MK7227 Postgraduate Dissertation

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U1422232

Relative Valuation; Determining the Most Accurate Valuation Multiples for the FTSE 100

A dissertation submitted in partial fulfilment of the requirements of the Royal Docks Business School, University of East London for the degree of **Master of Science in Financial Management**

September 2015

Word Count 14 884

I declare that no material contained in the thesis has been used in any other submission for an academic award

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Master of Science in Financial Management

University of East London School of Business and Law

Royal Docks Business School

Relative Valuation; Determining the Most Accurate Valuation Multiples for the FTSE 100

U1422232

September 2015

Supervisor: Dr. Baoying Lai

Abstract

This dissertation will critically examine five of the most commonly used valuation multiples by experts, price-to-earning, price-to-book value, enterprise value/EBIT, enterprise value/EBITDA, and enterprise value/sales, in an attempt to determine which is the most accurate multiple per sector as well as the most accurate multiples overall, across all sectors. The accuracy is measured in terms of valuation error between the predicted value, calculated based on comparable companies, and the companies listed value. The valuation errors are analyzed using the mean, median, and the percentage of errors within 15 percent of the listed value. The results of the study determines superior valuation multiples in eight out of the ten sectors as well as overall, across all sectors. The study will analyze data collected from Bloomberg Data Terminal of the FTSE 100 with the sample period of January 2010 to December 2014 with monthly frequency. The study supports common believes that certain multiples perform better for specific industries. Earnings are found as the most accurate value driver, however one of the limitations of this dissertation is that it does not include forward data such as forecasted earnings. Recommendation for future research included building on the finding, expanding the sample size as well as including additional multiples, especially forecasted earnings.

Acknowledgements

I would like to thank my supervisor Dr. Baoying Lai for her support and guidance. I would also like to thank my parents for everything they have done for me, I would not be where I am today without them.

Table of Contents

1 Introduction

1.1 Overview

This dissertation sets out to critically examine the accuracy of valuation multiples. Valuation multiples are an important valuation tool, used by analyst and investors around the world. Multiples gain popularity from being simple to use and easy to understand. Compared to cash flow valuation they require less assumption regarding future growth, cash flow, rate of return etc. This dissertation will examine five of the most popular valuation multiples, according to Bancel and Mittoo (2014), in an attempt to determine which multiple results in the highest accuracy for each of the ten sector (the sector are according to the Global Industry Classification Standard) as well as what multiple has the highest accuracy across all of the sectors. The purpose of this is to equip investor with a generalized guideline for which multiple are the most beneficial for what sector.

1.2 Introduction

This chapter, the Introduction, will introduce the topics covers for each of the chapters with the aim of giving the reader an idea of what to expect. The research question and the objective of the dissertation are presented as well as the background and justification.

1.3 Literature Review

The second chapter, Literature Review, will summarize and critically evaluate the previous published research and literature on the topics relating to valuation accuracy. The chapter will include the concepts of valuations multiples and present the theory behind the multiples. It will also present the background of the multiples selected and the value drivers used for this dissertation. There is a significant difference in the

amount of historical research for price-to-earnings and price-to-book, with journals published over half a century ago, compared to other three "newer" multiples. The chapter will also focus on empirical research of the performance and accuracy of valuation multiples.

1.4 Methodology

The third chapter will explain the methodology. It will go into detail of the research approach; explaining the theories and what approach will be used in this dissertation. The chapter will also present and explain the data from a qualitative/quantitative perspective. The chapter presents, in detail, the models and the methods of determining the valuation errors. In addition the sample that will be used, its limitation, and how it was gathered is explained.

The Financial Times Stock Exchange (FTSE) 100, which consists of the 100 largest companies on the London Stock Exchange in terms of market capitalization, will be used to examine the valuation multiples. The sample period will consist of five years historical data with monthly frequency staring from January 2010 and ending December 2014. The data will be downloaded from the Bloomberg Data Terminal to ensure reliable data. To determine and analyze the valuation errors Microsoft Excel will be used.

Relative valuation multiples is the relationship a companies value and a relatable financial statistic from the income statement or the balance sheet, known as the value driver. The value drivers used for this dissertation are historical earnings, book value, earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), as well as sales. Out of the five value drivers two are so called equity multiple, which use the stock price as the value, and the other three are entity multiples, which instead use the enterprise value. Hence the valuation multiples are the following ratios price-to-

earnings, price-to-book value, enterprise value/EBIT, enterprise value/EBITDA, and enterprise value/sales.

1.4.1 Research Question

The accuracy of the valuation multiples will be examined using three measures, the mean and median valuation error as well as the percentage of the valuation error that are within 15 percent of the listed value. The relative difference between the predicted price and the listed value is determined in order to compare across companies with varying financial sizes. The research question for this dissertation is, which is the most accurate valuation multiple, for each sector and across all sectors, in terms of valuation error, when examining the FTSE 100?

1.4.2 Research Model

To determine the predicted value of a selected company the company's value driver multiplied by the sectors average corresponding multiple. The sector acts as comparable companies and where the average is calculated by the harmonic mean. Research by Baker and Ruback (1999), Lie, Nissim and Thomas (2002), and Henschke and Homburg (2008) show that the harmonic mean helps improve the accuracy in terms of valuation errors. The harmonic mean results in a more representative value when the sample consisting of fluctuating data with possible outliers. The predictive value minus the listed value, scaled by the listed value calculates the valuation error. The results can then be compared for each of the multiples in order to determine the lowest valuation error and thereby the most accurate multiple. To improve accuracy companies with incomplete data, in terms of sample period and absence of valuation multiples over longer periods, will not be included in the study.

1.5 Data Analysis

1.5.1 Results

The fourth chapter, Data Analysis, is the most extensive one. In this chapter the results from the study are presented. The valuation error of each of the ten sectors, consumer discretionary, consumer staples, energy, financials, health care, industrials, information technology, materials, telecommunication services, and utilities, will be presented for both the mean and median valuation error as well as the percent of valuation errors within 15 percent. The result of the overall valuation error for each of the multiple across all of the sectors will also be presented. The results give varying accuracy, with certain sectors performing better than others and certain multiples outperforming others. This chapter will also present the companies that fulfill the set requirement in terms of complete sample period and non-missing multiples.

1.5.2 Findings

The second part of this chapter will be presenting the conclusion and findings from the study. The findings will be compared to well-referenced literature in order to determine if it contradicts or supports previous research. The objective of the dissertation is to determine which valuation multiple is the most accurate for each of the sectors as well as across all sectors. This is done form the basis of the valuation error measured three different ways, mean, median, and percentage or errors within 15 percent of the listed value. Three out the ten sectors, Consumer Staples, Health Care, and Information Technology have one superior multiple, which is the most accurate for all three of the measures. Five of the sectors, Energy, Industrials, Materials, Telecommunications Services, and Utilities, have a multiple which is the most accurate by two of the measures but not all three. In two of the sectors, Consumer Discretionary and Financials, three different multiples

are the most accurate for the different measures. A superior valuation multiples is also found across all sectors. For the sectors where a multiple could not be determined a beneficial value drivers could be identified.

1.6 Conclusion

The fifth chapter, the conclusion, will conclude and summarize the entire dissertation. The chapter will also present reflections of the research question and the objective of the dissertation. In the chapter the author will also reflect on the findings that have been made, with a focus on how the findings compares to previous research. In addition, it will review possible reasons for discrepancies.

1.7 Recommendations

The sixth chapter consists of recommendations. The recommendations are based of the observations that have been made through out the research process and the findings. It will include recommendations relating to the research question, how to overcome possible limitation and how the research could possible be improved on. The recommendations are made with future projects in mind, highlighting areas of which future research should be focused.

2 Critical Literature Review

2.1 Valuation Multiples

Suozzo et al. (2001) describes valuation multiples as expression of the relationship between a market value over a statistic related to the market value. The statistic is know as the value driver, as changes in the key statistic will driver the valuation ratio up or down, with a negative correlation (when the value is greater than one). Suozzo et al. (2001), divides valuation multiples into entity multiples and equity multiples.

Entity multiples are based on the enterprise value, which includes all the claimed value by the business. Examples of key statistic, or value drivers, commonly used in entity multiples are EBIT (earnings before interest and taxes), EBITDA (earnings before interest, taxes, depreciation, and amortization), and sales. Equity multiples, on the other hand, does not include all of the claims, instead is limited to the shareholders claim on assets and cash flow. Commonly used value drivers are earnings (both trailing and forecasted), book value, and cash flow.

2.1.1 Price-to-Earnings

The price-to-earnings ratio is one of the most recognized valuation multiples. Nicholson (1960) published one of the earlier journals on price-to-earnings, analyzing the multiple based on two robust empirical studies. The first study analyzed 100 common stocks for the time periods of 1939 with five-year intervals to 1959, the sample excluded nature utilities, banks, finance, and insurance companies. The second study consisted of 29 chemical companies common stocks, this was done with three-year, six-year, and ten year intervals from 1937 to 1950. Nicholson (1960) made important observations regarding the strong relationship between the price-earning ratio and the appreciation of the stock price over time, where the stocks with the lowest multiple showed a highest appreciation.

McWilliams (1966) also confirms that stocks with lower price-to-earning ratio produces better investment performance. The author analyzed 390 stocks between the time period 1953 and 1964 and concludes that portfolios with low price-earning ratio “is likely to be one that performs well”.

Basu (1977) empirically examines the relationship between investment performance and price-earning ratio. The sample used consisted of 753 stocks from the New York Stock Exchange between the time periods 1956 to 1969. His findings showed the portfolios consisting

of low price-to-earnings ratio securities have on average higher absolute and risk-adjusted rates of return than portfolios of high price-to-earnings ratios.

