Dominant Valuation Model and Valuation Model Accuracy in UK Technology, Media, and Telecom Sector

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Abstract

This study has investigated the dominant valuation model, and the accuracy of the valuation model from 147 sell-side analysts report issued by top five investment research houses during May 2014 and August 2017 covering 26 UK listed companies in TMT (technology, media, and telecom) sector. Using content analysis and further using univariate and multivariate analysis, it was found that discounted cash flow based models are dominant, and analysts favour the use of Price Earnings (PE) Model in the technology industry. A significant difference in the choice of valuation model is also noted between industries and investment research houses. Multivariate analysis confirmed the significant relationship between valuation model choice and size of the company, investment research house, and industry. Further, the accuracy of valuation model in these reports is tested using six measures of accuracy and performing binomial logistic regression to find the relationship between target price accuracy and factors such as size, recommendation, number of pages in analyst's reports, market sentiments, analyst's optimism. It is concluded that PE model performs more accurately than others, followed by DCF models. Multivariate analysis confirmed that the accuracy of the price targets is affected by analyst's optimism of price target and investment research house.

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Chapter 1: Introduction

There has been an agreement in the previous literature that sell-side analysts' reports provide value relevant information to the investors (Frankel et al., 2006, Asquith et al., 2005). A corollary of this finding is that analysts play a major role in improving market efficiency. Analysts process a large amount of information (Breton and Taffler, 2001) including macroeconomic data, industry data, and company data. Analysts try to generate new information by using proprietary information which could be their own modified models, quantitative or qualitative, and at the same time, they provide expert opinion to already available public information. All this information is transformed into a recommendation issued to investors which are usually backed by a target price. Analysts perform this task of converting information into price targets, known as valuation by using different types of valuation models. Prior literature suggests that the choice of valuation model could depend on the preference of analysts, it could also depend on the firm specific characteristics such as industry in which a firm is operating, leverage or stage of life-cycle of the firm, and it could also depend on the market sentiments such as bull or bear market (Bilinski et al., 2013, Imam et al., 2008, Demirakos et al., 2010). Hence, the choice of valuation model might be different in different situations. The existing literature has provided some evidence on the likely use of appropriate valuation model in a particular industry (Glaum and Friedrich, 2006 and Demirakos et al., 2010). However, the literature is limited, and none of the studies is specific to UK TMT sector (consisting of three industries - Technology, Media, and Telecom) which is the focus of this study.

When there are predictions and forecasts in financial markets, there is a huge amount of money at stake. Lin et al. (2016) find that institutional investors trades in the same direction as the target price changes. Therefore, the next important question is how accurate those predictions are. There is extensive prior literature on the accuracy of the price targets (Bonini et al., 2010, Asquith et al., 2005, Bradshaw et al., 2012). Academics have tried to study not only the accuracy of the valuation models as a whole but also differences in the accuracy of the different valuation models. There are also studies about factors which increases or decreases the accuracy. However, there is not a definitive agreement in the literature about the accuracy of the valuation models.

This study is focused on investigating the dominant valuation model in the technology, media and telecom industries (referred to as one Sector) in the UK by analysing the content of 147 sell-side analysts' reports issued by five top-ranked investment research houses between May 2014 and August 2017 covering 26 UK companies listed on London stock exchange. Another objective of this study is to find out the accuracy of the valuation models as evidenced in those reports and try to establish which valuation model exhibits the highest accuracy in these industries and which investment research house predicts target price more accurately than others. However, this study is different in a way that it focuses on TMT sector which has attracted some attention as the stock of TMT companies has experienced very strong recent bull run. Also, the data collected for this study is very recent, and hence the study is unique which will show recent practices, and they can be compared with older results from previous studies.

Previous studies had suggested that there are many factors which influence the choice of a dominant valuation model. Some of these factors are industry, time frame, characteristics of

the company (Demirakos et al., 2010, Glaum and Friedrich, 2006 and Imam and Barker, 2008). Therefore, three of these factors, namely, industry, time-frame, and research investment house, are tested in this study by using univariate and multivariate analysis. Similarly, the accuracy of price targets is also affected by different variables, and same statistical techniques are applied to test the accuracy of valuation models. It should be noted that the factors that affect the choice of valuation model are different from the factors that affect accuracy. This has been discussed further in next sections.

Firstly, there is an analysis of the dominant valuation model in each of the above-mentioned three industries by using descriptive statistics, univariate analysis and further a multivariate analysis to control for the variables such as industry and investment research house. Content analysis is used to analyse 147 sell-side equity analysts reports from five different investment houses and 26 different companies listed on London stock exchange spread across the three-year period. The three-year time period exhibits different sentiments as explained further in this study.

Secondly, since it is known that multiple factors can affect the choice of valuation model, a univariate and multivariate analysis is done first to test the significance of the difference of the valuation model choice between the three industries, and then between different time-frames, and finally between different investment research houses. Multivariate analysis is done to find the relationship between these variables and to control for all the variables at the same time.

Thirdly, there is an analysis of the accuracy of the valuation models by employing six measures of accuracy. Demirakos et al. (2010) did a similar study using four measures of accuracy. However, this study adds two more measures. The analysis is done using

descriptive statistics and then by using multivariate analysis to control for the differences amongst variable and to establish a relationship between accuracy and variables such as size, number of pages in the report, bull and bear market, recommendations, analyst's optimism, valuation model, industry and research house.

This study will add to the existing literature on the dominant valuation model and the accuracy of the valuation model in the UK market. Also, the result of this study can help practitioners who wish to follow or work in TMT sector in understanding and finding the appropriate model to use. Another group of people who can benefit from the result of this study are investors who are interested in investing TMT sector. The results can give them some indication of the quality of the analyst's report in terms of accuracy of price targets.

The remainder of this study is structured as follows. The next chapter focuses on the existing literature on valuation model, valuation model choice, and valuation model accuracy. Chapter 3 frames the main research questions and sub-questions with their research methodology and data collection and issues faced. Chapter 4 lists down the results and findings of the research for both the main questions and sub-questions in the form of descriptive statistics, univariate analysis, and multivariate analysis. Finally, chapter 5 presents the conclusion of the research and the limitations of this study.

Chapter 2: Literature Review

Equity valuation, valuation model choice, analysts target price accuracy and analysts themselves has attracted lots of interest from academics and therefore a significant amount of research has been done in these areas. Ramnath et al. (2008) investigated approximately 250 papers related to financial analysts published since 1992. There are suggestions for further research in all the seven areas, and one of them is the information content of analyst's report. This study aims to add to the literature on the accuracy of valuation model using content analysis of analyst's research reports. Frankel et al. (2006) researched analyst's forecasts, stock returns, and the firm characteristics for almost 24,000 firms issued during 1995-2002. They found analyst's research to be significantly informative. They further concluded that analyst's informativeness increases in uncertain environments, informativeness decreases where the cost of processing the information is high, and analysts are more informative when financial statements are related to prices. This means there is value-relevant information available in the analyst's reports. Brav and Lehavy (2003) analysed a large database of target prices, stock recommendation, and earnings forecast issued during 1997-1999 and found that market reacts significantly to the information contained in the analyst's target price. Asquith et al. (2005) and Krishnan and Booker (2002) found that the descriptive part of the report is also an important source of information because it gives the justifications of the assumptions and opinions of the analyst. Previous research has also studied the determinants of the price target accuracy. Breton and Taffler (2001) found that analysts analyse not only accounting statements but also the economic

environment in which a company operates, its competitors, quality of company management and the overall business strategy of the company.

Therefore, it is clear from above studies that although there has been increasing amount of research on areas like valuation model, analyst's role, and their accuracy but there are still areas for further research as Ramnath et al. (2008) concluded. Secondly, it is also evident from above findings that analyst's reports do provide value relevant information and has the ability to move the market significantly. This is clear that analysts have an important role to play in the capital market. It can be argued that analysts play a vital role in improving efficiency in the market. This is because of the vast amount of qualitative and quantitative information analysts possess and use in analysing the company. Because of the importance of analysts, amount of data they process and as Lin et al. (2016) concluded that the institutional investor trades in the direction of analyst's recommendation it becomes more important for market participants to understand what drives the valuation model choice and what is the accuracy of financial models which analysts use to arrive at the target prices. The process of transforming information and forecast into target price involves calculation using a valuation model.

Analysts use valuation model to arrive at the value of a given stock. In a most basic sense, the value of an asset is the present value of the future cash flow it generates. Discounted cash flow valuation models are based on the same principle. The value of a company is the present value of the income/cash it will generate throughout its life. There are also relative valuation multiple models. These models assume that the companies in same industry should be valued similarly because they will have similar value drivers. Some of the examples of these value

drivers are – Price to Earnings ratio, EV/EBITDA, Price to sales ratio which are explained briefly in section 2.1.2.

2.1 Valuation Models

This section discusses the equity valuation model widely used by analysts to calculate the target prices. Generally, two types of valuation models are used - discounted cash flow models and relative valuation models.

2.1.1 Discounted Cash Flow Models

Discounted cash flow (DCF) models are based on the principle that the value of an asset should be the present value of the cash it generates over its life. DCF technique uses cash flows that are generated from holding the asset and then discounting those cash flows with the risk associated with them on a time-weighted basis. A cash flow in early life is more valuable than the same amount of cash flow in the later life because of the time value of money concept. Since cash flow can be defined differently, there are different equity valuation models based on principle mentioned above. When cash flow is defined as a dividend, a dividend discount model can be used. However, if cash flow is defined as only the cash available to equity holder after deducting all the interest payments, after all the capital expenditure have been paid for, and after adjusting for working capital movement – a discounted free cash flow model can be used. These two models along with abnormal earnings model are discussed below –

A. Dividend discount model (DDM)

B. Discounted Free Cash Flow Model

C. Abnormal Earnings Model

All above models should give the same value of the company as different discount rates offset the different cash flows. Dividends are discounted at the cost of equity since dividends are claimed by equity shareholder while free cash flows to the firm are discounted at the cost of capital.

Dividend discount model

The most commonly used DDM is Gordon Growth Model firstly published by Gordon and Shapiro (1956) which incorporates an element of growth in dividend paying capacity of the firms. If a company declare a dividend that has a current value of D_t and it grows at a certain growth rate, say g then for any time t, the value of the stock is given by following formula.

$$V_0 = \frac{D_0(1+g)}{(r-g)}$$

There are practical problems associated with Gordon growth model. One of the main problems with this model is that growth rate cannot be larger than the required rate of return. If the growth rate is higher, denominator turns negative and hence leaving the final value as meaningless. Therefore, this model cannot be applied to high growth companies like technology firms. One more problem with this model is its inability to value companies who do not pay dividends. Many growth companies do not pay dividends as they prefer to invest in growth opportunities rather than distributing cash to shareholders. Another problem is that DDM uses dividend as input which does not necessarily reflect the value of the firm. This has been discussed very widely after the idea first proposed by Miller and Modigliani (1961). They argued that dividend policy of the firm is irrelevant and does not affect the value of the

firm. For these reasons, one might use potential dividends, also known as free cash flow to equity, rather than actual dividends. Following is the model which focuses more on cash generation rather than cash distribution.

