalued	Undervalued
Technology and Telecommunication	Overvalued	Undervalued	Overvalued

In the FCF model the intrinsic value were higher than the observed value for 4 of the 7 industries indicating that with the FCF model, the market appears to have undervalued the shares of those firms. For the EVA model, the intrinsic values were higher than the observed values for 6 of the 7 industries indicating that with the EVA model the market appears to have undervalued the shares of firms of most industries. Lastly, in the P/E model, the intrinsic value were lower than the observed values for 4 of the 7 industries indicating that with the EVA model the market appears to have overvalued the shares of those firms.

4.5 Valuation error over time

Table 19 below presents the valuation error for each of the valuation models over the research period between 2004 to 2013. The free cash flow model performed better

than the other two models over time with an absolute valuation error improving from above 100% in 2004 to 31,76% in 2013. The performance of the economic value add was strongly influenced by the firms who had negative economic value add in the Oil, Gas & Basic Material and Industrial sectors with it absolute valuation error not improving over time.

The absolute valuation error on the Price Earning model has not improved over time compared to the Free Cashflow model. However, the absolute valuation error in the Price earning models has improved from a negative to a positive. This is a reflection that the Price Earning valuation produces much higher intrinsic values than the observed prices since 2008. This could suggest an undervaluation in the JSE when price earnings multiples are taken into account. The Free Cashflow model has been consistent in producing a much higher intrinsic value than observed market prices over the period 2004 to 2013.

Table 19: Valuation Error over the period 2004-2013

Year	Absolute % valuation error		
	FCF	EVA	P/E
2013	31,76%	-110,36%	122,83%
2012	42,80%	-104,11%	98,44%
2011	21,94%	-108,05%	123,50%
2010	77,07%	-93,88%	97,31%
2009	17,10%	-2238508,25%	84,73%
2008	280,69%	-138,42%	39,68%
2007	937,57%	-2163,43%	-123,54%
2006	3847,79%	15412,91%	-147,48%
2005	379,38%	-164,76%	-134,79%
2004	110,44%	-188,43%	-133,90%

These results with the exception of the economic value add model suggest that the shares in the JSE are undervalued compared to its intrinsic values, much more when using the price earning models than the free cashflow models.

4.6 Comparison of all Valuation Models

There are three observations made from the above analysis. One, the intrinsic value of a share or firm is not always equal to its observed market price. Two, Sectors respond differently to the different share valuation models and lastly, the price earnings and free cashflow are both superior to the economic value add models in determining the intrinsic value of a share.

The results confirm Cheng (2005) that analysts forecast in valuation sometimes produces noisy or biased estimates. All the shares that were valued using the three valuation methods produced intrinsic values that are different from the observed market prices. Only a small percentage of the shares produced deviation (measured as absolute valuation error) less than 10%. According to Bernstein (1984) when investors follow the news instead performing own valuations will experience valuation errors. Brown and Cliff (2005) argue that there is absence of precise valuation models and this is also confirmed by the results of this study.

The price earning results are consistent with the findings of Francis et al (2000) who found the price earning valuation is more accurate than other models. The findings are not consistent with Subramanyam and Venkatachalam (2007) who argued that price earning valuation models tend to be better than cashflow based valuation methods.

Chapter Summary

This chapter presents the results of the study and notable results have been reported in the chapter. The results demonstrated that all valuation models result in absolute valuation errors. Both accounting based and discounted cashflow models performed better in the study with only one valuation model producing a bigger number of absolute valuation errors. The study also confirmed that relative valuation

model, specifically the price earning's ratio and free cashflow models are more accurate than the other accounting based and discounted cashflow valuation methods. Lastly the results showed that there is not a one size fits all approach in valuation of shares. Each sector responds differently to the valuation models.

Chapter 5: Discussion and Conclusion

5.1. Introduction

This chapter discussed the findings presented in Chapter 4. The chapter is organised as follows: Section 5.2 provides discussions. Section 5.3 presents conclusion from the study and section 5.3 discussed recommendations for further work.

5.2. Discussion

The aim of this study was to establish which valuation model provides an intrinsic value close to the observed share prices for JSE listed companies.