The findings from Nicholson (1960), McWilliams (1966), Basu (1977), as well as Graham (1934), all show that portfolios composed of stocks with low price-to-earnings ratios outperform comparable portfolios composed of high price-to-earnings ratios. However, there are contradicting studies, such as Jafe et al. (1989) and Chan et al. (1991), which state that there is no significant relationship between price-to-earnings ratio and returns instead pointing at the relationship between total asset size and return. Bodhanwala (2014) adds to the literature by show that for the Indian market investing in relatively low price-to-earnings ratios resulted in higher return than high price-to-earnings ratios.

2.1.2 Price-to-Book Value

The price-to-book value ratio and the price-to-earnings ratios are the two most recognized and researched value multiples. The price-to-book value ratio consists of the equity price and the book value as the value driver. The book value is defined as the companies total assets minus total liabilities, divided over the number of shares outstanding (Malkiel 2003). Research has shown the links between price-to-book value ratio and future returns, Fama and French (1992) state a clear relationship between future return and the price-to-book ratio when combined with the size of companies. A few years later, Fama and French (1997) state that the price-to-book ratio is important valuation tool not only for the United States stock market, also for many other world markets. However, Malkiel (2003) states mutual fund specializing in value stocks (generally with low price-to-earning and price-to-book value ratios) have not realized greater return tracking back to 1930s. Nevertheless, Lie and Lie (2002) state that multiples are an important valuation tool that

helps investors better understand strengths and weakness for companies.

2.1.3 Enterprise Value/EBIT and Enterprise Value/EBITDA

Enterprise value-to-EBITDA and enterprise value-to-EBIT are both well used, however there is less literate on entity multiples compared to equity multiples, more specifically price-to-earnings or price-to-book value. Enterprise value is defined as the market value of common stock and preferred equity plus the market value of debt and minority interest minus cash and investments. Kaplan and Ruback (1995) state that valuation multiples rely on the two important assumptions when selecting the comparable companies. The first is that the comparable companies have similar risk and cash flow expectations, secondly that the value driver, EBIT or EBITDA, is proportional to the enterprise value. Kaplan and Ruback (1995) find that when these two assumptions are true the valuation multiple result in as least as accuracy as any discounted cash flow approach. One of the main benefits with both EBIT and EBITDA is that is reduces accounting difference between countries and therefore resulting in more accurate valuations across international markets (Dittmann and Weiner 2005).

2.1.4 Enterprise value/sales

Enterprise value/sales also lacks in extensive literature compared to price-to-earnings. Souzzo et al. (2001) states that one of the benefits of using sales as the value driver is that can be applied to companies with negative earnings and/or cash flow. This is common amongst growing stages, especially for technological companies. Sales are, however, affected by accounting policies and interpretation. The use of gross versus net revenue is one example of such interpretation, in addition difference in operating marginal. These differences and interpretation may lead to decreased valuation accurate when using sales as the value

driver, however one of the advantages is that it is unaffected by market capitalization.

2.2 Advantages and disadvantages of valuation multiples

When comparing relative valuations with discounted cash flow valuations the simplicity is the main difference, however this is something that is both an advantage and a disadvantage for the valuation multiples. Valuation multiples are easy to understand, composed by a denominator and nominator, in many senses very straightforward. They can intuitively be understood and used to determine strengths and weakness between companies. The comparable companies and the benchmark used for valuation is easily selected in order to achieve the most accurate valuation. The multiples can be adjusted to use for companies without for example earnings, common for start-ups were the potential growth and potential revenues represents the large parts of the value. One example of this is the number of users of an application or monthly visits on a homepage. This can help the analyst when comparing a group of startups to determine which one presents the strongest investment opportunity. The simplicity also allows for a more widespread usage, providing a framework for value judgments for a larger amount of investors. Another benefit of valuation multiples is that compared to discounted cash flow methods fewer assumptions are made, increasing the reliability. Assumptions such as future growth and cash flow, which often is difficult to predict. Relative valuation models also ignore the intrinsic value resulting in valuations that better reflects the current mood of the market. This helps to determine undervalued companies amongst an overvalued sector. Damodaran (2012) even states that relative valuations generally yield more accurate values compared to market prices than discounted cash flow valuations. However, relative valuations are not all benefits, there are a number of potential pitfalls and disadvantages associated with them.

As mentioned, many of the advantages of valuation multiples in effect also contribute to their disadvantages. The simplicity contributes to a big part of the popularity of valuation multiples, but also results in some of the disadvantages. Relative valuations only become powerful when they are compared to other similar companies. The selection of other companies is a significant part of the outcome of the valuation. The companies are most commonly selected based on industry, risk, or earnings growth. Choosing one variable often leads to ignoring others. Certain companies are very difficult to compare to regardless of the selected variable. No two companies are identical, for example, what company can be used to compare Google INC? While there are other companies within the same industry they do not have the same market share, revenues, etc. That is one of the main disadvantages of using valuation multiples. Valuation multiples reflect the current market mood, as mentioned this is an advantage, however it is also a potential disadvantage. This may lead to overvaluations when the market is overpriced. As the market corrects itself the undervalued companies may become overvalued. In addition to these possible pitfalls, valuation multiples lack transparency. And in reality valuations multiples are also based on certain assumptions. One of these assumptions is the data that is used for a valuation multiple. The data used for example can be from the most recent financial year, from the last four quarters, as well as forward (1-year, 2-year etc.). The data may also be diluted before extraordinaire or after. It is important to know how the valuations multiples are defined in order to correctly compare them. The same goes for how they are measured, if it is the average or the median. The lack of transparency can lead to analyst to pick and chose the underlying assumption to support their strategies as well as the misusage of investors. (Damodaran 2012)

2.3 Valuation Methods in Practice

There are many different methods and approaches for relative valuations. There is the level of inconsistency between the academically literature and the reported professional analysts regarding the theory and application of valuation methods (Damodaran 2006). In addition, there is a significant difference between what methods and how the professional analysts apply them. Bancel and Mittoo (2014) published a survey interviewing over 350 valuation expert (with the qualification of CFA or equivalent for their respective country) across ten European countries regarding their valuation practices. The results showed similarities as well as interesting differences both in the number of methods used and the methods selected. There are also fundamental differences between assumptions that are made while using certain methods.

Bancel and Mittoo (2014) survey concludes that most experts use a combination of both discounted cash flow and relative valuation methods, but as mentioned there is a variation in which methods are used as well as the number of methods used. However, there is a silver lining in term of what methods are the most commonly used. Relative valuations is the most common valuation method used by just over 80 percent of the experts, a close second is Free Cash Flow to enterprise, just shy of 80 percent. The third method with around 37 percent popularity is Free Cash Flow to Equity. The Divided Growth Model and the Net Worth Approach are slightly less common with around 20 percent of the expert use these valuations. The most commonly used multiple, according to Bancel and Mittoo (2014), is Enterprise Value/ Earning Before Interest, Taxes, Depreciation, and Amortization (EBITDA) with 83 percent popularity amongst experts. The second most commonly used multiple is the price-to-earnings ratio at around 68 percent popularity. Price-book Ratio, Firm Value/EBIT, and Firm Value/Sales are slightly less common according to the survey, all around 45 percent popularity.

The study conducted in this dissertation will select the valuation multiple based on Bancel and Mittoo (2014) findings combined with the methodology from Alfred (1992) with some improvements by Liu, Nissim, and Thomas (2002) and Lie and Lie (2002) empirical studies, in order to examine the accuracy of the five most commonly used valuation multiples in an attempt to determine that most accurate one. The accuracy will be examined for each sector the ten sectors, with the objective of determining most accurate multiple for each sector, as well as overall, what is the most accurate multiple across all sectors. The data that will be used for this empirical study will be the Financial Time Stock Exchange 100 (FTSE100) index with the sample period from January 2010 to December 2014 with monthly frequency.

2.4 Previous Research

2.4.1 Selection of Comparable Companies

Lie and Lie (2002) examines ten different valuations, to identify the comparable companies for the valuation multiples the authors used Standard Industrial Classification (SIC) codes, which lists companies according to their business activities. They used companies with the same first three-digit codes. The study does a good job of breaking down the data and information to determining what multiple works better for which industries and financial situations. Lie and Lie (2002) made some interesting finding from the empirical testing. The first finding was that the predicted values from the multiples were in general somewhat negatively based. Their results showed that the mean valuations errors were slightly negative and that the median valuations error was around zero. The second finding was that asset value (book value) multiples were found to give better estimations in terms of precision and less biased compared to sale and earnings multiples. This was found to be even more so for financial companies. The third empirical result of the study

was that adjusting cash levels for do not improve company value estimations. The fourth finding was that in general the yields were more accurate for price-to-earing multiples when using forecasted earnings rather than for trailing earnings. The fifth finding was that EBITDA multiples give in general more accurate estimations than EBIT multiples, however this does not apply to pharmaceutical companies. The final finding was that the accuracy and bias of the valuation error was largely influenced by the size, profitability, and the amount of intangible assets. The authors found that for large companies the predicated value was more precise, but the bias was also greater compared with medium and small companies. However, regardless of the size, asset multiples performed best and sales multiples the worst. Asset multiples also performed best for companies with mediocre or low earnings. It is not as clear-cut when it comes to the bias of the multiples, suggesting that for some companies it is beneficial to use a combination of multiples. The study also determined that valuations tend to be more accurate for financial companies than for nonfinancial companies this because financial companies tend to have substantial liquid asset that are easier to value. This is also true for companies with less intangible asset than companies with large amounts of intangible asset for examples dot-com companies, this because it is hard to estimate the value of potential growth and opportunities. Lie and Lie (2002) conclude that the multiple selection is best described as a case by case process due to how different multiples perform under different circumstances.

Alford (1992) focuses exclusively on the price-to-earnings ratio and the methods of selecting the comparable companies. The author states that the comparable companies can be selected based on industry, risk, and earning growth. The result show that selecting the comparable company based on the industry was the most effective way to use the price-to-earnings ratio. Stating that using the three first SIC digits to find

appropriate companies to compare with is the most affective way. He states that increasing from two-digits to three-digit increases the accuracy, but the fourth digit does not give noticeable improvement. Alford (1992) however states that constricting a portfolio with risk combined with earnings-growth as comparable companies result in similar accuracy as the SIC third-digit, but notes that risk and earnings-growth, individually, does not produces the same level of accuracy. Finally, Alfond (1992) states that increasing the size of the company increases the accuracy slightly, but overall there are no large improvements when adding controls of leverage, earnings growth, and size.