Discounted free cash flow model

Cash flows can be defined in different ways – it can be dividends or potential dividends; therefore, discounted free cash flow model uses the cash actually available to the holder of capital after all the expenses and capital expenditure has been paid. This cash will not be distributed in the form of dividends but will be retained by the company for taking up new projects. However, if the company does not take the projects then cash is available to the owners of capital, and for this reason, it is known as potential dividend and considered as the best proxy for cash generation ability of a firm. For example, if a company is a high growth company and invest aggressively in investment activities like buying non-current assets then cash flow to the firm will be negative. Discounted free cash flow (DFCF) model focuses only on cash generation rather than value generation (Gode & Ohlson 2006, p. 3). Another problem with DFCF model is difficulty in forecasting free cash flow over the forecasting horizon. Givoly et al. (2009) investigated 7,543 sample of earnings and cash flow forecast in their study and found that cash flow forecasts are much less accurate than earnings forecast.

Free cash flow model generally used in one of two forms, free cash flow to the equity and free cash flow to the firm. A firm value can be derived either by discounting the free cash flows to equity (FCFE) by the cost of equity or by discounting free cash flow to the firm (FCFF) by the cost of capital and then subtracting debt, preferred stock and adding cash. Both the methods should give same value if the weighted cost of capital is calculated

correctly, i.e., if the cost of debt and cost of preferred stock are calculated using market values and not book values.

When valuing a company using DCF model a forecast of free cash flow is made over the forecasting period. Since one cannot keep forecasting forever, a simplified assumption is made that the firm will continue to generate a certain level of cash flow which is also assumed to grow at a constant growth rate. This is called terminal value which can be defined as the present value of all the cash flow which a company will generate over its life after the forecasting period. These cash flows can be constant (if the growth rate is zero) or can be assumed to grow at a certain rate. The growth rate in perpetuity must be lower than company's weighted average cost of capital for this model to work.

Abnormal Earnings Model

Another form of discounted cash flow model is abnormal earnings model or residual income model. This model is based on the principle that the value of the company should be equal to the book value of original invested capital, the value of the normal rate of return on invested capital which is represented by the cost of capital, and the value of the abnormal rate of return on invested capital. All the normal and abnormal earnings are discounted back to present as in the case of above-described models. Although it is easy to calculate earnings and abnormal earnings using book value but by very definition, abnormal earnings are not sustainable. Another problem with the model is that it relies on the book value of equity rather than market value. Book values are often affected by accounting adjustments, for example, if a company do a share buyback, the company could even have a negative book value.

2.1.2 Relative valuation or multiples models

All the above models discussed so far are intuitive in a way that they link the value of an asset to the benefits which are expected over the life of the asset, they, however, do not link or compare the price with other similar assets available in the market. Relative valuation models do so. Relative valuation models are based on the law of one price which states that similar assets should sell for a similar price. Therefore, in the valuation of a company, an analyst would look at other similar companies operating in the same industry and would try to apply a most appropriate multiple to the target company. This multiple is usually an average of the same multiple of all the companies. For example, Price Earnings (PE) ratio is the widely used valuation multiple in the industry. In the valuation of a target firm, analysts would look at the PE ratios of all the firms in the same industry and arrive at the average PE ratio of the industry. Then this PE ratio can be multiplied with earnings of the target company to arrive at a price. There are also other multiples which can be used like Enterprise value to Earnings before interest, tax, depreciation, and amortisation (EV/EBITDA) ratio, Price to Sales (P/S) ratio. It can be argued that there can be even sector specific multiples. For example, one can argue that it would make more sense to value a young growing social media company using a customised multiple like Number of users to Revenue ratio. This is because a young growth company could have negative earnings and hence an earnings multiple cannot be used. The second reason could be that most of the value of a young company is captured through future prospects and these prospects are directly related to the number of users in this case. Ratio chosen should reflect the underlying value drivers of the company. Therefore, it is important to understand the company, and it's value drivers while at the same time it is important to understand the industry in which company is operating so an

appropriate comparable group can be constructed. The comparable group should not only have similar broad characteristics like risk and return profile but sometimes also similar ratios like gross margin, net profit margin, return on equity, return on the asset to name a few.

Price multiple valuations are simple and easy to understand and implement, and for this reason, they are widely used in valuation industry. Relative valuation multiples models have two implied assumptions. Firstly, they assume that the target company will have similar future performance measure like net earnings, EBITDA, cash flow proportion as the comparable firms. Moreover, they also assume to have similar risk profile. Secondly, the performance measure is assumed to be proportional to the value. While choosing a multiple, one should understand that fundamental chosen indeed represents the underlying business driver and is value-relevant. The multiple chosen are comparable, and the comparable stock prices are close to their intrinsic values (Nissim, 2012).

While using multiples, one has the choice of using earnings or cash flows. Multiples can be forward-looking or backwards-looking, they can industry-based or market-based. Therefore, there are lots of choices available to analysts which they can use to their advantage in supporting price targets.

While using a multiple to value a company, an analyst makes certain assumptions implicitly. These assumptions are about risks, returns, leverage, profitability structure of the company. If using other valuation technique like DCF, analysts have to think about these assumptions explicitly. Because of this reason, applying a multiple based valuation can sometimes be dangerous. There are also other limitations for multiple based valuation, for example, PE, most widely used multiple, cannot be used when earnings are negative. Even the multiples which use Enterprise Value, which is defined as, the market value of equity plus the market

value of debt minus cash, can be difficult to use if the company holds lots of cash which can make enterprise value as negative.

Below is the full form of the abbreviations and a brief explanation of all the multiples cited in this study.

PE – Price Earnings Ratio is one of the most utilised valuation multiple. It is calculated as current market price per share divided by earnings per share. This valuation multiple, by definition, shows that how many times of its earnings a stock is trading.

EV/EBITDA – Enterprise value to Earnings before interest, tax, depreciation, and amortisation. Enterprise Value is defined as the market value of equity plus the market value of debt minus the cash and cash equivalents. Therefore, EV is considered as the theoretical purchase price of the company.

P/FCF – This is the ratio of current market price per share to free cash flow per share. This multiple is similar to PE multiple but focuses on cash generating ability instead of earnings. The inverse of this ratio is called FCF yield.

EV/Sales – This is the ratio of enterprise value to sales. Dividing EV by sales gives an indication of how much times it costs to purchase a company for one unit of its sales. This measure can also be used when earnings, as well as cash flows, are negative.

2.1.3 Sum-of-the-parts Valuation Model

Often it is seen in the research reports that analysts use sum-of-the-parts (SOTP) valuation to value the firm. This model is not a separate model per se; rather it is merely a method to add up the different operating segments of a firm where each operating segment is valued either by DCF method or multiples method as described above. As Damodaran (2009) concluded that companies operating across multiple businesses or across the globe are difficult to value and SOTP model is useful in case of larger companies who are operating in different business lines or different countries. For example, The Walt Disney Company operates in four business segments which are Parks and Resort, Studio Entertainment, Media Networks, and Consumer Products & Interactive Media. In this case, analysts might use either DCF based model or Multiples based model on each of the business segment and then sum it up to arrive at the value of the firm. He further said that the rationale behind using SOTP valuation techniques is fairly intuitive. This is because different business has different risk and return characteristics, different value drivers and hence different valuation model are suited to them. This concept of the suitability of valuation model to a specific industry is one of the main focus of this study and explained in detail in further sections. Similarly, as mentioned before, another use of SOTP valuation model is when company operating in different countries and it is not possible to use the same model in all the countries because of the reasons such as unavailability of comparable data, or different country risk premiums. In that case, each segment in a country can be valued by the valuation model most suited in that country and results from all the countries could be summed up.

2.2 Valuation Model Choice

In this section, there is a discussion around previous research findings on the choice of valuation model by analysts. A fair amount of research has been done in general or in specific areas like the choice of valuation model in different time period, in a particular industry or choice of valuation model for different purposes, for example, mergers and acquisition, management buyout, equity research.

DeAngelo (1990) provided evidence from his sample of management buyout that investment bankers extensively use accounting information as well as comparable stock market prices. 100% of the sample reports used accounting information as well as comparable stock market prices. 73% of the reports used comparable prices paid in similar types of acquisition. Only 23% of the reports used individual asset appraisal technique. He further provided evidence from his sample management buyout report from four major investment banks that all the investment bankers used comparable prices, comparable acquisition prices, and DCF techniques whereas none of them used direct asset appraisals.

Barker (1999) study examined the valuation practices of analysts and fund managers during July 1994 and May 1996. He used three complementary research methods – participant observation, questionnaires from 42 analysts and semi-structured interviews with finance directors, analysts, and fund managers. He concluded some interesting results. Firstly, the uncertainty, and hence the difficulty in forecasting forces the analysts to adopt a short-term horizon. This uncertainty means that the analyst's own assessment of the company's future prospect is at the heart of investment analysis. Secondly, he argued that analysts use accounting information to the extent that it is reliable and value-relevant. Finally, and most importantly, he found that models like dividend yield are used as the first screener and only

after that analyst incorporates both accounting and subjective information to feed into valuation models like DDM or DCF model. He emphasises that dividend yield and PE ratio are used extensively. Barker (1999b) used questionnaire and interview surveys with analysts and found that use of different valuation model is based on company sector. He found that PE ratio is used to value companies in sectors like consumer goods, industrial and services, whereas the use of dividend yield is dominant in utilities and financial services sector. DCF technique is used very rarely in all the sectors, but it is frequently used in the valuation of the utilities companies. This, however, leaves an important question as for why there is a difference in valuation techniques used in different sectors.

Block (1999) used questionnaire sent out to 900 members of the association for investment management and research (AIMR) and received 297 responses. He found that, in analysing a stock, only 15.2% of the respondent always used present value techniques whereas 45.2% never use present value techniques. And remaining said they sometimes use present value technique. This might be because of the uncertainty associated with forecasting cash flows. He also found that only 3 out of 297 respondents assigned the importance to dividends in the valuation of a security. This perhaps can be linked to Modigliani and Miller (1961) dividend irrelevance theorem.

Bradshaw (2002), based on a sample of 103 sell side equity analyst's reports, found that favourable recommendations are more likely to be justified by PE ratio while least favourable recommendations are likely to be justified with qualitative statements. He further found evidence which suggests that analysts compute target price using price multiple heuristics. One example of such a heuristic is PEG ratio which is price-earnings to growth ratio.

Demirakos et al. (2004) analysed valuation methodologies used in 104 analyst's reports for 26 large UK listed companies operating in beverages, electronics, and pharmaceuticals sector. They found that use of comparable valuation techniques like PE is higher in beverages sector. Secondly, analysts typically either use PE model or a DCF model as their dominant model. Another finding is that, although PE is a dominant model, some another form of model complements it. He further found that use of valuation model not only depends on the sector but also depends on the characteristics of the company being analysed. Characteristics analysed in their study are annualised sales growth, volatility of earnings, the ratio of R&D to sales, and the ratio of market value of equity to book value of equity.

Asquith et al. (2005) used a database constructed from 1126 analyst's reports issued by institutional investors during 1997-1999 covering 46 industries. The reports are analysed in entirety and results are in line with above findings. There are 56 unique analysts in their sample. They found that most analysts use simple earnings multiple valuation models. Only a few use net present value or other DCF techniques. 99.1% of the reports use some form of earnings multiple while only 12.8% use DCF or any of its variation. Interestingly, the use of DCF method is seen more in downgrade reports than in upgrade reports. It is also evidenced that 25.1% of the reports use asset based valuation models.