The Free Cashflow model was found to produce lower absolute valuation errors in some industries, even performing better than the accounting based valuations. The extent of the absolute valuation errors produced by the FCF model supports the argument by Steiger (2008) that it cannot be relied upon as the sole valuation model but should rather be used to support other valuation models.

The study showed that the two accounting based models produced differing results, with the relative valuation model (price earnings) performing much better than the economic value add model. The study showed that the PE valuation model produced lower absolute valuation errors than the economic value add model with the majority of the differentials being less than a 10%. The fact that the PE valuation model produced most of the lower absolute valuation errors in all the industries in the JSE confirms the argument by Hickman and Petry (1990) that the intrinsic value obtained from a P/E model resembles its fair market price. This is also supported by Francis et al (2000) in their study of the accuracy of the P/E valuation model.

The economic value add (EVA) model performed much worse than most P/E valuation model, with much higher absolute valuation errors and did not produce intrinsic value closer to the observed prices. It produced results that showed the observed prices were much higher than it intrinsic values, contrasting the other accounting valuation model. This was in contrast to the argument by Chen and Dodd (2001) that EVA is the most relevant valuation model.

The results showed that the both accounting based and discounted cashflow models can result in intrinsic values that are closer to the observed valuation errors depending on the sector being analysed. Both the relative valuation model using the Price Earnings ratio and discounted free cashflow models produces the lowest valuation errors when the intrinsic value is compared to the observed market prices. Rie (1995) study that valuation models do not work equally well for all firms is further confirmed in this study. As a result of low earnings among many of the JSE listed firms from 2008 which resulted in lower intrinsic values, the results of the study concurred with Stubelji (2010) who did a similar study on Slovenian firms which indicated that internal values of firms cannot be relied upon due to low earnings used in the valuation models.

The fact that the P/E model resulted in much higher percentage of firms with absolute valuation error of less than 10% while the EVA model resulted in much lower percentage of firms with absolute valuation error of 10%, counters Penman and Sougiannis (1998) who found that accounting based models performed much better than cashflow model. The results from the EVA model indicate that not all accounting based models perform better than the discounted cashflow model.

The differences between the intrinsic values and the observed prices in this study shows that the analysis of a company's financial statement is an important aspect of making buy or sell decision and confirms Bernstein (1975) who indicates that fundamental analysis is a useful approach in making investment decisions. The extent of the differences in all the models in the study also agrees with Brown and Cliff (2005) that there are no precise valuation models hence there is inherent mispricing in the market. Esner & Krumholz (2013) and Bjurggen & Wiberg (2008) conclusion that there are valuation errors because markets are not efficient due to forecasting errors in the estimation process is confirmed in the study as all models resulted in valuation errors, though the extent differed across models.

There was no evidence in the study that corroborated Penman and Sougiannis (1998), Yoo (2006) arguments that accounting based models yields lower valuation errors than those based on cashflows.

5.3 Conclusion

The primary goal of this research was to determine which of the valuation models is superior between the accounting based valuation models and the discounted cashflow models. The empirical results show that individual models within the two groups of valuation models perform differently. There are some accounting based valuation models that are inferior in performance to the discounted cashflow models, while others are superior. Therefore general conclusion cannot be made that accounting based models are better than the discounted cashflow models without looking at the individual valuation models. Accounting based valuation models are no better than the discounted cashflow models. One needs to look at the specific models within each group to find a model that will fit the characteristic of the industry being subjected to a valuation exercise. There are some discounted cashflow models that perform better than accounting based models, and equally there are some accounting based models that perform better than discounted valuation models.

The empirical result also showed that the performance of valuation models also depends on the industry a firm is operating in as these firms respond differently to the each of the model.

5.4 Recommendation for future research

The study recommends that future research to be done in two areas; firstly, is to determine the causes of over and undervaluation of shares when using the P/E and FCF models and secondly, to compare the performance of the EVA model during the difference phases of a business cycle to determine if these phases have an influence on the intrinsic value obtained using EVA model. The study period coincided with the difficult period during the 2008 -2009 financial crisis with many firms suffering losses which might have influenced the performance of the model.

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