Dittmann and Weiner (2005) also examine which is the most accurate method of selecting comparable companies, but when using enterprise value/EBIT. The authors find that the valuation errors decreased for all of the companies when selecting comparable companies from a basis of return on assets. This method was a more accurate than using companies within the same industry as well as selecting based on total assets. In addition, Dittmann and Weiner (2005) examined what markets the comparable companies should be selected from and found that for most European countries the 15 European Union members stock markets give the most accurate results. However, for the United Kingdom and the United States they found that the companies should be selected from their respective countries only.

2.4.2 Usage of Valuation Multiple

Pablo Fernandez (2015) published a journal on the topic of valuation multiples with the focus on how analyst reach their conclusions. Fernandez (2015) uses the fourteen most common multiples analyzing 175 companies, a total of 1200 predictive valuations. The author divides the fourteen multiples into three groups; multiples based on capitalization, multiples based on the company's value, and growth-

referenced multiples. The fourteen valuations are taken from Morgan Stenley Dean Witter's research, stating that the most widely used valuation method is price-to-earnings ratio and second is enterprise value/EBITDA. This is different compared to what Bancel and Mittoo (2014) gathered form their survey that listed enterprise value/EBITDA as number one and price-to-earning ratio as number two. Bancel and Mittoo (2014) research is a more recent report compared to Morgan Stenleys (1999), and however the differences are marginal. Fernandez (2015) states that the dispersion when using valuation multiples result in them only being useful as second stage valuation, after the using another method. The author also states that earning per shares, EBITDA and profits after tax are the most volatile equity values. In addition the authors examines the recommendation of analyst based on the valuation multiples and finds that analyst rarely recommend to sell. Over the five year analyzed that less than 10 percent of the recommendations are to sell.

2.4.3 Accuracy Amongst Valuation Multiples

Liu, Nissim, and Thomas (2002) show through a robust empirical study analyzing over 26,000 observations across 20 years that using forward earnings is the most accurate value driver in terms of relative performance. They ranked the value driver in terms of accuracy as forward earnings, historical earnings, book value and cash flow tied, and lastly sales. The authors determine that there is an increase in accuracy when the earnings are aggregated. Also when using sales and EBITDA as the value drivers using enterprise value worsen performance compared to equity value. The authors find that intrinsic value measures does not preform well and is outperformed by forward earnings. Other findings are that the harmonic mean improves the accuracy, that the performance of relative valuation is consistent over year and industries, and that using more complicated approaches of comparable companies only affects

poorly performing multiples and therefore not worth the inconvenience. Some of Liu, Nissim, and Thomas (2002) finding are contradictive to previously published research, that forward earnings consist of more value-relevant information compared to historical data, that certain sectors do not have best performing multiples, and that more intrinsic value drivers does not result in more accurate valuations. However, the authors state that due to their methodology, where they exclude companies with no forecasted or negative earnings, the results may not be representative.

Lie, Nissim, and Thomas (2007) published a second paper building on the results from the previous one focusing on cash flow valuations. They extended the study by increasing the sample size to include additional markets and they used forecast of operating cash flows, dividends, and earning. The authors find that when using forecasted numbers instead of historical were that performance improved for operating cash flows, however the performance of earnings improved even greater. The earnings per shares forecast were superior to operational cash flow forecast for all five countries and for most industries.

Cheng and McNamara (2000) publish a study in which they analyze the accuracy of three valuation ratios, price-to-earnings, price-to-book value, and a combined P/E-P/B. They show when using benchmark valuation method for the price-to-earnings and for price-to-book value the most accurate way to select comparable firms is a combination of industry membership with size and return on equity. In addition they find that price-to-earnings methods is more accurate than price-to-book value, however the combination is superior to both of them. They conclude that the best valuation approach is selecting comparable firms based on industry membership and using the combined P/E-P/B valuation method.

Gilson, Hotchkiss and Ruback (2000) found that there is not real improvement of discounted cash flow valuation compared to relative valuations. The sample used in their study consisted of companies that recognized bankruptcy.

2.4.4 IPO Valuations

Kim and Ritter (1999) published a journal with the focus of valuating initial public offers, IPOs. The authors state that IPOs are often young companies, which makes it difficult to forecast future cash flows meaning that valuations of IPOs become problematic. In their study they examined 190 USA IPOs between 1992 and 1993. They compared different companies multiples to analyze difference in accuracy. The result of their study showed that for valuations of standard priced IPOs using price-to-earnings, price-to-sale, enterprise value-to-sales, and enterprise value-to-operating cash flow ratios there is a great advantage of using forecasted number rather than historical. They found when using trailing multiples the number of stock prices that had an error within 15 percent was only 15 percent, but when using one-year and two-year the percentage increased to 19 and 36 respectively. In addition, they found that multiples valuations within the same industry had too large variation leading to only modest predictive value. They also found that the accuracy for valuations increased largely for older companies compared to young ones. For enterprise value/sales ratio the accuracy increased when using historical accounting information and controlling for leverage effects, but even more so when adjusting for sales growth rates and difference in profitability per dollar of sales. They state that this is often accounted for when using industry multiples by adding or subtracting ten to twenty percent for growth rates, profitability, quality of earning and so on.

2.4.5 Historical and Forward Valuations

Schreiner and Spremann (2007) publish a very extensive study analyzing the accuracy of multiples in the European equity market. They use the Dow jones STOXX 600 as well as validate their finding with the S&P 500 index. By using these indices they cover 85 percent and 75 percent of total market capitalization for Western Europe and U.S.A., respectively. They author use the industry classification benchmark, ICB, system, rather than the SIC code that is commonly used in other literature. They authors set out to support the three following hypothesis, "equity value multiples outperform entity value multiples in valuation accuracy, knowledge-related multiples outperform traditional multiples in science-based industries, and forward-looking multiples outperform trailing multiples." The results of their study strengthened the hypotheses and pervious published research. They found that equity value multiples are in general more accurate compared with entity value multiples, stating that the reason for this lies in the distortion-effect that arise when estimating the enterprise value. The authors support the second hypotheses showing evidence that preferring knowledge-related multiples outperform traditional multiples in science-based industries. Stating that it is true with only one exception, enterprise value/EBIT + amortization of capitalized intangible assets. The third hypothesis is also supported by their study and agrees with studies by Kim and Ritter (1999) and Lie, Nissim and Thomas (2002). They show that forward-looing multiples outperform trailing multiples in terms of accuracy, even more so two-year forecast. When they analyzed 300 companies comparing trailing, one-year, and two-year forecast multiples, the ladder was ranked first 160 times and one-year forecast 72 times while trailing multiples received 68 first rankings.

2.4.6 Valuation Multiples and Related Issues

Harbula (2009) set out to examine four question relating to valuation multiples. The first question asks what multiples give the most accurate valuations, and the author finds that contradicting Liu, Nissim, and Thomas (2002) that entity multiples outperforms equity multiples. Harbula (2009) finds that valuation multiples that included measures of profitability lead to higher accuracy, especially EBIT and EBITDA. The second question asks if combining multiples results in increased accuracy, the author finds that combing enterprise value/EBIT or enterprise value/EBITDA with price-to-earnings or cash flow based multiples result in higher accuracy. The third question asked is which multiple for which industry, and author finds certain multiples performing better for specific industries. The results showed that the most accurate multiples for one industry were often not the most accurate for the next industry, however found some general tendencies. Invested capital multiples outperforms equity multiples and that price-to-book value does not perform as well as expected. The final question the author asks is what drivers valuation multiples? Harbula (2009) finds that liquidity and size does not play a significant role rather growth, stability of earnings growth, earnings quality, and asset utilization play a significant role in determining the level of valuation multiples.

3 Research Methodology

3.1 Research Philosophy

The research philosophy used for this dissertation is positivism. It is based on a natural science approach, where there is separation between the observer and the observed. The nature of the research is descriptive as it serves the purpose defining a conclusion from a set objective.

3.1 Research Approach

Research methodology is a very important part of producing a dissertation; it is the backbone of the entire paper. The first thing to distinguish between is that there are two general approaches to the research, deductive and inductive. The deductive approach can be described as “top down research” and inductive approach being “bottom up research”.

Saunders et al. (2009) does a good job of summarizing the deductive approach as when a researcher initially forms a theory followed by rigorous testing in order to strengthen or weaken it. Robson (2002) breaks down the deductive approach into five stages, describing this process from start to end. The first step is to deduce a hypothesis or objective that consists of a testable proposition regarding the relationship between two or more concepts or variables. Step two of the approach is done by going into detail how the concepts or variable are to be measured as well as the stating the relationship between them. The third step is to test the theory through rigorous testing. The outcome is then examining, which is the fourth step, in order to attempt to either confirm or indicate the theory or determine if it needs to be modified. Lastly step is to modifying the theory if needed based on the outcome of the testing.

An inductive research approach is on the contrary known as “bottom up research”. Rather than forming the hypothesis at the first stage, it is formed after analyzing the data. An example of this would be to interview the employees at a certain store regarding their working experience. Once the data has been collected, it is examined in order to obtain a better understanding of the nature of the situation. It is after the researcher has examined and analyzed the data the theory is formed. The result of inductive approach rather than the deductive approach may lead to a different theory or in some cases it might be the same. (Saunders et

al. 2009) The main difference between the two approaches is that deductive approach has a set theory or objective before analyzing the data whereas for inductive approach it is formed after (Bryman and Bell 2015).

For this dissertation the relationship between the theory and the research is best described by the deductive approach, where the objective is formed at the start and the research set out to determine the outcome.