Glaum and Friedrich (2006) used interviews with a small sample size of 25 sell-side analysts to gain insights into analysis and valuation done by financial analysts who specialise in European telecommunication industry. They find that approach to valuation had changed from largely multiple based valuations at the end of the 1990s to DCF methods. They found that all 25 analysts use both DCF and multiples method but DCF is rated higher, and they use multiples method only to validate results from DCF method and not a standalone

technique. When asked about the importance of the techniques, 72% responded that DCF is more important techniques while 24% responded that multiples based valuation method is more important. Other methods like residual income and real options scored very low and almost had no practical use. These results contrast with above literature. This could mean that either it is more practical to use DCF methods in telecommunication industry or DCF based methods have gained popularity after tech bubble crisis of the 1990s.

Imam et al. (2008) concluded based on semi-structured interviews with 42 analysts and based on content analysis of 98 equity research reports for FTSE-100 companies that DCF method have become significantly more important especially after 2000 because of pressure from buy-side clients and because of the desire of analysts to incorporate more rational and sophisticated techniques. However, famous valuation multiples like PE ratio are still in use. These results are consistent with above findings from Glaum and Friedrich (2006). Previous findings from Demirakos et al. (2004) have also confirmed that industry factors are related to the application of DCF which is mostly adopted by analysts in high growth sectors. They also found that client's preference drives the choice of valuation techniques, for example, fund managers and buy-side analysts have a strong preference for DCF methods.

All these findings had suggested that while multiples based valuation models were widely used before the 2000s, DCF valuation have gain popularity amongst mainstream analysts. Therefore, the choice of valuation model can depend on time frame based on the market sentiments existing in that time. Another important point to note is that use of valuation method depends on the type of industry being analysed. This could be explained by the fact that it is difficult to forecasts cash flows in risky industries and hence use of price multiple will make life easier for analysts. And finally, analysts do not use a single valuation method

in isolation but use different methods. Analysts use a dominant model to value a stock and then do a cross check with another model (Demirakos et al., 2004). These findings form the basis of the hypotheses which are developed in chapter three.

2.3 Valuation Model Accuracy

Since this study focuses on valuation model choice and their accuracy, this section shed light on the previous research on the accuracy of the different valuation model. A fair amount of research has been done in this area as well in different regions, business lines and for different purposes. An underlying assumption here is that the price targets are the direct output of the valuation model used. Therefore, the accuracy of price targets can be considered as the accuracy of valuation model used while acknowledging that there are other factors which can affect accuracy.

Kim and Ritter (1999) examined the pricing of IPOs using multiples based valuation and found that the use of earnings forecast improves the accuracy of the valuations, specifically, PE multiple using forecasted earnings gave much more accurate results than what was produced by trailing PE multiples. They also found that the accuracy increased when valuing an older firm in comparison to the older firm. Another study by Liu, Nissim, and Thomas (2002) shows that forward-looking earnings multiples produce more accurate valuations than backwards-looking multiples.

Kaplan and Ruback (1995) investigated 51 highly leveraged transactions (HLT) and found that DCF valuation methods produced reliable market value estimates. Their median estimates were within 10% of the market values of the completed transactions and performed at least as well as other valuation approach using comparable multiples or comparable transactions.

Gilson et al. (2000) investigated 63 public firms who filed for chapter 11 of US bankruptcy code between 1984-1993 and found that both DCF and comparable companies valuation method provided unbiased estimates of value. However, valuation error range was very wide.

Berkman et al. (2000) arrived at the same conclusion, and he also used a similar methodology as Kaplan & Ruback (1995). Their result showed that the market-based DCF valuations and market-based PE multiples valuation yielded lower valuations errors than industry based and transaction comparable methods. The results are interesting as mostly industry based multiples are used because it is assumed that company in the same industry have similar risk and return characteristics.

Francis et al. (2000) compared the accuracy of DDM, DCF model and discounted abnormal earnings model. Their sample included a five-year forecast of nearly 3000 firms between 1989-1993 and results provided evidence that discounted abnormal earnings model valuations are more accurate than DDM or DCF model. Penman and Sougiannis (1998) had larger and more diversified sample, found similar results and concluded that discounted abnormal earnings model has significantly smaller prediction errors than DCF model and DDM.

As explained earlier, the process of arriving at target price is called valuation in which several factors play a role. Some of the factors that could affect valuation are assumptions of the analyst's and also valuation model used to arrive at the target price. Since analysts use a valuation model to arrive at target price, it can be argued that the performance of target prices regarding accuracy can be considered as the accuracy of the underlying model used in arriving those target prices. For this reason, below is the literature review of the accuracy of the price targets while acknowledging the fact that there are more factors which affect the accuracy of the price targets. These other factors are also equally important and are included in this study for testing the accuracy of valuation models.

Asquith et al. (2005) investigated 818 price targets in 1126 reports issued during 1997-1999. Their results showed that price targets are achieved in 54.3% of all cases. Bearish price targets achieved in 20 cases out of 22. These price targets were achieved over the period of following 12 months. Where price target was missed, it was at least 84% of the price target. This study also found that probability of achieving the target is negatively related to the magnitude of the price change. 0-10% projected price changed were achieved in 74.4% of cases whereas the projected change of 70% or more was achieved only in less than 25% of cases. Also, where target price was achieved, it exceeded the target price by an average of 37% during the 12 months. However, this study fails to observe any association between target price accuracy and the use of valuation method employed by an analyst.

Demirakos et al. (2010) investigated 490 equity research reports issued between 2002-2004 from international investment houses for 94 UK listed companies. They found that during the forecast horizon of 12 months, PE model outperforms DCF model in terms of accuracy. "However, after controlling for variables that capture the difficulty of the valuation task, the performance of the DCF model improves significantly in all specifications, and they outperform PE models." The control variables used in their study are risk which is measured by standard deviation of stock return, size which is measured by market capitalisation, boldness measured as absolute difference between target price and current price, sales growth, profit or loss as categorical variable, recommendation as categorical variable, number of peers in the industry, investment research house, and FTSE return in past and next 12 months. They found only recommendation, boldness and risk are significantly related to absolute forecast errors while FTSE next 12-months return, risk, boldness and recommendations are significantly related to forecast error of missed price targets.

Bonini et al. (2010) investigated 10,939 research reports issued during 2000-2006 for the companies listed on Milan Stock exchange. He found that target prices are met in only 33.12% of cases during any time of the forecasting horizon while only 20% of the cases met the target price at the end of forecast window. They also found statistically significant overshooting with an average of 22.26% for strong buys and 19.75% for strong sell. These results are different from the similar research by Bradshaw. Bradshaw et al. (2012) examined the overall accuracy of a very large sample of 492,647 price targets issued between 2000 and 2009. They found that analysts, on an average, overestimate the target prices by 15% with an absolute forecast error of 45%. Their results also suggested that on an average, target price forecasts are met 38% of the time at the end of following 12-months forecasting horizon while 64% of the targets are met during some time of the forecast horizon. They also found that target price performance is worse when the volatility of the stock is high, and target prices are usually met when there is positive price momentum for the firm and overall returns from the market are positive. Although results are different in absolute terms, both of the studies confirm that the accuracy of the price targets are low and there are significant overestimates in both the directions.

Kerl (2011) analysed the target price accuracy and the factors which influence the accuracy. The target price accuracy after 12 months is reported very high at 73.64%. He further finds that target price accuracy is negatively related with analyst-specific optimism and stock specific risk where risk is measured by volatility and price-to-book ratio. Furthermore, target price accuracy is positively related to the level of the detail of each report, company size and the reputation of the investment bank.

Gleason et al. (2013) investigated a large sample of 45,693 price targets issued by analysts during the year 1997-2003. They considered two valuation models – Residual income specification of the DCF approach and PEG ratio as a form of relative multiple valuation model. Their results suggested substantial improvement in price target quality when analysts used residual income model rather than PEG multiple. They further found that this quality of price target is most prevalent when analysts formulated accurate earnings forecast. The central message from their dataset is that investment returns value of price target decreased significantly when price targets are calculated using inferior earnings forecast and valuation heuristics like PEG ratio.

Asquith et al. (2005) found analyst optimism to be a factor behind target price accuracy. He found that analysts optimism reduces accuracy while Bonini et al. (2010) found analysts target price accuracy to be negatively correlated with research intensity contradicting the conventional learning curve intuition. They also found strong evidence that fundamental factors like the level of EPS consensus and the Price to book value ratio help in explaining accuracy. Demirakos et al. (2010) tried to study valuation model choice as a factor for target price accuracy. De Vincentiis (2010) investigated 8,157 research reports on 79 different companies by 30 different analysts issued during 2004-2007 and found analysts forecasting ability to be poor. Only 15.36% of the forecasts are accurate. This result is in some contrast with Bilinski et al. (2013) who argued that analysts exhibit differential forecasting ability. De Vincentiis (2010) further found that there is a positive but weak correlation between accuracy and firm-specific experience. This is consistent with learning curve logic and is contradictory to the findings of Bonini et al. (2010) as stated above.

Therefore, it is evident from above literature review that there has been fair amount of research on not only the accuracy of the price targets but also the factors such as analyst optimism (Asquith et al., 2005), research intensity (Bonini et al., 2010), valuation model choice (Demirakos et al., 2010), analyst themselves (Bilinski et al., 2013) which could affect the accuracy of price targets. There is no conclusive evidence on how accurate the target prices of analysts are and what drives the accuracy although it is argued that the limited accuracy is because of the limited skills of the analysts to forecast financial statement with accuracy and it is also argued that it could be because of lack of incentive to produce accurate target prices. However, there is no evidence of these arguments.

These wide varieties of views and inconclusive evidence have motivated this study to try making an attempt to find out the accuracy and the factors driving those price targets. However, this study is different in a way that the focus of this study is on finding the accuracy of valuation model as evident from the performance of the price target from the sell-side analyst's reports in UK TMT sector. The next chapter explains the research questions, research methodology, and data collection.

Chapter 3: Research Questions, Methodology and Data Collection

In this section, I have explained the main research questions and sub question which I intend to find out the answer from this study. In below reading, TMT is considered as one sector, however, when referring to a single component of this sector like technology, it is considered as an industry. Therefore, TMT sector consists of three industries.

3.1 Research Question One

What is the dominant valuation model in Technology, Media, and Telecommunication (TMT) sector? The motivation for the main research question comes from the fact that there are no studies which focus on the UK TMT sector. This study will add to the previous research on the UK market. Also, this particular question can help practitioners who wish to follow or work in TMT sector in understanding and finding the appropriate model to use.

There are also sub-questions -

A. It is seen by way of general observation that technology, media, and telecom companies are covered by one team of analysts, and they refer to it as TMT coverage. This makes sense because, in a broader perspective, all three industries are technology-driven and rely much on research and development. And one could argue that similar industries should be valued using similar techniques. For this reason, I expect that there will not be any statistically significant difference in the use of valuation model between the three industries. Therefore, the important question to answer is **if there is any significant difference in the use of valuation model between the industries in TMT sector?**

B. As seen in Figure 1 below, FTSE 100 index has behaved differently in 2014, 2015 and 2016. From the beginning of 2014 till the end, the index is seen as range bound ranging from 6718 to 6547 that is a change of only 2.5%. From the beginning of 2015 till the end, FTSE 100 dropped by 4.6%. 2016 have seen a spectacular bull run, and FTSE 100 rose 17% from 6093 in Jan 2016 to 7143 in Dec 2016. In 2017 markets further rose by 2.8%. Imam et al. (2008) showed in their research the difference in the use of valuation model across the different time period. Further, Demirakos et al. (2010) noted, "Analysts also appear to use PE (DCF) models in bull (bear) markets." Therefore, it becomes important to understand whether Analysts choice of valuation model is also affected by the condition of the market. Broadly, the below chart shows Bear market till 11 Feb 2016 and Bull market after that. Hence, the question here to answer is **if there is any significant difference in the use of valuation model between different time period?**

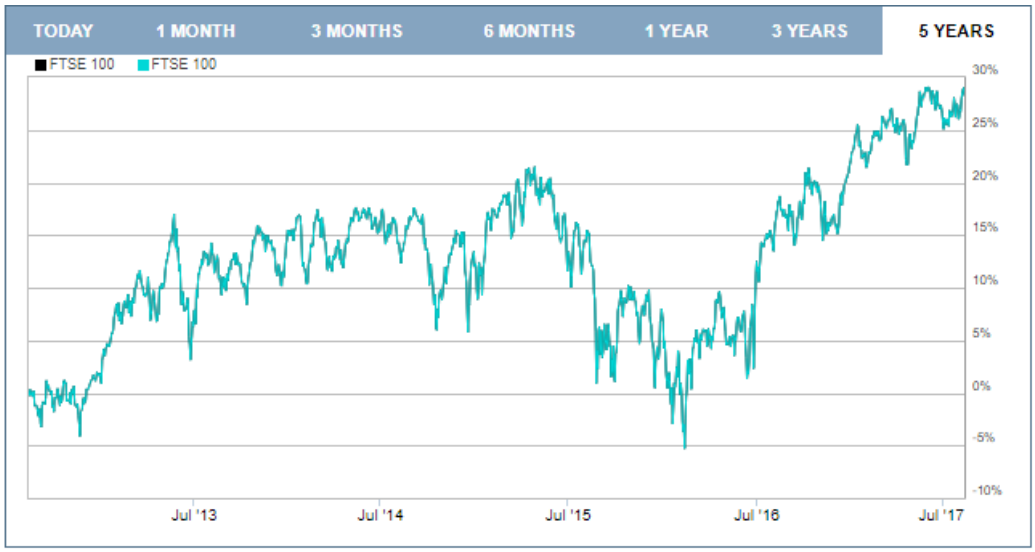

Figure 1 FTSE 100 Index for last five years, source: www.londonstockexchange.com

C. As noted before that the choice of valuation model could be affected by several factors such as industry, time frame. It becomes important to understand whether the valuation model choice is also dependent on investment house, perhaps, one investment house has a preferred method of valuation, and this could affect the findings. As Bilinski et al. (2013) note that analysts exhibit differential and persistent ability to forecast target prices accurately. Therefore, there could be a possibility that analysts have a preferred model for valuation. Hence the question here to answer is **if there is any statistically significant difference in the use of valuation model between different investment houses?**

3.1.1 Methodology

In analysing equity research reports, academics have used different methodologies. For example, Asquith (2005) and DeAngelo (1990) used content analysis. Penman (1998), Liu (2002), and Gleason (2013) used consensus data from some databases. Barker (1999), Block (1999) and Imam (2008) used surveys and feedback. Jones and Shoemaker (1994) cited in Breton and Taffler (2001) reference to many studies done using content analysis which shows that content analysis methodology has been widely used. Breton and Taffler (2001) further noted that "content analysis methodology is appropriate because of unobtrusive nature in analysing narratives prepared for other reasons and audiences and its ability to measure the implicit importance attributed to an information category by the report's author." For this study, content analysis methodology seems more appropriate and therefore is chosen. Another reason for choosing content analysis and not surveys is difficulty in getting access

to research analysts. The reason could be restrictions placed on analysts by their company because of the sensitive nature of the client's information they hold.

The procedure I have followed for content analysis is, first to identify the information which needs to be extracted from the research reports in order to answer the research question. I have read the reports manually without using any automated software and extracted information. For example, the information derived from the reports include report date, valuation model, recommendations, and price target. The information extracted is then tabulated in a spreadsheet, and different pivot tables are used to do a meaningful analysis. I have also used statistical techniques as described in detail in further sections. Since there are two different main questions I intend to answer from this study, therefore, different techniques have to be used for them. Following is the methodology used for first main question and its sub questions.

In order to answer the first main question as described previously, I have done a content analysis of 147 analysts reports. I have chosen to divide all the reports according to industry, i.e., technology, media and telecom and list down the valuation model used in each of the industry. This is because an analysis can be done about the dominant valuation model in each of the industry. In each of the report, I have extracted information on report date, target price and what valuation model analyst has used using steps described in the section titled "data collection." Once all the information is extracted, they are presented in tabular form, and descriptive statistics are used to analyse the dominant valuation model for each sector.

For answering the sub questions of the first main question, I also employ chi-square test of independence to check whether the use of valuation model is independent of the industry, time frame, and investment research house. Three hypotheses are developed for this testing.

H_0 = *Valuation model use is independent of the type of industry.*

H_1 = *Valuation model use is not independent of the type of industry.*

Another hypothesis testing to test valuation model independence for the time frame is:

H_0 = *Valuation model use is independent of the timeframe.*

H_1 = *Valuation model use is not independent of the timeframe.*

And finally, hypothesis testing to test valuation model independence for investment house is:

H_0 = *Valuation model use is independent of the investment research house.*

H_1 = *Valuation model use is not independent of the investment research house.*

Multivariate Analysis

While descriptive and univariate analysis are conducted on valuation model level, multivariate analysis is conducted on valuation method level (DCF & Multiples) because it was noted in descriptive results that most of the samples use either DCF or PE and samples from some of the multiples models are very less. I employ multivariate analysis by using binomial logistic regression technique. There are two reasons to apply multivariate analysis. Firstly, since there are many factors working simultaneously in choosing valuation model, therefore, one needs to control for all the variable at the same time and establish a relationship between valuation model choice and these variables. Secondly, I acknowledge that a perfect balanced sample might not be possible because of the reason explained further in data collection and hence I need to attribute the differences to both variables using multivariate regression.

I decided to choose binomial logistic regression. Regression techniques are used to establish a relationship between two variables, and binomial logistic model is used because it allows more than one independent variable, and also it allows a dependent variable to be dichotomous, i.e., it can take one of the two values. In this case, I have assigned the code 0 to DCF methods (including DCF based SOTP) and code 1 to Multiples methods (including multiples based SOTP). Independent variables are size, recommendation, number of pages in the report, market sentiments, analyst's optimism, investment research house and industry.

Size of the company as measured by the market capitalisation is another variable which could affect valuation model choice. It is a continuous variable. Market capitalisation is taken as on 31 July 2017.

Recommendations are also taken as an independent categorical variable which could affect valuation model choice. Buy recommendations takes the value of 1 while Hold and Sell take the value of 0 because hold is considered as a weak signal. Bradshaw (2002) noted that savvy investors interpret Hold as Sell.

Market sentiments as measured by the presence of Bull or Bear market. The bear market takes the value of 0 while Bull market takes the value of 1. As mentioned before, reports issued till 11 Feb 2016 are considered to be in Bear market and reports issued after that are considered in a Bull market.

Analyst's optimism is measured by the percentage increase from the current price to analyst's target price. This is a continuous variable.

Another independent variable is investment research house which again takes the value of either 0 or 1, the reason for taking investment house as a variable is because of evidence from

previous research by Bilinski et al. (2013) who argues that "analysts exhibit differential and persistent ability to forecast target prices accurately, which confirms that some analysts have superior TP forecasting ability."

Finally, I have also included industry as an independent variable as it is learned in the literature review that industry could affect the choice of a valuation model.

The regression equation formed by the above-defined model is:

$$Valuation\ Model = \beta_0 + \beta_j Size + \beta_k Recommendation + \beta_m Market\ Sentiment + \beta_n Optimism + \beta_o InvestmentHouse + \beta_p Industry$$

3.1.2 Data Collection

Since this research is focusing on the Technology, Media, and Telecommunication (TMT) sector in the UK, I started with an initial sample of 241 TMT companies listed on London Stock Exchange (LSE). The classification is taken as it is, according to how LSE classifies it. There are 74 Media companies, 148 Technology companies, and 19 telecommunication companies in the initial sample. Because of time limitation that this study has to be completed, I decided to take a sample of 30 companies. Ten from Media, ten from Technology and ten from Telecommunication. From the initial sample of 241 companies, I decided to take only top ten companies in terms of market capitalisation as they represent the market as described next. From top ten companies, I had to eliminate few more because of reasons which are discussed further in detail. The final sample consists of ten Media companies, eight Technology companies, and eight Telecommunication companies. This sample can be considered as representative of the market as top ten media companies represent 86.33% of the combined market capitalisation of all media companies. Top eight

Technology companies represent 86.94% of the combined market capitalisation of all technology companies. And top eight telecommunication represent 99% of the entire market capitalisation of telecommunication companies. The final sample of 26 companies represents 91.18% of the total market capitalisation of all TMT companies. These values of market capitalisation are taken at the end of the trading on 31st July 2017.

Since this study is focused on the dominant valuation model in TMT sector, differences in valuation model choice across the different time period, research houses and finally accuracy of the valuation model, therefore it becomes very important to draw an even sample. The best effort is made to draw the sample which is evenly spread across the industry, time period and investment house. One report is downloaded for each company for 2017, two from 2016, two from 2015 and one from 2014. These reports are spread evenly across different chosen investment house. Where there are multiple reports available in the chosen time period from same investment houses, reports which are downloaded are chosen at random. There are five investment houses chosen, and the reason for this is explained in next paragraph. This makes for six reports for one company and a total of 180 reports. After above-mentioned elimination, final sample includes 147 reports. The time frame taken for this study is from 1 May 2014 till 30 April 2017, i.e., a total of three years. This time frame is chosen for the study to find the recent trends and as explained previously, markets have somewhat behaved differently in that three-year period. However, this precisely is the reason that this time period is chosen and differences across different sentiments of the markets can be studied. Reports downloaded are spread across the year, usually within the gap of six months. Barber et al. (1999) show that the average time period between two recommendations is 200 days. Therefore, there is a gap of six months, and this also means that each report can be read

independently. The best effort has been made to download those report at an equal interval of time. This is to ensure that data analysed is spread evenly across the whole-time frame and therefore there is no effect of any particular event (such as Brexit in 2016) in the data.

There are numerous investment research houses which cover the research of listed securities in the UK. Five of the most famous names are chosen for this study namely – Barclays Bank, Credit Suisse, HSBC, JP Morgan Chase, and Morgan Stanley. As per the recent Extel survey of 2017, four out of these five investment houses are ranked in top 10 with respect to their equity research quality. Only Credit Suisse is ranked at number 13, but even that was ranked in top 10 in the previous year. Based on this data, one can argue that these investment research houses are some of the best in the industry. It will be interesting to find out the accuracy of the price targets issued by some of the best research houses in the industry. The best effort is made to download the report for each company from different investment houses, however, it is sometimes not possible for one of these reasons, i.e., either reports from one of the chosen investment house is not available for the required time period, or that investment house does not cover that particular company. Sometimes the report does not meet the initial selection criteria, i.e., any one of the required information is missing. The required information is report published date, target price, recommendation, and valuation model. Different research houses use different keywords for the recommendation, but for this study, all the recommendations are translated to Buy, Hold and Sell. Recommendations like overweight, outperform are considered as Buy. Equal-weight, Neutral is equivalent to Hold, while Underweight, underperform is Sell.