3.2 Qualitative verses Quantitative

For both the deductive and the inductive approach certain set of data is used to support the theory. The data can be generalized into two groups, quantitative data and qualitative data. Quantitative data is explained as data that is measured by a numerical value, a simple example can be a person's weight. Qualitative data, on the other hand, consist of information collected through for questionnaires, interviews, and focus groups. An example on qualitative data would human behavior or how they reason. (Tubey, Rotich, and Bengat 2015)

Quantitative data will be used and collected for this dissertation through Bloomberg Data Terminal in the form of equity value, enterprise value, and value drivers. The data is secondary data rather then primary. Primary data can be described as first-hand data often from interviews, surveys, and focus groups. Whereas secondary data is taken from databases or cases studies for example, where the data has already been collected.

3.3 Theory

The purpose of this dissertation is to critically examine five of the most commonly used valuation multiples, price-to-earnings, price-to-book value, enterprise value/EBIT (earnings before interest and taxes), enterprise value/EBITDA (earnings before interest, taxes, depreciation, and amortization), and enterprise value/sales (Bancel and Mittoo 2014) in

order to determine what multiple is the most accurate for each of the ten sectors as well as what multiple is the most accurate across all sectors. In order to do this the predicted value will be compared with the listed value to determine a relative (or scaled) valuation error. The valuation error as a percentage can be compared across all companies regarding the value sizes, in order to determine which multiple has the lowest valuation error, and therefore is the most accurate.

Out of the five valuation multiples two are based on the equity value (price-to-earnings and price-to-book value) and three on the entity value (enterprise value/EBIT, enterprise value/EBITDA, and enterprise value/sales). Valuation multiples are based on the relationship of listed value and a key statistic, also known as a value driver. The value drivers that are used for this dissertation are earnings, book value, EBIT, EBITDA, and sales.

The predictive value is calculated by multiplying a company's value driver by the comparable companies average corresponding multiple. For example, the company's earning is multiplied with the comparable companies average price-to-earnings ratio. The value driver for this study is calculated from the listed value (equity or enterprise) divided by the multiple, using the same example, the stock price divided by the price-to-earnings ratio to gather the earnings. There are different methods of selecting the comparable companies; this study will follow the methods of Alford (1992). However, due to the low number companies the FTSE100 cannot be divided into large enough 3-digit groups. Instead the sectors will represent the comparable companies. When calculating the sector mean, studies by Baker and Ruback (1999), Lie, Nissim and Thomas (2002), and Henschke and Homburg (2008) show that using the harmonic mean compared to the average improves valuation accuracy. The sector mean is calculated using the harmonic mean calculated from all of the firms in the sector excluding the selected firm. The valuation

error is calculated by the predicted value minus the actual value, and then divided by the actual value.

3.4 Sample

The data that is used for this study is downloaded from Bloomberg Data Terminal and examined through Microsoft Excel. The downloaded data consists of the five valuation multiple, price-to-earnings, price-to-book value, enterprise value/EBIT, enterprise value/EBITDA, and enterprise value/sales for the entire FTSE 100 over the time period 2010-2014 with monthly frequency. In addition the stock price (equity value) and the enterprise value (entity value) is download for the same sample, period and frequency. The stocks will then be sorted according to the Global Industry Classification Standard into the following sectors, Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Telecommunications Services, and Utilities (Bloomberg 2015).

The FTSE 100 consists of the 100 largest companies on the London Exchange Stock Market in terms of market capitalization, which results in that companies are continually replace to represent the 100 largest ones. For my sample this means that some of the companies joined the index later than 2010 and therefore do not have incomplete data in terms of the time period. Furthermore, companies with large gaps in their data, with over a year of missing valuation multiples will not be included in the study. The multiples are based on statistics from the income statement and calculated with the value driver in the denominator, which when the value driver is zero the multiple cannot be calculated. This is the case often for earnings.

3.5 Research question

The research question for this dissertation is, which is the most accurate valuation multiple, for each sector and across all sectors, in

terms of valuation error, when examining the FTSE 100? The objective of this dissertation is to determine which multiple performs the best for each of the ten sectors, as well as what multiple performs the best across all sectors. The valuation errors will be examined in terms of mean and median valuation error and errors within 15 percent of the listed value.

3.6 Empirical Models

The empirical mode used from this dissertation is based on Alford (1992) model, where i is the selected company and j is the comparable companies.

$$\hat{P}_{i,t} = E_{i,T} * median_{\,j \epsilon \gamma_i} \left\{ \frac{P_{j,t}}{E_{j,T}} \right\}$$

Where $\hat{P}_{i,t}$ is the predicated value and $E_{i,T}$ is the value driver of the selected company. Where $median_{\,j \epsilon \gamma_i} \left\{ \frac{P_{j,t}}{E_{j,T}} \right\}$ is the "capitalization rate" which is computed using all the comparable companies, Alford (1992) used the median multiple, this was done to lessen the impact of extreme multiples. The median is a better representation, compared to the average when using scattered data with possible outliers. More recent research has shown that the harmonic mean results in an ever better representation, improving the valuation accuracy.

The concept of Alford (1992) model will be used, however, some changes will be made to improve the accuracy. The main difference, as mentioned, the harmonic mean will be used instead of median to calculate the comparable companies. For this dissertation the comparable companies will consist sector-peers excluding the selected company. The model used for this dissertation will be the following, where i is the selected company and j is the comparable companies

$$\hat{P}_{i,t} = value\ driver_{i,\mathrm{t}} * harmonic\ mean_{j \epsilon \gamma_i} \left\{ \frac{P_{j,t}}{value\ driver_{j,\mathrm{t}}} \right\}$$

Where $\hat{P}_{i,t}$ is the predicted value (equity or entity) for the selected company, i at the time, t and the $value\ driver_{i,t}$ is the value driver for the selected company, i at the time, t . And where $harmonic\ mean_{j\epsilon\gamma_i}\left\{\frac{P_{j,t}}{value\ driver_{j,t}}\right\}$ is the harmonic mean calculated over all comparable companies, j in γ_i , the set comparable companies for company i using the one of the five valuation multiples.

The next step is to determine the relative valuation error, $e_{i,t}$, based on the relation between the predicted and the listed value. Where $\hat{P}_{i,t}$ is the predicted value and $P_{i,t}$ is the listed value.

$$e_{i,t} = \frac{\hat{P}_{i,t} - P_{i,t}}{P_{i,t}}$$

The valuation errors are measure three separate ways in order to determine the accurate of the valuation multiple as well as comparing results across different multiples and sectors. The first measure is the mean. It is a commonly used measure to give a good overview of the data, however outliers can largely affect results. The median will therefore also be included, as outliers do not affect the median. The mean and the median give a good overview, however it does not present where the data lies on a horizontal line. For example, for the valuation errors of 50 percent and -50 percent, the mean valuation error is 0; in addition the median valuation error for the values of 20, 0, and -20 is also 0. For this reason a third measure will be used, which calculates the percentage of valuations error that fall within the range of 15 percent and -15 percent of the listed value. When this measure is applied to the above examples, one out of five valuation errors fall within 15 percent. Resulting in 20 percent of the valuation error fall within 15 percent. When examining all three of these measures it allows for a better understanding of the accuracy in an attempt to determine the most accurate multiple for each of the sectors as well as across all sectors.

3.7 Limitations

The study was originally set between the time period 2000 and 2014, however, as mentioned when the value drivers is less than zero the valuation multiple cannot be calculated correctly. This was the case for a large amount of companies after the dot-com bubble as well as during the 2008-2009 crises with large amount of incomplete data for the price to earnings multiple, enterprise value over EBIT, and enterprise value over EBITDA. Furthermore, the original sample period included many companies with "incomplete data" in terms of not dating back to 2000, reducing the sample. The sample period was consequently reduced to 2010 to 2014, limiting the gaps and thereby increasing the companies in the study.

The predicted value is calculated using the sector as the comparable companies, studies have shown that using comparable companies with the same 3-digit SIC code improvers the valuation error, which is was not possible with the number of companies in the study. This leads to the variation within the sectors are large in terms of the value drivers and the values, ultimately leads to reduced accuracy and increased valuation errors. In addition the sectors Energy, Health Care and Utilities have a small number of companies limiting the comparable companies.

As stated in the literature review, forecasted earnings has proven to increase accuracy, however the Thomas Reuters DataStream did not allow for forecasted earning or be downloaded restricting the multiple to historical data.

3.8 Trustworthiness

Bloomberg Data Terminal is trusted by scholars as well as professionals around the world, considered to be extremely reliable source.

4 Data Analysis

The Global Industry Classification Standard developed by MSCI and Standard & Poor's is a commonly used to classify companies by sector, industry group, industry and sub-industry (MSCI). There are ten sectors and the FTSE 100 consists of the following companies, 11 Consumer Discretionary, 21 Consumer Staples, 4 Energy, 23 Financials, 5 Health Care, 11 Industrials, 10 Information Technology, 10 Materials, 7 Telecommunications Services, and 5 Utilities. Adding this up makes 101 companies, however, only 63 meet the set requirements and will be included in this study.

4.1 Result

Consumer Discretionary

Out of the 21 companies in the Consumer Discretionary sector the following 13 were included in this study, Burberry Group PLC, Carnival PLC, Compass Group PLC, Capita PLC, easyJet PLC, Intertek Group PLC, Kingfisher PLC, Marks & Spencer Group PLC, Next PLC, Persimmon PLC, Sports Direct International PLC, Taylor Wimpey PLC, and Whitebread PLC, the remaining eight did not meet the requirements. However, with 13 companies, Consumer Discretionary has the largest number of companies across all ten sectors. As a sector it performed very well in terms on mean valuation error, with no error over 3 percent and three errors under 1 percent. In comparison the sector did not perform as well for a point of view of the median valuation error, with two around 10 percent and one close to 30 percent, all with a negative bias. In terms of the third measure of performance, the percentage of valuation errors that fall within 15 percent of the listed value, the results for the sector vary from 8 percent to over 30 percent. The enterprise value/EBITDA had the highest percentage of valuations within 15 percent with just shy of 1/3 of valuation errors at 31.0078 percent, enterprise value/EBIT had the second highest at 27.2021 percent, followed by price-to-earnings at

22.2376 percent. The price-to-book value and enterprise value/sales did worse at 8.2051 and 15.1282 percent, respectively. The three multiple with mean valuation errors under 1 percent was, price-to-earning, enterprise value/EBIT, and enterprise value/EBITDA at 0.0037, 0.9939, and 0.7822 percent, respectively. Price-to-book value ratio has the fourth highest mean valuation error at 1.7968 percent and enterprise value/sales ratio had the least accurate at 2.5888 percent. Price-to-book value had the worse performing multiple in terms of the median valuation error at 27.9619 percent, with a negative bias. Price-to-earning and enterprise value/sales both had a negative biases median around 10 percent at 9.5278 and 11.2972 percent. Enterprise value/EBITDA performs slightly better with a negative median of 6.3753 percent and the lowest median valuation error is for enterprise value/EBIT at 2.2675 percent, with a negative bias.

Consumer Discretionary sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	0.0037%	-9.5278%	22.2367%
Price-to-book value	1.7968%	-27.9619%	8.2051%
EV/EBIT	0.9939%	-2.2575%	27.2021%
EV/EBITDA	0.7822%	-6.3753%	31.0078%
EV/sales	2.5888%	-11.2972%	15.1282%

Consumer Staples

For Consumer Staples only one company was not included leaving the following ten companies, Associated British Foods PLC, British American Tobacco PLC, Diageo PLC, Imperial Tobacco Group PLC, WM Morrison Supermarkets PLC, Reckitt Benckiser Group PLC, SABMiller PLC, Sainsbury PLC, Tesco PLC, and Unilever PLC. This makes it the second largest sector in this study after Consumer Discretionary. The lowest mean valuation error can be found for enterprise value/EBIT at 0.9233 percent, followed by the enterprise value/EBITDA at 1.5911 percent. Price-to-book value mean valuation error is 5.9446 percent, while

enterprise value/sales and price-to-earnings has the worst mean at 12.6403 and 55.8079 percent, respectively. It should be noted that an outlier for Associated British Foods PLC largely increases the price-to-earnings valuation mean. All of the medians have a negative valuation error, with the lowest median is for enterprise value/EBIT at 2.9456 percent and price-to-earnings have the second lowest at 5.8676 percent, both with a negative bias. Enterprise value/EBITDA median is just below 10 percent at 9.8826 percent, with a negative bias. Price-to-book value and enterprise value/sales have the worst median at 24.2246 and 50.5845 percent, both with negative bias. In terms of the valuation errors that fall within 15 percent the enterprise value/EBIT has the largest amount with 44.8097 percent, followed by the price-to-earnings ratio with 36.6723 percent. The enterprise value/EBITDA has the third most valuation errors within 15 percent at 33.4465 percent, while price-to-book value and enterprise value/sales preforms worse at 10.3333 and 5.2632 percent respectively.

Consumer Staples sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	55.8079%	-6.4233%	36.6723%
Price-to-book value	5.9446%	-24.2246%	10.3333%
EV/EBIT	0.9233%	-2.9456%	44.8097%
EV/EBITDA	1.5911%	-9.8826%	33.4465%
EV/sales	12.6403%	-50.5845%	5.2632%

Energy

The Energy sector is one of the sector were all of the companies meet the requirement and all of the following companies will be included in the dissertation, BG Group PLC, BP PLC, Royal Dutch Shell PLC A, and Royal Dutch Shell PLC B. The energy sector only includes four companies making it one of the smallest sectors. All of the mean and medians for the energy sector are positive. The price-to-book value, enterprise value/EBITDA, and enterprise value/EBIT all have low mean valuation

means at 2.1990, 3.0256, and 3.1739 percent, respectively. The price-to-earning mean valuation error is not far behind at 5.0568 percent and enterprise value/sales has the highest mean error at 10.1127 percent. Enterprise value/EBIT has the lowest median valuation error at 7.7703 percent, with price-to-earning as a close second at 8.8796 percent. Price-to-book value and enterprise value/EBITDA both have median errors around 10 percent at 10.7730 and 11.7095 percent, respectively. The enterprise value/sales has the by far highest valuation error with a median of 27.5022 percent. In terms of the valuation that fall with in 15 percent the price-to-book value performs the best at 32.3529 percent, followed by enterprise value/EBITDA at 29.4118 percent and price-to-earnings at 29.2576 percent. For enterprise value/EBIT 17.6471 percent of the valuation errors are within 15 percent and enterprise value/sales performs the worst with only 2.2510 percent.

Energy sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	5.0568%	8.8769%	29.2576%
Price-to-book value	2.1990%	10.7730%	32.3529%
EV/EBIT	3.1739%	7.7703%	17.6471%
EV/EBITDA	3.0256%	11.7095%	29.4118%
EV/sales	10.1127%	27.5022%	2.5210%

Financials

The Financial sector is the largest sector in the FTSE 100. However, out of the 23 companies listed only five will be used for this study, which are the following, Aberdeen Asset Management Plc., Hargreaves Lansdown Plc., Hammerson Plc., Intu Properties Plc., Land Securities Group Plc., and Schroders Plc. The other companies were removed because of not meeting the sample period and/or due to the data having large period of incomplete data (more than a year) in terms of valuation multiples. The financial sector does not perform well with high mean and median valuation errors combined with a small amount of valuation

errors within 15 percent. The sector performance the worse in terms of mean valuation error, with errors over 100 percent and even as high as over 300 percent for enterprise value/sales. However, it should be noted a few outliers largely affected the mean. For the sector all of the means are positive while all of the medians are with a negative bias. The lowest mean was for the price-to-book value at 17.7721 percent followed by the price-to-earnings ratio at 18.3727 percent. The remaining three valuation mean were over 100 percent, 135.7477 percent for enterprise value/EBITDA, 139.2899 percent for enterprise value/EBIT, and as much as 339.0764 percent for enterprise value/sales. For the median valuation error price-to-earnings is the most accurate at 17.2016 percent, with a negative bias. Enterprise value/EBIT, price-to-book value, and enterprise value /EBITDA medians are all around 30 percent with a negative bias at 29.8206, 33.7179, and 34.3355 percent, respectively. The worst median valuation error is for enterprise value over sales with 64.5336 percent, with a negative bias. The sector does not perform well in terms on valuation errors within 15 percent with only two multiples over 10 percent, the enterprise value/EBIT at 14.2857 percent and price-to-earnings at 11.8881 percent. Enterprise value/EBITDA, enterprise value/sales, and price-to-book value all have less then 10 percent of valuation error within 10 percent at 8.7719, 6.9444, and 3.3333 percent, correspondingly. The financial sector is the sector with the highest valuation errors overall, especially in terms of the mean. The reason for this is extremely large outliners Schroders PLC between November and December 2012 the enterprise value drops from £2011.99 million to £16.69 million. As well as the multiples fall under 1 percent as low as 0.0117 for the enterprise value over sales. For that month the enterprise value over EBIT, enterprise value over EBITDA, and enterprise value over sales have a valuation error of 35 757 percent, 33 681 percent, and 78 884 percent. Which is the reason for the over all mean valuation error to

be all over 100 percent. When that month is excluded the median is adjusted by a small fraction, less 0.5 percent, however the real difference is seen for the mean. The mean valuation error changes from 139.2899 to 19.7533 percent for the enterprise value over EBIT changes, from 135.7447 to 19.7056 percent for enterprise value over EBITDA, and form 339.0764 to 68.6860 percent for enterprise value over sales.

Financials sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	18.3727%	-17.2016%	11.8881%
Price-to-book value	17.7721%	-33.7179%	3.3333%
EV/EBIT	139.2899%	-29.8206%	14.2857%
EV/EBITDA	135.7447%	-34.3355%	8.7719%
EV/sales	339.0764%	-64.5336%	6.9444%

Health Care

All five of the Health Care companies in the sector are included in the study, AstraZeneca PLC, GlaxoSmithKline PLC, Hikma Pharmaceuticals PLC, Shire PLC, and Smith & Nephew PLC Enterprise. The data is very "complete" in terms of no absent of stated multiples. In general, the Health Care sector valuation errors are comparably low, with mean errors all under 10 percent and median errors all under 16 percent and most of the multiples having around 25 percent of the valuation errors within 15 percent. Enterprise value/sales performed the best for all three measures with a mean valuation error of 1.9826 percent, a median of 3.9756 percent, and 27.5510 percent of valuation errors falling within 15 percent. The second lowest mean valuation error is for the price-to-book value at 4.1985 percent, however, it has the largest median at 15.4814 percent as well as the lowest percent of errors with in 15 percent at 11.0000 percent. The remaining three multiples have similar errors with a mean around 7 percent, median around 13 percent with a negative bias, and 25 percent of errors within 15 percent. The price-to-earnings has a mean valuation error of 6.6257 percent, median at 11.8782 percent

with a negative bias, and 25.3333 percent of errors within 15 percent. Enterprise value/EBIT and enterprise value/EBITDA have mean valuation error of 8.1059 percent and 7.3954 percent respectively as well as the median of 13.5368 and 13.9210 percent, both medians are with a negative bias. Enterprise value/EBITDA have slightly higher valuation errors within 15 percent at 26.4605 while enterprise value/EBIT has 26.0000 percent.