All the reports are downloaded from Thomson One database. Since this study focuses on accuracy of price targets of valuation model and valuation model choice, therefore while

choosing the report, only those reports are taken into the sample which has a price target, rating and valuation model stated.

Another reason for choosing top companies is the availability of the coverage by research houses. Reports for these companies are readily available in the database from different research houses. Even with top ten companies, I faced the problem of non-coverage by chosen investment houses. Therefore, I had to eliminate few more companies. Some companies got listed after the beginning period of this study, for those companies, the number of reports are less. These companies are – Sophos Group Plc – Listed on 26 June 2015, hence only five reports are downloaded from 2015 till 2017. Auto Trader – Listed on 24 March 2015. Hence only five reports are taken from 2015 till 2017. There is no data available for Micro Focus International Plc for 2017, and hence only five reports are chosen. Reports for Telecom Plus Plc are only covered by JP Morgan and that too starting December 2015, and hence only four reports are downloaded. Similarly, KCOM Group Plc is only covered by Barclays and JP Morgan but reports downloaded from JP Morgan did not have any price targets, and hence only Barclays reports are taken in the sample. Zegona Communications Plc is only covered by JP Morgan starting 2016, and hence only two reports are available which meets the criteria. There is no data available from none of the chosen investment houses for FDM Group Plc, Gamma Communication Plc, Cityfibre Infrastructure Holdings Plc and hence they are eliminated from the sample. Those companies which are listed after the said dates have to be eliminated as well; ALFA Financial Software is such company which got listed on 26 May 2017.

Valuation method extracted from the report is the one which is explicitly stated by the analysts in the report. Sometimes there are more than one models are used in the report, and

weight is assigned to each valuation model. Dominant model is considered if weight assigned to that model is more than 50%. If weight assigned is equal, then only one model (which is appearing more number of times in the report) is chosen to be consistent with the methodology of choosing one dominant model per report. However, it was very rare to see such a scenario in my sample that two equally weighted models are used at same time. Valuation method used is also stated at the bottom, in the disclosure part of the reports. Also, if there is no explicit mention of the model use then, those reports are eliminated as they do not meet the initial selection criteria of containing all required information. It is noted during the content analysis that almost every report gave reference to some form of multiples (PE, EV/EBITDA, P/FCF) in addition to the dominant valuation method which has driven price target. These mentions are not considered as the valuation model used in the reports as they are simply stated by analysts for quick comparison. They are derived after the fact. This means, once the target price has been derived using a model explicitly stated, that price target is converted to a reference multiple just for the comparison amongst the peers. Target price and recommendations data are extracted from the first page of the report.

3.2 Research Question Two

As seen in the literature review, target price accuracy has been a popular area of research, but there is no convincing evidence of how accurate analyst's price targets are, and what are the factors for accuracy. This study aims to make an attempt on finding the accuracy of valuation model and if certain variables drive the accuracy of valuation models. This could be helpful for investors if they can analyse the model used in the analyst's report and try to predict the accuracy of the price targets based on different variables. The second main question here is to find out **what is the target price accuracy of different valuation models in Technology, Media and Telecommunication sector?**

While a sub-question is to identify the relationship between accuracy of price targets and different variables such as valuation models, recommendation, number of pages in the report, market sentiments, and boldness.

3.2.1 Methodology

The methodology which I have adopted for answering this question is first to identify what qualifies as accurate. I have identified below six different definitions of accuracy. Then the price targets are tested for accuracy according to those six measures of accuracy. Once these accuracy measures are calculated, then the results are tabulated, and a descriptive analysis is done using pivot tables. Four similar measure of accuracy is also used by Demirakos et al. (2010), however, in this study, I employ six measures of accuracy. These six measures of accuracy are –

Achieved within forecasting horizon (AWFH) – This is the simplest and most relaxed measure of accuracy which measures if the target price is achieved anytime during the forecasting

horizon of 12 months. According to this measure, it does not matter if the price on the last day of forecasting horizon is higher or lower than the target price, however, once the target price has reached its target anytime during the 12 months, it is counted as one occurrence of the accuracy. This measures the accuracy in both the directions, i.e., if the target price estimated by analysts was higher than current price on the date of report, and if the target price estimated was lower than the current price on the date of the report. This measure of accuracy is based on the assumption that analysts believe that the stock has the ability to move to the estimated target anytime within 12 months. This measure by definition already includes another measure which is defined below.

Achieved at the end of forecasting horizon (AEFH) – This is a stricter measure of accuracy than the above one. All of the price targets which are considered as missed using AWFH has obviously missed AEFH as well. However, the opposite is not true because some of the price targets which are met using AWFH might not meet using AEFH. This measure whether the price at the end of the forecasting horizon is equal or better than the target price. If the target price was set higher than the price on the publishing date of the report and the price at the end of forecasting horizon is equal or greater than the target price, then it is counted as accurate. Also, if the target price was set lower than the price on the published date of the report and the price at the end of forecasting horizon is equal or lower than the target price, then it is counted as accurate. This measure of accuracy is based on the assumption that analysts believe that the price of the stock may move up and down but the stock is worth the target price in one-year time.

Total forecast error (TFE) – This measure the difference between the target price and the actual price at the end of the forecasting horizon as a percentage of the price at the end of

forecasting period. This is a total forecast error which means this is for both the cases where target price is met and where target price is not met. This measure of accuracy helps to understand the margin by which target price is missed. For example, if the target price is 900 and the end of period price is 1000 then TFE is 100/1000 or 10%. This measure takes the only absolute difference, so even if the end of period price is 800, TFE would still be 10% according to this measure. However, this should not affect the results because the aim of this variable is only to measure the difference. One can reasonably believe that it will be very rare to see total forecasting error as zero. However, the combined results should reveal interesting findings.

Forecasting error of achieved targets (FEAT) – This measure of accuracy is only for those price targets which are achieved. Therefore, it only includes all the price target which met the definition of some of the AEFH and all of the AWFH. This is measured by taking the absolute difference between the target price and the end of the period price and then divide it by the end of period price. This measure of accuracy is interesting because it will show by how much percentage the end of the period price was better than the target price of only achieved target prices. Also, it tries to answer that if an analyst achieves a price target, then on an average by how much they overshot it.

Forecasting error of missed targets (FEMT) – This measure of accuracy is only for those price targets which are not achieved. Therefore, if a target price has missed AWFH and thus by definition, it has obviously missed AEFH, then it is considered as missed for this definition. This is calculated as a percentage by taking the absolute difference between the target price and the end of the period price of only missed price target and then divide it by the end of the period price. For example, if the price on a published date is 900 and the target

price is 1000, and the end of the period price is 970, then the FEMT is 30/1000 or 3%. This measure of accuracy will shed light on the information such as if an analyst misses a price target, then on an average by how much percentage they miss it.

Near miss forecasting error (NMFE) – This measure of accuracy is only for those price targets which are missed using the definition of AWFH. It measures by how much percentage the target price was near to the stock price during forecasting horizon. It is calculated by taking the absolute difference between the target price and maximum price during the forecasting horizon for those price targets which were set higher than the current stock price (that time) and dividing by target price. And for those price targets which were set lower than the current stock price (that time), it is calculated by taking the absolute difference between the target price and minimum price during the forecasting horizon and dividing by target price. For example, if the price on a published date is 900 and target price is 1000, and during the forecasting horizon the price has reached a maximum of 960 then NMFE is equal to 40/1000 or 4%. This measure is interesting because it will reveal by how much percentage analyst are close to the actual prices.

Multivariate Analysis

While descriptive and univariate analysis are conducted on valuation model level, multivariate analysis is conducted on valuation method level (DCF & Multiples) because it was noted in descriptive results that most of the samples use either DCF or PE and samples from some of the multiples models are very less. As is the case with the question one, there might be an attribution problem here because of the presence of many variables and also because of unbalanced data. Therefore, to address these problems, I have decided to use multivariate analysis on the accuracy of the valuation model. Binomial logistic regression is

used again because of the presence of multiple variables and also because it allows independent variables to be a mix of categorical and continuous. For TFE, FEAT, and FEMT linear regression model is used since dependent variables are continuous.

For this regression, AWFH is taken as dependent variable which takes the value of 1 if the target price is achieved within 12 months, or in other words, valuation model appears to work accurately. If target price is not achieved within 12 months, then AWFH takes the value of 0. The same procedure is followed with AEFH regression. TFE, FEAT, and FEMT are continuous variables.

All the independent variables are already explained in the first research question. One additional variable here is the number of pages in the report which is explained below.

The number of pages in the report is another variable which could affect the target price accuracy. Although it might not seem intuitive, more number of pages means that analysts have given a comprehensive analysis. This comprehensive analysis can increase the analyst's understanding of the company, industry, value drivers and hence it will lead to better forecasts and better accuracy. Number of pages is a continuous variable.

Industry variable might not sound very intuitive, however, if there is any significant relationship found between accuracy and industry, it could mean that particular industry exhibits accuracy because it could be easier to forecasts drivers and hence easier to value.

Demirakos et al. (2010), Bradshaw et al. (2012), Kerl (2011) used a similar type of regression model, however, none of them includes number of pages in analyst's report. The regression equation formed by the above-defined model is:

$$Accuracy = \beta_0 + \beta_i ValModel + \beta_j Size + \beta_k Recommendation + \beta_l Pages +$$

$$\beta_m Market + \beta_n Optimism + \beta_o InvestmentHouse + \beta_p Industry$$

3.2.2 Data Collection

The data collected for this analysis is taken from the same data which is used in the previous question. However, there are some reports in the sample which are issued after August 2016 and hence the actual price data is not available for those. There are 49 such reports, and therefore, I have eliminated those samples and ended up with 98 price targets. The historical share price data is downloaded either from company's official website and if it was not downloadable, then other publicly available websites are used which are, http://uk.finance.yahoo.com and http://markets.ft.com. From this data, I have manually extracted the following information -

1. Maximum or minimum price during forecasting range depending upon the direction of target price
2. Price at the end of the forecasting horizon

The data which is taken for this analysis includes the date on which report is published, target price which is taken from the analyst's reports and historical share price from the date of the report till the end of the forecasting horizon for each price target. End of forecasting horizon date is taken as one year after the date of the report.

Using all this data, I am able to calculate all of the six accuracy measures which I have defined for this study.

Chapter 4: Results and Findings

4.1 Results, Findings, and Analysis for Question One

This section presents descriptive statistics, results, univariate analysis and multivariate analysis for research question one.

4.1.1 Descriptive Statistics

Table 1 below shows the descriptive statistics of the data collected arranged by industry. There is a total of 147 reports. There are 59 reports from media companies representing 40.14% of all the reports. 46 reports are from Technology companies representing 31.29% of the total sample. 42 reports are from telecommunication companies representing remaining 28.57% of all the reports. There are 26 companies in the final sample, out of which ten are from the media industry, eight from the technology industry and eight from the telecommunication industry. There are 2513 pages combined from all 147 reports. This is an average of approximately 17 pages of each report which shows that reports chosen are comprehensive. The average number of pages of the reports in the Media industry is 18.29, in the technology industry, it is 14.11, and in the telecommunication industry, it is 18.69. Analyst's recommendations are in line with expectations with 68 Buys representing 46.26% of all the recommendations, 58 Holds which is 39.46% of all the recommendations and not very surprisingly 21 Sell recommendations accounting for 14.28% of all the recommendations. Even though highest number of Sell recommendations are in the technology industry, one other interesting statistics to note that is the ratio of the number of reports to the number of Buy recommendation. The highest ratio (2.875) of Buy

recommendation is seen in technology industry while the lowest is seen in telecommunication industry (1.615). The ratio of the number of reports to the number of companies ranges from 5.25 to 5.90 which means there are at least 5 to 6 reports available from each company in each industry.