Health Care sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	6.6257%	-11.8782%	25.3333%
Price-to-book value	4.1985%	15.4814%	11.0000%
EV/EBIT	8.1059%	-13.5368%	26.0000%
EV/EBITDA	7.3954%	-13.9210%	26.4605%
EV/sales	1.9826%	3.9756%	27.5510%

Industrials

The Industrial sector has 11 companies, whereby nine will be used, Ashtead Group PLC, BAE Systems PLC, Babcock International Group PLC, Bunzl PLC, Meggitt PLC, Rolls-Royce Holdings PLC, Smiths Group PLC, Travis Perkins PLC, and Weir Group PLC. At first glances the industrial sector as a whole performs well, with only two errors in double digits and one with less than 1 percent. Both the equity and entity multiple have low valuation errors. The enterprise value/EBIT has the lowest mean valuation error at 0.9762 percent, and with a median of 3.1026 percent (negative bias) and the largest amount of errors within 15 percent at 42.4074 percent. Thee price-to-earning ratio has the lowest median at 2.4954 percent (negative bias), and with a mean of 2.6635 percent and 30.0752 percent of errors within 15 percent. The enterprise value/EBITDA has the second most accurate multiple in terms of mean valuation error at 1.2423 and valuation within in 15 percent at 35.0000 percent, but has a slightly worse performing median at 8.1742 percent, with a negative bias. Both the price-to-book value and the enterprise value/sales have

large difference in the mean valuation error and the median valuation error and the lowest percent of errors within 15 percent. The price-to-book value has a mean of 2.4870 percent and a median of 17.8175 percent, with a negative bias, and 19.8148 percent of the errors within 15 percent. The enterprise value/sales has a mean of 3.5645 percent and a median of 16.1336 percent, with a negative bias, and only 12.7778 percent of errors within 15 percent

Industrials sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	2.6635%	-2.4954%	30.0752%
Price-to-book value	2.4870%	-17.8175%	19.8148%
EV/EBIT	0.9762%	-3.1026%	42.4074%
EV/EBITDA	1.2423%	-8.1742%	35.0000%
EV/sales	3.5645%	-16.1336%	12.7778%

Information Technology

Information Technology sector consists of four companies, but Sage Group PLC data does not meet the requirements leaving, Arm Holding PLC, Experian PLC, and RELX PLC to represent the sector. With only three companies in the sector is makes it the smallest sector for this study. The best performing multiple for the sector in terms of mean and median valuation error as well as largest amount of errors within 15 percent is the price-to-book value with a mean of 3.2131 and median 0.5078 percent and 32.7778 percent of errors within 15 percent. The price-to-earnings ratio is the second most accurate multiple with a mean of 27.1181 and median of 14.4796 percent and 10.5556 percent of errors within 15 percent. The remaining three multiples performed considerably worse. The second lowest mean is recorded by the enterprise value/EBIT at 14.6694 percent, and with a median of 31.8247 percent, but only 1.1111 percent of the errors fall within 15 percent valuation error. Enterprise/sales mean valuation error was 20.5018 percent and the median of 28.2503 percent and with 6.1111 percent of

errors within 15 percent. The least accurate multiple is the enterprise value/EBITDA with a mean of 18.0417 and median of 37.9681 percent and with all valuation errors greater than 15 percent.

Information Technology sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	27.1181%	14.4796%	10.5556%
Price-to-book value	3.2131%	0.5078%	32.7778%
EV/EBIT	14.6694%	31.8247%	1.1111%
EV/EBITDA	18.0417%	37.9681%	0.0000%
EV/sales	20.5018%	28.2503%	6.1111%

Materials

Ten firms represent the Material sector in the FTSE 100, whereby eight will be used in this study, Antofagasta PLC, BHP Billiton PLV, CRH PLC, Fresnillo PLC, Johnson Matthey PLC, Mondi PLC, Rio Tinto PLC, and Randgold Resources Ltd. Materials sector has roughly the same amount of companies as the Industrials sector, however, there is a noticeable difference in the performance between the two sectors. As mentioned the Industrial sector has only two valuation errors over ten while the Material sector on the other hand only has three that are under ten. With a majority in the tens and twenties, however comparing the errors falling within 15 percent between the two sectors is gives more similar result. The Material sector valuation error for means and medians all are negative, the only sector with no positive mean or medians. The multiple with the lowest valuation error in terms of the mean is the price-to-book value at 8.7310 percent, and with a median of 28.2384 percent (both with a negative bias), as well as 38.6441 percent of errors within 15 percent. In terms of the median valuation error and the percentage of errors falling within 15 percent, the price-to-earnings ratio is the most accurate with a median of 16.6219 percent, with a negative bias, and 43.3099 percent of errors within 15 percent. The price-to-earnings ratio has a mean valuation error of 9.9861 percent, with a negative bias. The

enterprise value/EBIT ratio has a mean valuation error of 11.5511 percent and median is 22.4739 percent, both with a negative bias, and 31.3333 percent of the errors are within 15 percent. The enterprise value/EBITDA performs similar with the mean valuation error at 9.8264 and median at 22.5454 percent, both with a negative bias, and 27.3333 percent of errors are within 15 percent. The enterprise value over sales is the worst performing multiple in the sector with a valuation error mean of 27.7354 and the median of 40.8170 percent, both with a negative bias, and the multiple does not have any valuation errors that fall within 15 percent of the listed enterprise value.

Materials sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	-9.9861%	**-16.6291%**	**43.3099%**
Price-to-book value	**-8.7310%**	-28.2384%	38.6441%
EV/EBIT	-11.5511%	-22.4739%	31.3333%
EV/EBITDA	-9.8264%	-22.5454%	27.3333%
EV/sales	27.7534%	-40.8170%	0.0000%

Telecommunications Services

Telecommunication Services as a sector had relative complete data with only one of the seven firms not meeting the set requirement, the six that are included are Inmarsat PLC, IVT PLC, Pearson PLC, Sky PLC, Vodafone Group PLC, and WPP PLC. The best performing multiples for the communications sector is enterprise value/EBITDA in terms of mean valuation error and errors within 15 percent, while enterprise value/EBIT has the lowest median valuation error. Enterprise value/EBITDA had the sectors lowest mean valuation error at 0.5359 percent and the second lowest median at 3.4975 percent, with a negative bias, combined with the highest percent of errors within 15 percent at 63.0000 percent. Enterprise value/EBIT has the lowest median valuation error for the sector at 1.1637 percent, with a negative bias, and a mean of 3.9860 percent and with 46.6667 percent of errors within 15 percent. Enterprise

value/sales scored in the middle of the sector in terms of mean and median valuation error at 14.2777 percent and 9.1886 percent, respectively and with 26.3333 percent of errors within 15 percent. Price-to-book value has the highest mean valuation error at 37.7348 percent, with a median of 7.2225 percent and only 13.3333 percent of errors within 15 percent. Price-to-earning had a median at 11.2577 percent, with a negative bias and a mean valuation error at 20.8779 combined with 30.1038 percent of errors within 15 percent.

Telecommunication Services sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	20.8779%	-11.2577%	30.1038%
Price-to-book value	37.7348%	7.2225%	13.3333%
EV/EBIT	3.9860%	-1.1637%	46.6667%
EV/EBITDA	0.5359%	-3.4975%	63.0000%
EV/sales	14.2777%	9.1886%	26.3333%

Utilities

All five of the companies, Centrica PLC, National Grid PLC, SSE PLC, Severn Trent PLC, and United Utilities Group PLC, in the Utilities sector meet the set requirements and will be included in the study. The valuation errors for the sector as a whole are low with six errors lower than 4 percent, however enterprise value/sales is the exception with a median over 50 percent. The price-to-book value is the most accurate in terms of mean valuation error at 0.8257 percent and in terms of errors with 15 percent at 57.0000 percent. The price-to-book value has a median valuation error of 5.7656 percent. The lowest median valuation error is 2.0973 percent, with a negative bias, for the enterprise value/EBIT with a mean of 2.7084 percent and 32.3333 percent of errors within 15 percent. The price-to-earnings valuation has a mean of 3.9051 and a median of 2.1082 percent as well as 27.3333 percent of errors within 15 percent. Enterprise value/EBITDA has a mean of 3.0159 percent and median of 9.4297 percent, with a negative bias, combined with

33.3333 percent of errors within 15 percent. The worse multiple for the utilities sector is the enterprise value/sales with a mean of 26.1328 percent and a median of 29.5300 percent, with a negative bias, and with no valuation error falling within 15 percent. The sector performs well with the exception of enterprise value/sales.

Utilities sector

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	3.9051%	2.1082%	27.3333%
Price-to-book value	0.8257%	5.7656%	57.0000%
EV/EBIT	2.7084%	-2.0973%	32.3333%
EV/EBITDA	3.0159%	-9.4297%	33.3333%
EV/sales	26.1328%	-59.5300%	0.0000%

Overall

To determine the accuracy for each of the multiples the performance for all five multiple across all ten sectors for the entire sample period is calculated. The purpose of this is to find the most accurate valuation multiple in general when analyzing FTSE100, in addition to finding the most accurate valuation multiple for each of the sectors. The result show that all of the multiples have a median valuation error is with a negative bias, while all of the means are positive. The most accurate multiple, outperforming the other multiples for all three measures is the enterprise value/EBIT with a mean of 3.6162 percent, a median of 4.6083 percent (with a negative bias), and with 29.7432 percent of the valuation errors falling within 15 percent. The second most accurate multiple is the enterprise value/EBITDA with a mean of 3.8230 percent, a median of 5.8730 percent (with a negative bias), and with 29.1812 percent of the errors within 15 percent. The price-to-earnings is the third most accurate multiple with a mean of 5.1615 percent, median at 5.8917 percent (with a negative bias), and with 26.1562 percent of errors within 15 percent. The price-to-book value is fourth place in terms of accuracy with a mean of 6.0583 percent and median valuation error of

9.8753 percent (with a negative bias), and with 18.2335 percent of errors within 15 percent. The enterprise value/sales is the least accurate multiple with a mean of 12.9613 percent and a median valuation error of 17.7517 percent (with a negative bias), and with 10.3285 percent of errors within 15 percent. The data has been adjusted to remove the extreme outliers (over 10,000 percent) in order for the results to be more representative of the data.

Overall

Multiple/Valuation Error	Mean	Median	Within +/-15%
Price-to-earnings	13.4689%	-5.8917%	26.1496%
Price-to-book value	6.0583%	-9.8753%	18.2335%
EV/EBIT	**3.6162%**	**-4.6083%**	**29.7432%**
EV/EBITDA	3.8230%	-5.8730%	29.1812%
EV/sales	12.9615%	-17.7517%	10.3285%

4.2 Findings/Discussion

Consumer Discretionary

Consumer Discretionary is one out of two sectors where a single superior multiple is difficult to determine, due to the fact that there are three different multiples ranked highest for the three measures. Therefore, the study cannot bring forward one multiple that is the most accurate for the sector. However, multiple with earning as the value driver outperform multiples with book value and sales as the value driver. This finding agrees with Liu, Nissim, and Thomas (2002) stating that earnings are superior to asset and sales multiples, but the result of this sector show that the sales multiple outperforms the asset multiple. Other findings are difficult to make, where for example EBITDA as a value driver outperform EBIT for the mean valuation error but not for the median. One of the reasons for this is the large numerical difference between multiple ratios. For example, the price-to-book value ratio stretches at one point from as low as 0.5643 (Taylor Wimpey PLC) to as high as 45.7402 (Next

PLC). Research by Dittmann and Weiner (2005) show that selecting comparable companies based on return on assets creates more accurate valuations. When comparing the return on asset for a certain month between Taylor Wimpey PLC with less than 20 percent to Next PLC with over 200 percent (Thomas Reuters) it becomes clear the financial differences within the sectors. The total assets for Next PLC is on average around half on Taylor Wimpey PLC (Bloomberg Business). In addition there is a fundamental difference in the business that the companies conduct, Next PLC produce clothing, footwear, and home products, whereas Taylor Wimpey PLC is a homebuilding company. This example includes only two companies, but it represents the difference within the sector in terms the type of business they conduct as well as the financial size. However, when examining the result of all three measures a more overviewing picture is presented.

Consumer Staples

The findings of this study show that enterprise value/EBIT is the most accurate valuation multiple for the Consumer Staples sector based on all three measures. The results also show that earnings as a value driver is superior to book value and sales, in that order. This contradicts with Lie and Lie (2002) findings, which state that that multiples based assets value outperforms earnings and sales multiples. The result also contradicts Lie and Lie (2002) finding that using EBITDA instead of EBIT improves accuracy. The findings for the Consumer Staples sector for this study support Liu, Nissim, and Thomas (2002) finding stating that historical earnings outperforms both book value and sales, in that order. Comparing the valuation errors between equity and entity multiple does not show one clearly outperforming the other as Schreiner and Spremann (2007) findings did, stating that equity multiples outperform entity.

Energy

The results from the energy sector show that the price-to-book value is the most accurate in terms of both the lowest mean and the highest amount of errors within 15 percent. The results also show that sales is the worst value driver after earnings, which is inline with Lie and Lie's (2002) findings state that book value is superior ahead of earnings and sales, in that order. The results also show that EBITDA as a value driver outperforms EBITDA, also supports Lie and Lie's (2002 findings. In addition the results also show that equity multiples marginally outperforms entity multiples, which agrees with Schreiner and Spremann's (2007) findings. However, the result contradict Lui, Nissim, and Thomas' (2002) finding stating that earnings outperforms book value as a value driver. The sales multiple is by far the least accurate and is not recommend for this sector.

Financials

The result show that financial sector as a whole is one of the least accurate ones when using valuation multiples. A limited amount of the valuation errors fall within 15 percent and the mean and median error are high, even after adjusting for the outlier. For financial sector, as well as the consumer discretionary sector, it is difficult to determine what is the most accurate multiple. This reflects all the result of this sector, making it difficult to rank the multiples. The price-to-book value has the lowest mean, price-to-earnings the lowest median, and the enterprise value/EBIT has highest percent of errors within 15 percent. Similar to the Consumer Discretionary sector one of the reason for the poor accuracy can be found in the large variance within the sector. For the financial sector, multiple ratio values amongst the companies vary from 1 percent to well over 50 through the sample period leading to high valuation errors. The results of this sector contradict with Lie and Lie (2002) statement that financial

companies have more accurate valuations because of the larger amounts of liquid assets. When valuating the financial sector it may be beneficial to complement with a free cash flow method.

Health Care

Enterprise value/sales is the most accurate valuation multiple when valuating companies within the health care sector. In terms of mean and median valuation error enterprise value/sales is a clear winner, for the amount of errors within 15 percent it is only marginally more accurate. The result show that the entity multiples outperform the equity multiples, which contradicts with Schreiner and Spremann's (2007) findings. Sales as the superior value driver contradicts Lui, Nissim, and Thomas (2002) finding, which states that sales is the least accurate value driver. The results of this sector also contradicts with Lie and Lie's (2002) findings, that book value is the most accurate value driver, but is inline in terms of EBITDA outperforming EBIT.

Industrials

The most accurate valuation multiple for the industrial sector is the enterprise value/EBIT, with the most accurate mean and the highest amount of errors within 15 percent, combined with the second lowest median. The earnings multiple are the most accurate outperforming both asset and sales multiples, which is inline with the findings of Lui, Nissim, and Thomas (2002). The result also show that enterprise value/EBIT is superior to enterprise value/EBITDA contradicting with Lie and Lie's (2002) findings. The result are inconclusive in terms of Schreiner and Spremann's (2007) finding stating that equity multiples outperforms entity multiples. However, entity multiples has a tendency of better accuracy than equity multiples with the exception of enterprise value/sales.

Information technology

Price-to-book value is the superior valuation multiple for the information technology sector. It has a clear advantage in term of accurate compared to the other multiples, but especially the entity multiples. Price-to-book value as the most accurate multiple supports Lie and Lie (2002) findings stating that asset multiple outperforms both earning and sales multiples. The results clearly show that equity multiple outperforms the entity multiples supporting Schreiner and Spremann (2007) finding. The sector consists of only three companies with sizeable difference in financial performance, which partly contributes to the poor accuracy, with the exception of price-to-book value and to a certain degree to the price-to-earnings ratio. The price-to-book value is also the only tested multiple not based on earning or sales, and as stared by Souzzo et al. (2001) technological companies do not always produce sale and/or earnings in an argument for the superior accuracy for the price-to-book value.

Materials

The most accurate valuation multiple for the material sector is the price-to-earnings ratio, it outperforms the other multiples noticeable in terms of mean valuation error as well as had the highest relative amount of error within 15 percent. What also can be noticed is that price-to-book value has is the second most accurate multiple in terms of errors within 15 percent. This supports Schreiner and Spremann (2007) finding that equity multiples outperforms entity multiples. Price-to-earnings is the most accurate multiple supporting Lui, Nissim, and Thomas (2002) finding, however that price-to-book value outperforms both enterprise value/EBIT and enterprise value/EBITDA contradicts the finding. The enterprise value/sales is the indisputably worst multiple in terms of

accuracy, with not a single valuation error falling within 15 percent. The main factor for this is that low enterprise value/sales ratio (under 1) for a number of companies over long non-overlapping period. This resulted in the inaccurate valuations.

Telecommunication Services

The most accurate valuation multiple for the telecommunication services sector is the enterprise value/EBITDA, with the lowest mean valuation error and the relative largest amounts of valuation error within 15 percent. The enterprise value/EBITDA for the telecommunication services sector has the largest amount of errors within 15 percent across all sectors and multiples, as much as 63.0000 percent. It also outperforms the enterprise value/EBIT supporting Lie and Lie's (2000) finding regarding EBITDA being superior to the EBIT as value drivers. Enterprise value/sales, a multiple that in many sectors is the worst multiple performs in comparison significantly better, outperforming both equity multiples. This contradict Schreiner and Spremann's (2007) finding as the entity outperform the equity multiples for this sector.

Utilities

The most accurate valuation multiple for the utilities sector is the price-to-book value. It has the lowest mean valuation error as well as the relative largest amount of errors with 15 percent. This supports Lie and Lei's (2002) finding that asset multiples outperform earning and sales multiples. However, the results contradicts Lui, Nissim, and Thomas (2002) finding that earnings as a value driver is superior to book value. The utilities sector performs well overall with exception of the enterprise value/sales, which preforms particularly poorly. The enterprise value/sales does not have any valuation errors within 15 percent, for similar reason to the enterprise value/sales in the materials sector, where

periods of the enterprise value/sales ratio is under 1 resulting in poor accuracy across the sector.

Overall

The most accurate valuation multiple across all sector, examining the valuation errors from all of the companies, is the enterprise value/EBIT. It has the lowest mean and median valuation error as well as the largest amount of valuation errors within 15 percent. What also can be found is that earnings as a value driver is superior over both book value and sales, in that order. This supports Lie, Nissim, and Thomas (2002) finding in which they state the order of accuracy in terms of value driver as forward earnings, historical earnings, cash flow as well as book value, and lastly sales. Enterprise value/EBIT as the superior multiple contradicts Lie and Lie's (2002) finding stating that EBITDA outperforms EBIT in terms of accuracy as a value driver.

4.3 Discussion

Valuation errors are noticeably larger when multiples ratios are less than 1. For this dissertation companies with negative multiple ratios were not included, however excluding ratios under 1 would most likely increase the accuracy for the entire study. Liu, Nissim, and Thomas (2002) excluded all ratios under 2 in their study which showed increased accuracy, but as they stated their findings are not as represented due to their requirements on the data. This suggests that there is a trade-off between valuation accuracy and the increased set requirements.

Common belief, back with research, shows that there are certain multiples that perform better for specific industries, however some researchers do no agree, Liu, Nissim, and Thomas (2002) is one example of this. They find that their results are consistence over time and across sectors. This study strengthens the common belief as there are different best performing multiples for most of the different sectors. Enterprise

value/sales is a multiple that in general does not perform well however, it performs the best for the health care sector, supporting that certain sectors have so called best performing multiples.