Table 1 – Descriptive Statistics - Industry

	# Reports	%	# Companies	# Pages	Mean Pages	Buy	Hold	Sell
Table 1 - Industry								
Media	59	40%	10	1079	18.29	26	28	5
Technology	46	31%	8	649	14.11	16	16	14
Telecommunications	42	29%	8	785	18.69	26	14	2
Total	147	100%	26	2513	17.10	68	58	21

The table reports descriptive statistics of the data collected arranged by three industries namely Technology, Media, and Telecom. In order, columns give: number of reports, % of the total reports, the number of companies represented in the sample, the total number of pages in the reports, average number of pages per report, and the number of buy, hold, sell recommendations.

Table 2 below shows the data collected arranged investment research houses. Lowest number of reports are from HSBC; this is because HSBC did not cover all the companies chosen in the sample. Highest is from Barclays representing 29% of all the reports. Except for HSBC, all other percentages are between 18% to 29% which shows that fair amount of reports from each investment house are taken in the sample. This is also evident by the ratio of the number of reports to the number of companies. Lowest ratio is 1.44 reports from Credit Suisse while the highest is 2.00 from Barclays. The mean number of pages also ranges from 11.50 by HSBC to 20.55 by Barclays which could mean that on an average, HSBC has shorter reports

while Barclays have lengthy comprehensive reports. Recommendations are evenly spread across all the investment houses.

Table 2 – Descriptive Statistics – Investment House

	# Reports	%	# Companies	# Pages	Mean Pages	Buy	Hold	Sell
Table 2 - Investment House								
HSBC	14	10%	8	161	11.50	7	7	0
Morgan Stanley	30	20%	20	527	17.57	13	14	3
JP Morgan	35	24%	21	642	18.34	19	12	4
Credit Suisse	26	18%	18	320	12.31	11	12	3
Barclays	42	29%	21	863	20.55	18	13	11
Total	147	100%		2513	17.10	68	58	21

The table reports descriptive statistics of the data collected arranged by investment research house, namely, HSBC, Morgan Stanley, JP Morgan, Credit Suisse, and Barclays. In order, columns give: number of reports, % of the total reports, the number of companies represented in the sample, the total number of pages in the reports, average number of pages per report, and the number of buy, hold, sell recommendations.

Table 3 below shows the statistics arranged by the time period. The ratio of the number of reports to the number of companies is ranging from 1 in 2014 and 2017 to 2 in 2015 and 2016. The data below confirm the initial selection criteria that one report is taken from 2017 and 2014 while two from 2016 and 2014. The mean number of pages from each year is also fairly constant which shows an equal amount of data is taken from each year.

Table 3 – Descriptive Statistics - Years

	# Reports	%	# Companies	# Pages	Mean Pages	Buy	Hold	Sell
Table 3 - Years								
2017	25	17%	25	378	15.12	7	12	6
2016	51	35%	26	851	16.69	23	20	8
2015	49	33%	25	933	19.04	24	19	6
2014	22	15%	22	351	15.95	14	7	1
Total	147	100%		2513	17.10	68	58	21

The table reports descriptive statistics of the data collected arranged by year from which data is collected. In order, columns give: number of reports, % of the total reports, the number of companies represented in the sample, the total number of pages in the reports, average number of pages per report, and the number of buy, hold, sell recommendations.

4.1.2 Results

What is the dominant valuation model in Technology, Media, and Telecommunication (TMT) sector?

Table 4 below shows the descriptive statistics of the different valuation model used from the sample analyst's reports. Overall, DCF model remains dominant across all the sectors which are used in 62 out of 147 cases or 42% of the times. If DCF based SOTP method is also counted under the same heading, then this figure jumps to 78 cases or 53% of the times. This finding is in line with previous research from Demirakos et al. (2004) which confirms that analysts use DCF or PE as a dominant model. This finding is also consistent with Glaum and Friedrich (2006) who found that 72% of their respondent said that DCF is more important.

Telecommunication industry reports almost always use some form of DCF, i.e., DCF or DCF based SOTP valuation. This is 36 times out of a sample of 42 or almost 86% of all the cases.

These findings again confirm the study of Glaum and Friedrich (2006) who interviewed 25 analysts from telecommunication industry and confirmed that all of the 25 analysts use DCF and multiples method but rate DCF higher. There is no other notable use of another model in this sample of telecommunication companies reports. DCF seems to be dominant valuation model in the telecommunication industry.

In the technology industry, the results are different. DCF model is used only in 5 cases out of 46 or 11% of the times. Dominant valuation model in the technology industry is price-to-earnings (PE) multiples based on below results. PE model is used in 30 cases out of 46 which is 65%. Multiples based model seems to more popular in the technology industry as they account for 89% of the cases. It can be argued that this is in some contrast with the previous study from Imam et al. (2008) who find that analysts are likely to employ DCF in a high-growth industry. One can argue that technology industry is a high-growth industry and results below confirm the use of multiples almost most of the time. One reason for this could be that there might be a trend shift in the recent times as this study is focused on samples taken from 2014 to 2017 while the study from Imam et al. (2008) published in 2008. Although chances are very remote since the sample is drawn randomly, one reason could be that sample drawn shows this behaviour randomly.

Media industry results also are in favour of DCF models. DCF model, including DCF based SOTP, accounts for 37 of the cases out of 59, or almost 63%. Multiples models are used in remaining 37% of the cases. Second most dominant model in the media industry is multiples based SOTP valuation models which are used in 25% of the cases while least used is EV/EBITDA which was used only in 1 case.

It is also noted that analysts sometimes use a second valuation model as a sanity check of the results from their dominant model. The use of second valuation model is spread evenly across all three industries. Use of second valuation model is seen in 48 cases, and 16 times out of those 48 cases EV/EBITDA is used.

One more interesting result to note that is the popularity of SOTP technique. Both DCF based and multiples based SOTP valuation models account for 35 cases out of 147 which accounts for 24% of the cases in the sample. It could be because SOTP technique has started gaining popularity recently.

Table 4 - Dominant Valuation Model - Industry

	DCF	DCF-SOTP	EV/EBITDA	EV/Sales	Multiples-SOTP	P/FCF	PE
Table 4 - Industry							
Media	35	2	1		15		6
%	*59%*	*3%*	*2%*		*25%*		*10%*
Technology	5		5	1	1	4	30
%	*11%*		*11%*	*2%*	*2%*	*9%*	*65%*
Telecommunications	22	14	1		3	2	
%	*52%*	*33%*	*2%*		*7%*	*5%*	
Total	62	16	7	1	19	6	36
%	*42%*	*11%*	*5%*	*1%*	*13%*	*4%*	*24%*

The table reports the frequency of the use of different valuation model as observed in the reports arranged by industry. % figure is calculated as the number of observed models divided by total number of model observed in that industry. In order, columns give: DCF, DCF based SOTP, EV/EBITDA, EV/Sales, Multiples based SOTP, P/FCF, PE.

Table 5 below shows the distribution of use of valuation model according to years. I have arranged years into two equal time period which is 2014-2015 and 2016-2017. The results confirm the same findings as previous one. The dominant model remains DCF which is used 39% of the time in 2014-15 and 45% time in 2016-17. PE remains second most dominant model which is used 27% of the time in 2014-15 and 22% of the time in 2016-17. This could mean that analysts use of valuation model does not take into account different conditions which might exist at different time frames rather their choice is affected by the industry.

Table 5 - Dominant Valuation Model - Years

	DCF	DCF-SOTP	EV/EBITDA	EV/Sales	Multiples-SOTP	P/FCF	PE
Table 5 - Years							
2014-2015	28	8	3		10	3	19
%	*39%*	*11%*	*4%*		*14%*	*4%*	*27%*
2016-2017	34	8	4	1	9	3	17
%	*45%*	*11%*	*5%*	*1%*	*12%*	*4%*	*22%*
Total	62	16	7	1	19	6	36
%	*42%*	*11%*	*5%*	*1%*	*13%*	*4%*	*24%*

The table reports the frequency of the use of different valuation model as observed in the reports arranged by the time period of the study divided into two equal time periods, 2014-2015 and 2016-2017. % figure is calculated as the number of observed models divided by the total number of models observed in that year. In order, columns give: DCF, DCF based SOTP, EV/EBITDA, EV/Sales, Multiples based SOTP, P/FCF, PE.

Results for Sub Questions

Is there any significant difference between the use of valuation model in above-mentioned industries?

Is there any significant difference between the use of valuation model in the different time period?

Is there any significant difference between the use of valuation model by different investment house?

4.1.3 Univariate Analysis

To test whether analyst's choice of valuation model is affected by industry, I employ univariate analysis by using chi-square test. I tested the frequency of the use of different valuation model across all three industries and found the chi-square test p-value as 0.000 which is less than 0.05, hence null hypothesis is rejected. Therefore, there the use of valuation model is not independent of the industry which is in line with above analysis. This is also consistent with the previous study from Barker (1999b) who finds that valuation models are chosen based on the sector in which company is operating. Demirakos et al. (2004) also did a similar study of 26 UK listed company and found the frequency of the use of different valuation model to be different in different sectors. Even though any of the previous research is not focused on TMT sector as a whole, the results are according to the expectations.

A similar test is employed to test whether valuation model use is independent of the time frame used in this study. I tested the frequency of the use of different valuation model across the above two identified time frames and found the chi -square test p value as 0.944 which is greater than 0.01. Therefore null hypothesis is accepted. Therefore, from the sample data collected in this study, it can be concluded that use of valuation model is independent of the time frame used in this study.

While collecting data, I have also recorded the investment house. Therefore, I decided to check whether the valuation model choice is dependent on investment research house. This should give interesting information because some of the investment house might have a preferred valuation model. And in my sample, some of the investment house are over-represented like Barclays with 42 reports while some are less frequent like Credit Suisse with 26 reports. I have not taken HSBC into this analysis since the number of reports are very less (only 14). Table 6 below shows the descriptive statistics of the investment research house. Dominant valuation model for Morgan Stanley and JP Morgan is DCF (including DCF based SOTP) utilised in 72% and 60% of their reports respectively, while Credit Suisse and Barclays use some form of multiples valuation model in 81% and 62% of the cases respectively. Single most dominant model for Credit Suisse is PE model used in 42% cases while for Barclays it is Multiples based SOTP used in 29% of their reports.

When these results were checked for chi-square test of independence, I got a chi-square p value of 0.0001 which is less than 0.05. Therefore, it can be concluded that based on the sample drawn, valuation model is dependent on the preference of the investment house. However, to attribute the differences, next step is to conduct the multivariate analysis.

Table 6 - Descriptive Statistics – Investment House Valuation Model use

	DCF	DCF-SOTP	EV/EBITDA	EV/Sales	Multiples-SOTP	P/FCF	PE
Table 6 - Investment House							
Morgan Stanley	21	2		1	1	1	4
%	*70%*	*7%*		*3%*	*3%*	*3%*	*13%*
JP Morgan	19	2	1		3		10
%	*54%*	*6%*	*3%*		*9%*		*29%*
Credit Suisse	5		3		2	5	11
%	*19%*		*12%*		*8%*	*19%*	*42%*
Barclays	10	6	3		12		11
%	*24%*	*14%*	*7%*		*29%*		*26%*
Total	55	10	7	1	18	6	36
%	*41%*	*8%*	*5%*	*1%*	*14%*	*5%*	*27%*

The table reports the frequency of the use of different valuation model as observed in the reports arranged by investment research house. % figure is calculated as the number of observed models divided by the total number of model observed in the report of that investment house. In order, columns give: DCF, DCF based SOTP, EV/EBITDA, EV/Sales, Multiples based SOTP, P/FCF, PE, and total. The difference in total is because HSBC has been left out of this analysis.

4.1.4 Multivariate Analysis

For the purpose of this analysis, I have run regression two times. Firstly, on only industry variable and the second time, on both industry, and investment house variable. This has allowed me to understand the impact of introducing investment research house to the regression model by observing Pseudo R-square.

Firstly, I have set telecom industry as a reference for comparison between industries for PE Model and run the binomial logistic regression on only industries. The reported Pseudo R-square is 33.5% which indicates that 33.5% of the variation in valuation models is explained by the type of industry. The odds ratio for the technology industry as reported below is 49.2 which means that if a sample belongs to technology industry than it is 49.2 times more likely to be multiples based model than if it belonged to telecom industry, and these results are significant for both technology and media industry with a p-value of less than 0.05. Hence, the industry does affect the choice of a valuation model.

Next step is to run a second regression with all the variables. The reported Pseudo R-square has increased to 50.9% which indicates that the regression model defined in methodology section is a better model because all the factors together explain 50.9% of the choice of the valuation model. The other result from this regression confirms the univariate analysis as multiples in the technology sector has the highest odd ratio. Credit Suisse is expected to apply multiples based model 63.564 times more than Morgan Stanley. The results of market sentiments, analyst's optimism and recommendations are not significant. These results are also consistent with univariate analysis as it was seen that JP Morgan had used DCF methods in 60% of all their cases and HSBC used DCF based methods in 92.8% of their cases. Also, market capitalisation is significant suggesting that analysts are more likely to employ multiples based models in bigger companies.

Therefore, multivariate analysis confirms the significant relationship between the choice of valuation model and factors like size of the company, type of the industry and investment house doing the research and the results are in agreement with univariate analysis.

Regression 1 – Valuation Method and Industries

Model[a]		Coefficient	p-value	Odds Ratio
Multiples based Model	Intercept	-1.792	.000	
	[Technology]	3.896	.000	49.200
	[Media]	1.199	.021	3.316
	[Telecom]	0[b]	.	.

a. The reference category is: .0, i.e. DCF Model

b. This parameter is set to zero because it is redundant.

Regression 2 – Valuation Method and other factors

Model[a]		Coefficient	p-value	Odds Ratio
Multiples based Models	Intercept	-5.921	.000	
	Capitalization	.000	.014	1.000
	Optimism	.021	.456	1.021
	[Sell/Hold]	-.443	.492	.642
	[Buy]	0[b]	.	.
	[Bear]	-.235	.675	.791
	[Bull]	0[b]	.	.
	[Barclays]	3.485	.000	32.626
	[Credit Suisse]	4.152	.000	63.564
	[HSBC]	.518	.700	1.679
	[JP Morgan]	1.281	.148	3.599
	[Morgan Stanley]	0[b]	.	.
	[Media]	2.746	.002	15.578
	[Technology]	5.936	.000	378.560
	[Telecom]	0[b]	.	.

a. The reference category is: .0, i.e. DCF Model

b. This parameter is set to zero because it is redundant.

4.2 Results, Findings, and Analysis for Question Two

This section presents descriptive statistics, results, univariate analysis and multivariate analysis for research question two.

4.2.1 Descriptive Statistics

Table 7 below shows some of the basic descriptive statistics of the data collected. There are 98 price targets from all 26 companies representing all three industries of TMT sector. 54% of the price targets are backed by either DCF or DCF based SOTP method while 45% of the price targets are based on any of the multiples described in this study. Therefore, price target data is evenly distributed and will be useful for testing accuracy of these valuation methods and further valuation models.

Table 7 – Descriptive Statistics – Valuation Method

	# Targets	%	# Companies	# Industry
Table 7 - Valuation Method				
DCF	53	54%	20	3
Multiples	45	46%	17	3
Total	98	100%	26	

The table reports descriptive statistics of the two valuation methods, DCF, and Multiples. In order, columns give: number of price targets, % as total price targets, number of companies represented in the sample, and the number of industries represented in the sample.

Table 8 further distribute these valuation methods into valuation model and represent the frequency of use. As it can be noted that samples for EV/EBITDA and P/FCF are very less, therefore, I acknowledge that a meaningful conclusion cannot be drawn from such a small sample size regarding these two valuation models.

Table 8 – Descriptive Statistics – Valuation Model

	# Targets	%
Table 8 - Valuation Model		
DCF	43	44%
DCF-SOTP	10	10%
EV/EBITDA	3	3%
Multiples-SOTP	13	13%
P/FCF	3	3%
PE	26	27%
Total	98	100%

The table reports descriptive statistics of the valuation models. In order, columns give: number of models observed, % of total number of models observed.

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4.2.2 Results

Result for Question – What is the target price accuracy of different valuation models in Technology, Media and Telecommunication sector?

Table 9 below shows different accuracy measures arranged by two main valuation techniques – DCF and Multiples. Overall there are 98 price targets out of which 59 price targets are achieved using AWFH measure which is 60.2% accuracy, while only 26 price targets are such which are already equal or better than the target price on the last day of forecasting horizon. AEFH is less accurate than AWFH, and it is consistent with the expectation. Average TFE is 22.9% which means that on an average, target prices were different by 22.9% of the stock prices on the last day of forecasting horizon. So, whether analysts achieved the target or not, they were still off by 22.9%. Another interesting finding is that average FEAT (16.25%) is less than the average FEMT (32.9%), this means if analysts have missed the target, they were more inaccurate than they would have been if they would have achieved

the target. Also, NMFE suggests that if analysts missed price target, on an average they were still off by at least 10.1% during the forecasting horizon.

Multiples based methods were used in 45 cases and out of which 28 are accurate according to AWFH, i.e., 62.2% accuracy against DCF methods which resulted only in 58.5% accuracy out of 53 cases. These results are interesting since it is seen from the previous chapter that DCF is a dominant model across all three industries yet it is now seen that DCF is not as accurate as multiples model. Similarly, AEFH shows the higher accuracy of 31.1% in multiples based models against 22.6% in DCF based models. All other accuracy measure of errors in Multiples are less than those of DCF with the exception of NMFE. Taking all the below information into account, it seems Multiples based valuations are more accurate than DCF based methods.

Table 9 – Accuracy – Valuation Methods

	DCF	Multiples	Total
Table 9 - Accuracy - Method			
AWFH	31	28	59
%	58.5%	62.2%	60.2%
AEFH	12	14	26
%	22.6%	31.1%	26.5%
Average TFE	25.1%	20.2%	22.9%
Median TFE	18.9%	16.1%	17.5%
Average FEAT	19.4%	12.7%	16.2%
Median FEAT	14.8%	8.3%	10.4%
Average FEMT	33.2%	32.6%	32.9%
Media FEMT	25.0%	33.9%	32.2%
Average NMFE	7.6%	13.3%	10.1%
Median NMFE	7.4%	11.0%	9.0%

The table reports the accuracy of the two valuation methods, DCF and Multiples based methods. In order, columns give: DCF, multiples, and total. Rows represent six measures of accuracy as defined earlier with mean and median values where applicable. AWFH and AEFH % is calculated as the number of accurate targets divided by total number of instances in which that method is used.

Now since the broad analysis is done, the next step is to drill down further to check the accuracy of valuation models using same six measures.

For this analysis results of EV/EBITDA and P/FCF models are not taken into account since the sample size is small, although they are shown below in the table. They are left from the analysis because the results will be misleading because of small sample size. For instance, as Table 10 shows that EV/EBITDA exhibits 100% accuracy in terms of AWFH, however,

there are just three samples, and there is a high probability that 100% accuracy is by chance considering other figures.

Table 10 below shows the six measures of accuracy arranged by different valuation models. Valuation models in the column are shown in order of frequency, i.e., DCF is used in more cases than PE and so on.

The results are somewhat mixed. According to AWFH, leaving EV/EBITDA and P/FCF aside, highest accuracy in seen in PE model followed by DCF based SOTP and standalone DCF and least accurate is Multiples based SOTP. The accuracy of PE model is 69.2% which is even higher than average of total accuracy of 60.2%. If accuracy is measured according to AEFH, Multiples based SOTP takes the lead with 30.8% accuracy while DCF based SOTP is lowest at 20%. PE is ranked second. However, there is no big difference in terms of percentage between PE and multiples based SOTP. Average TFE is again lowest in PE model while it is highest in multiples based SOTP representing that PE model has the lowest difference between the target price and actual price.

Average FEAT is lower than average FEMT in all the model again confirming that analysts are likely to be relatively more accurate if price target is achieved. PE model is again the most accurate with lowest average FEAT of 13.4% followed by multiples based SOTP and DCF while DCF based SOTP is least accurate according to this measure. Results are not very different using average FEMT which shows most accurate is DCF based SOTP with 30% error followed by PE at 31.2%. The difference is negligible and results till now are in favour of PE.

The results of average NMFE are intriguing. The most accurate models according to this measure are DCF and DCF based SOTP while least accurate is PE which is surprising considering PE model has been accurate in almost all of the other measure of accuracy. It could mean that DCF model has the potential to predict the accurate value of the stock in a forecasting horizon. However, this requires further research.

Table 10 – Accuracy – Valuation Models

	DCF	PE	Multiples-SOTP	DCF-SOTP	*EV/EBITDA*	*P/FCF*	Total
Table 10 - Accuracy – Model							
AWFH	25	18	5	6	*3*	*2*	59
%	58.1%	69.2%	38.5%	60.0%	*100.0%*	*66.7%*	60.2%
AEFH	10	7	4	2	*2*	*1*	26
%	23.3%	26.9%	30.8%	20.0%	*66.7%*	*33.3%*	26.5%
Average TFE	25.1%	18.9%	27.9%	25.3%	*8.2%*	*10.2%*	22.9%
Median TFE	17.9%	17.5%	29.7%	19.4%	*6.8%*	*6.7%*	17.5%
Average FEAT	18.8%	13.4%	15.7%	22.1%	*8.2%*	*5.2%*	16.2%
Median FEAT	13.7%	10.2%	8.6%	21.5%	*6.8%*	*5.2%*	10.4%
Average FEMT	33.9%	31.2%	35.6%	30.0%	*N/A*	*20.3%*	32.9%
Media FEMT	33.7%	34.2%	33.1%	17.0%	*N/A*	*20.3%*	32.2%
Average NMFE	7.7%	17.4%	10.8%	7.1%	*N/A*	*1.2%*	10.1%
Median NMFE	7.4%	13.3%	11.9%	7.2%	*N/A*	*1.2%*	9.0%

The table reports the accuracy of valuation models observed. In order, columns give: DCF, PE, multiples based SOTP, DCF based SOTP, EV/EBITDA, P/FCF, and total. Rows represent six measures of accuracy as defined earlier with mean and median values where applicable. AWFH and AEFH % is calculated as the number of accurate targets divided by total number of instances in which that model is used.