Harbula (2009) in his study finds the most relevant valuation multiples by industry. It is listed by 14 industries rather than the 10 sectors used in this dissertation. However, comparisons can be made between the two studies. The financial sector and Harbula's (2009) Banking and Insurance industry both show price-to-earrings performing well. Even similar are the results from the health care sector and the Life Sciences/healthcare industry as both show that enterprise value/sales is the most accurate valuation multiple. Also comparing the telecommunication services sector with the telecommunication industry show that enterprise value/EBITDA perform in the top. But this was not the case for all, as information technology sector show that the equity multiple clearly outperforms enterprise multiples whereas Harbula (2009) finds that enterprise value/EBITDA and enterprise value/EBIT performs the best for the Technology industry. Across all sectors Harbula (2009) finds that enterprise value/EBITDA or enterprise value/EBIT often gives the most accurate valuation, especially when combined with price-to-earnings. This study shows that enterprise value/EBIT with enterprise value/EBITDA as a close second result in the most accurate valuation.

The previously published research varies in terms of the method of selecting the comparable companies. This dissertation is based of Alford (1992) model choosing companies within the same industry. However as the results show and by examining the data there are large gaps in the level of financial and the nature of the companies in this study. The method that Alford (1992) used has been adjusted for this study due to the restricted amount of companies, not allowing for large enough groups using the 3-digit SIC code. It would be interesting expand the same size to allow for 3-digit SIC code and compare the results with this

study. In order determine the impact of the more general groups. Also to compare the results when using an alternative method of selecting, such as Dittmann and Weiner (2005) based on return on equity. The results would be based on return on equity size rather than sector. However the results could be compared to determine what methods is the most accurate.

4.4 Limitations

One of the limitations of this study is that forecasted data is not included. As previous research show forward data, especially forecasted earnings, which tend to results in the more accurate valuations. In addition there are other valuation multiples such as cash flow, invested capital etc. that were not included limiting the finding to the five valuations used. Another limitation is the number of companies that were not included from the FTSE100 due to limitations on the data. The reasons for this were either because the companies were "new" to the index or due to valuation ratios that were less than 0. In effect the study is less representative as it included a lower number of companies. The original sample stretched across 15 years, however too many companies did not meet the requirements due to the dot-com bubble and 2008-2009 crisis, in many cases resulting in negative ratios.

When valuation multiples ratios are less than 1 they increase the valuations error of the sector, which was the case for a number of the sectors in the study. Liu, Nissim, and Thomas (2002) excluded all companies with ratios under 2 in their study, however that would have significantly reduced the sample size.

5 Conclusion

This dissertation sets out to examines the accuracy, defined as mean and median valuation errors as well as the percentage of valuation error within 15 percent of the listed value, for the five most commonly

used valuation multiples. A robust survey, conducted by Bancel and Mittoo (2014) severing over 350 valuation experts across ten European countries, show that the enterprise value/EBITDA, price-to-earning, price-book value enterprise value/EBIT, and enterprise value/sales uses are the most popular valuation multiples amongst the experts. These five multiples will be used to determine the valuation error for the FTSE 100 over the time period of 2010 to 2014 with monthly frequency. Valuation multiples are a powerful valuation tool when comparing performance amongst similar companies. Alfred (1992), a well-referenced journal state that when selecting the comparable companies doing so according to the Standard Industrial Classification with companies with the same first three-digit codes results in the most accurate valuations. This is the most common belief in the literature, however, not all agree. Dittmann and Weiner (2005) state that selecting according to return on equity and according to total assets result in more accurate valuations. Due to a limited number of companies the comparable companies of this dissertation consists of the companies within the same sector according the Global Industry Classification Standards. The FTSE 100 consists of ten sector, consumer staples, consumer discretionary, energy, financials, health care, industrials, information technology, materials, telecommunication services, and utilities. One of the limitations of the methodology is that companies with the same sector vary large both in operations and financial situations. In order to help improve the valuation error the harmonic mean will be used for the comparable companies. Research by Baker and Ruback (1999), Lie, Nissim and Thomas (2002), and Henschke and Homburg (2008) show that the harmonic mean helps improve the accuracy in terms of valuation errors.

The research question for this dissertation is, which is the most accurate valuation multiple, for each sector and across all sectors, in terms of valuation error, examining the FTSE 100? The objective is to

determine for each of the ten sectors what multiple would give the most accurate valuation as well as what multiple give the most accurate valuation across all sectors, with the purpose of determine what multiple is best are used for the ten sectors and what multiple has the best accuracy overall.

The study found the most accurate valuation multiple for all sectors, but two where the results where inconclusive. The study also found the most accurate multiple across all of the sectors. In addition certain other observation were made and compared to previously published journals.

The consumer discretionary was one of the two sectors were the most accurate valuation multiple could not be determined due to the fact that three different multiple were ranked best for the three different valuation error measures. However, it could be determined that using earning as the value driver lead to superior accuracy. The two sectors with inconclusive results were consumer discretionary and financials. These are the two largest sectors in terms on number of companies for the FTSE 100. Further research is needed, but there is a possible relationship, where the larger sectors included a very wide variety of companies leading to the sector average not representing the diverse sector well enough resulting in the inconsistent ranking between the multiples.

Enterprise value/EBIT is the most accurate valuation multiple for the consumer staples sector. It is superior to the other multiples in terms of all of the valuation error measures. The results also show that, again, earnings are the most accurate value driver.

Price-to-book value is the most accurate valuation multiple for the energy sector, with the best performing mean as well as the largest amount of errors within 15 percent.

As mentioned, there was no superior valuation multiple for the financial sector. Lie and Lie (2002) state that financial companies are easier to valuate because of their liquid nature which is not supported by the results of this study, however, the financial gaps between the companies may result in the poor accuracy for this study.

The enterprise value/sales is the most accurate valuation multiple for the health care sector. It is the only sector where enterprise value/sales in the most accurate, as it in many sector it is the least accurate. When examining this closer all five of the companies have very similar enterprise value/sales ratio, one reason for this could be that pharmaceutical companies have steady sales number as a result of prescription medication and are mature companies in terms of growth.

The enterprise value/EBIT is the most accurate valuation error for the industrial sector. The industrial sector is one of the larger one in the study and it performs very well. Earnings as a value driver outperform both book value and sales in terms of accuracy.

Price-to-book value is the most accurate valuation multiple for the information technology sector. It clear winner, outperforming the other multiples, which supports Souzzo et al. (2001) finding that technology companies do not always rely on earning or sales leading to the high valuation errors. However, this tends to be truer for start-ups and in the growing stages of a company, whereas the FTSE 100 consists on large cap companies and this should have less significant. But, entity multiples perform extremely poorly. When examining the enterprise values for the companies they have all increased substantially and rapidly. One of the companies had an enterprise value around £2 000 million at 2010 and over £ 13 000 five years later, definitely still in a growing stage.

Price-to-earnings is the most accurate multiple for the materials sector. The sector performs well with the exception of enterprise value/sales. There are a number of the enterprise value/sales ratios that

are less than 1 throughout the sample period. When using ratios with values less than 1 it created large valuation errors as the value is used as the denominator.

Enterprise value/EBITDA is the most accurate valuation multiple for the telecommunication services sector. It has the largest amount of errors within 15 percent for all multiples across all sectors. Earnings multiples are superior for the sector, but as a whole the sector preforms well.

Enterprise value/EBIT is the most accurate valuation multiple for the utilities sector. The sector performs well with the exception of enterprise value/sales.

Enterprise value/EBIT is the most accurate valuation multiple across all sectors. It can also be found that earning as a value driver results in lower valuation error followed by book value and sales give the largest errors. This supports previously published research such as Liu, Nissim, and Thomas (2002).

Previously stated research shows that certain multiple preform better for specific industries, Lie and Lie (2002) among others state this, however, Liu, Nissim, and Thomas (2002) finding state that multiple performance vary and different industries are not associated with “best multiples”. The findings for this study support Lei and Lie (2002) and contradict with Lui, Nissim, and Thomas (2002), clearly showing certain so called “best multiples” for all but two sectors.

The mean valuation error is very receptacle to outliers, as seen one outlier on one of the months affects the overall mean significantly. For the sector average the harmonic mean is used while for the mean valuation error is simply the average. However when examining all three of the valuation measures it gives a better picture of the accuracy.

The number of companies in the FTSE 100 in some cases did not allow for suitable comparable companies. One of the main assumption

when using valuation multiples is similarities for the comparable companies. The companies that were used as comparable companies for this study were many times very different in terms of type of operation and financial situations, which lead to reduced accuracy. Future research is recommended to expand to a larger scale covering the London Exchange Stock Exchange, in order to have more similar comparable companies. However, this dissertation shed some light on the accuracy of valuation multiple and help determine what multiple is the most accurate for what sector.

6 Recommendations 1,000

This chapter will suggest future research recommendation based on this dissertations research question and objectives. It will focus on the findings that were made in this dissertation and make recommendation on improving and continuing future research.

The objective of this dissertation was to present what valuation multiple is the most accurate for each of the ten sectors, when defining accuracy in terms of valuation error. In addition, the objective was to determine what valuation multiple is the most accurate overall, across all the sectors. This was done by calculating the predictive value based on the comparable companies, for this study that was the companies within the same sector. For two of the sectors a superior multiple could not be determined. One of the most vital assumptions of valuation multiples is regarding the comparable companies. For this dissertation the number of companies was relative small and the variance of between them was large, in terms of operations and financial situations. This lead to the companies used as comparable were not very similar. There was a big difference in both the type of business they conducted as well as the size of the company. To improve the accuracy of a study of this nature the sample needs to cover a much greater number of companies. Ideally with

around ten comparable companies according to sub-industry or return on equity and total asset, depending on what literature one chooses to follow.

Studies examining valuation errors have in the past focused on the U.S. stock market and Europe. There has been less of a focused on developing countries to analyze the difference in valuation errors between different parts of the world and different stages of an economy and with different market efficiencies. In addition the focus has been on large companies, it would be interesting comparing the valuation multiples performance for small companies with large companies.

Future research is recommended to excluding ratios that are under 1 in order to improve accuracy and better represent the valuation multiples as often times the comparable companies are hand picked and such companies would not be included. Also to examine the correlations between the valuations and key statistics to future determine possible relationships. Lastly compare the valuation errors of this study with a study using return on equity as a base for selecting comparable companies.

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