4.2.3 Multivariate Analysis

For this multivariate analysis, I have run binomial logistic regression by keeping AWFH as dependent variable and valuation model, market capitalisation, number of pages, analyst's optimism, recommendations, market sentiments, industry, and investment house as the independent variable. Below regression 3 shows the relationship between achieved accuracy (met price target) and variables mentioned above. The results are rather surprising with none of the variable showing significance except analyst's optimism which is negatively related to accuracy and is significant with a p-value of 0.004. This means that higher the difference between the target price and current stock price, the lower is the accuracy. This is consistent with the previous study from Kerl (2011) who found that analyst-specific optimism to be negatively related with accuracy. Only JP Morgan and Credit Suisse are significant and that too at 10% level. They are expected to meet price target 4.14 times and 6.57 times respectively than Morgan Stanley. The results are consistent with Demirakos et al. (2010) who found no significance between accuracy and valuation model or broker houses and found negative significance with optimism. The number of pages in the report are negatively related with accuracy and are significant at 10% level. This is contradictory to expectations as the higher number of pages in the reports should mean that analysts explain the price target more comprehensively which signify that analyst has more understanding of the company and therefore will be able to predict accurate target prices. Demirakos et al. (2010) found only two significant variables which can affect accuracy, the number of companies in the industry and one-year return after the report publishing date. The reported pseudo R-square is 23.2% which shows that 23.2% of the accuracy is explained by these chosen variables.

This calls for more research to understand which variables can predict the target price accuracy.

Similarly, AEFH is also regressed against above-mentioned variables. The results show that none of the variables are significant except the effect of two broker house on accuracy. Credit Suisse and JP Morgan are expected to achieve more stricter measure of accuracy than Morgan Stanley. Regression 4 below shows all the results.

Regression 3 – Accuracy (AWFH) and other factors

AWFH[a]		Coefficient	P-value	Odds Ratio
	Intercept	.864	.545	
	Capitalisation	.000	.522	1.000
	# of Pages	-.040	.063	.961
	Optimism	-.086	.004	.918
	[DCF Model]	.807	.293	2.242
	[Multiples Model]	0[b]	.	.
	[Sell/Hold]	.341	.534	1.406
	[Buy]	0[b]	.	.
Met	[Bear Market]	-.165	.776	.848
	[Bull Market]	0[b]	.	.
	[Barclays]	1.294	.098	3.648
	[Credit Suisse]	1.882	.070	6.569
	[HSBC]	.289	.767	1.335
	[JP Morgan]	1.421	.051	4.142
	[Morgan Stanley]	0[b]	.	.
	[Media]	-.052	.939	.950
	[Technology]	.629	.470	1.876
	[Telecom]	0[b]	.	.

a. The reference category is: .0.

b. This parameter is set to zero because it is redundant.

Regression 4 – Accuracy (AEFH) and other factors

AEFH[a]		Coefficient	P-value	Odds Ratio
Met	Intercept	-2.400	.145	
	Capitalisation	.000	.849	1.000
	# of Pages	.004	.866	1.004
	Optimism	-.030	.271	.970
	[DCF Model]	.194	.797	1.214
	[Multiples Model]	0[b]	.	.
	[Sell/Hold]	-.681	.255	.506
	[Buy]	0[b]	.	.
	[Bear Market]	-.538	.362	.584
	[Bull Market]	0[b]	.	.
	[Barclays]	1.955	.101	7.061
	[Credit Suisse]	3.326	.010	27.813
	[HSBC]	.946	.534	2.576
	[JP Morgan]	2.575	.024	13.136
	[Morgan Stanley]	0[b]	.	.
	[Media]	.376	.601	1.457
	[Technology]	.287	.745	1.332
	[Telecom]	0[b]	.	.

a. The reference category is: .0.

b. This parameter is set to zero because it is redundant.

For next measure of accuracy (TFE), a linear regression is used since TFE is a continuous variable. TFE is regressed against the same variable as above. Morgan Stanley and Telecom are kept as reference for this regression. Regression 5 shows results are as per expectations considering above regressions, they confirm the findings from Regression 3 and 4. Optimism is positively related with TFE which means forecasting errors are expected to increase with increased optimism. This is logical considering AWFH and AEFH are negatively related. Another result which is significant according to this regression is market sentiments. The

coefficient is negative which means that Bull market (Dummy variable 1) is expected to decrease TFE in comparison to Bear market (Dummy variable 0).

FEAT and FEMT are also regressed against same variables and none of the results are significant.

Regression 5 – Accuracy (TFE) and other factors

TFE	Coefficient	P-value
(Constant)	26.646	.002
Valuation Model	3.557	.538
Capitalization	-8.457E-005	.330
Recommendation	-6.705	.128
Pages	.013	.942
Market Sentiment	-8.812	.047
Optimism	.431	.018
Barclays	-3.747	.541
Credit Suisse	-11.281	.142
HSBC	5.697	.472
JP Morgan	1.334	.814
Media	-.876	.868
Technology	-9.002	.180

Dependent Variable: TFE (Total Forecasting Error)

Morgan Stanley and Telecom are kept as a reference.

4.3 Additional Analysis of Recommendations

The nature and amount of data collected have allowed me to do the further analysis on the recommendations issued. Table 11 below shows the descriptive statistics of the recommendations issued arranged by valuation technique (not valuation model). In below data, DCF includes SOTP which is driven by DCF and Multiples includes all the multiples previously noted in this study including multiples driven SOTP. As expected, number of Buy recommendations are more than any other. The reasons for more of Buy recommendations have been a subject of research. One of the reason could be the compensation of the analysts is connected with the revenue growth of the research arm of the investment bank. Another reason could be the motivation of analyst to keep a good relationship with the companies they are covering and hence issuing a favourable recommendation to the stock of that company.

In this sample, 78 observations (53.06%) used DCF methods in justifying target price while remaining 69 (46.94%) used some form of multiples to justify price target. Further, out of 68 Buy recommendations, 57% are backed by DCF techniques where as 76% of the Sell recommendations are backed by Multiples valuation techniques. Further analysis is done to check whether a recommendation is affected by the type of valuation technique used. I have run a chi-square test of independence and found chi-square p value of 0.0147. Therefore, at 1% significance level, one can conclude from below samples that recommendations are not affected by valuation techniques.

Table 11 Descriptive Statistics Recommendations – Valuation Method

	Buy	Hold	Sell	Total
Table 11 - Recommendations				
DCF	39	34	5	78
%	*57%*	*59%*	*24%*	
Multiples	29	24	16	69
%	*43%*	*41%*	*76%*	
Total	68	58	21	147

The table reports descriptive statistics of the recommendations in the sample arranged by two main valuation methods, DCF and Multiples based. In order, columns give: Buy, Hold, Sell recommendations and total. % is calculated as the number of observed recommendation divided by total number of that recommendation across both the methods.

Chapter 5: Conclusion

There has been an extensive amount of research on the dominant valuation model and the accuracy of the price targets of sell-side analysts. However, the literature on the dominant valuation model focusing on UK TMT (Technology, Media, and Industry) sector is not very widely discussed. Also, the accuracy of valuation models by directly linking their output from analyst's report is limited as most of the prior study focuses on the accuracy of the price target in general (Bonini et al., 2010, Gleason et al., 2013 and De Vincentiis 2010). Lin et al. (2016) find that institutional investors trades in the same direction as the target price changes. This means that there is a significant amount of money at stake and therefore the analyst's report becomes important and so does the valuation model and their accuracy.

The purpose of this study was to investigate dominant valuation model and their accuracy in UK TMT sector. This study has investigated the 147 sell-side analyst's reports issued during May 2014 to April 2017 from five top investment banks (as evidenced by Extel survey) covering 26 UK listed companies in TMT sector. The content analysis methodology has been used because of unobtrusive nature in analysing narratives prepared for other reasons and audiences and its ability to measure the implicit importance attributed to an information category by the report's author" (Breton and Taffler, 2001).

In terms of dominant valuation model, descriptive statistics, univariate analysis, and multivariate analysis have been used to find the dominant valuation model in TMT sector. Descriptive statistics showed that overall 42% of the reports used DCF model and 11% used DCF based SOTP model. Therefore, the results are from descriptive statistics are in favour

of DCF based models which account for 53% of the total reports. When looked at individual industries, in technology industry 89% of the reports used some form of multiples based models, mainly, PE Model which is used in 65% of the cases. Media industry used DCF based model in 62% of the cases while in telecommunication industry the use of DCF based models increases to 85%. A univariate analysis using chi-square test of independence further confirmed that there is a significant difference in the choice of valuation models between these three industries and also between the investment research houses. This study acknowledges that choice of valuation model depends on many factors as previous literature states, and a balanced sample could not be selected because of the reasons explained earlier, a multivariate analysis using binomial logistic regression is used to attribute the differences. The results from multivariate analysis confirm that after controlling for the factors, PE model has been dominant. It was also found out that preference of investment research house affects the choice of a valuation model.

For calculating target price accuracy, this study has employed six measures of accuracy as explained earlier. The sample for studying the price target accuracy was 98 sell-side analyst's reports. Descriptive statistics and multivariate analysis have been used for analysis. According to the most lenient measure of accuracy, AWFH, which means that price target is achieved anytime within forecasting horizon, overall 60.2% of the target prices were achieved. As per descriptive statistics, PE models showed the highest accuracy where price target achieved 69.2% of the time out of 26 cases. This is followed by DCF based SOTP with 60% accuracy and DCF with 58.1% accuracy. According to the second measure of accuracy, AEFH, which means that price target is at the achieved point or better at the end of forecasting horizon, Multiples based SOTP showed the highest accuracy of 30.8% of the

target price achieved and it is followed by PE model which exhibited accuracy in 26.9% of the cases. Overall, PE model seems to work most accurate. Multivariate analysis is done to analyse the relationship between accuracy and variables such as size, recommendations, number of pages, analyst's optimism, bull/bear market, valuation model, industry, and investment research house. This analysis also helped in controlling for the differences amongst all the variables. The results show that only analyst's optimism, which is defined as the difference between current stock price and target price, is negatively related to accuracy (AWFH). Number of pages in analyst's report is significant at 10% level and shows the negative relationship between accuracy and number of pages. For stricter version of accuracy, AEFH, only two research houses, Credit Suisse and JP Morgan are significant in achieving accuracy. The other two measure of accuracy FEAT and FEMT did not have any significant relationship with any of the variable studied.

There are limitations in this study. One of the limitation, as is with another similar type of studies, is that it was assumed that price targets are the direct product of valuation model. There could be scenarios where analysts use a proprietary model to arrive at the target price. However, they justify the price target in the public report using either DCF or Multiples based models. Therefore, future research should explore ways to eliminate this limitation. Another limitation is that the sample could not be selected in a balanced way as either the report was not available for a particular time period or a particular investment research house does not cover the company. This limitation can be solved by using multiple databases which require paid access. The third limitation of this study is the short time period taken, i.e., three years. It can be argued that this time period is too short for a trend. However, this study tried to justify the presence of three different market scenario in this time period. Fourthly, the

accuracy data is based on a relatively small sample of 98 reports. And Finally, there is an acknowledgement that there could be other factors which affect the target price accuracy and they are not taken into the equation in this study. As multivariate analysis showed that only two variables are significant predictor of accuracy, it becomes more evident that there should be other factors which are better in explaining accuracy. Hence, further study should explore some more factors to explain the accuracy.

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