An Analysis of the Valuation Practices in Sell-Side Equity Analyst Reports Regarding the Banking & Pharmaceutical Sectors in United Kingdom

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ABSTRACT

This study employs a structured, positive approach to investigating the choices of financial analysts for valuation models in their reports on firms drawn from the banking and pharmaceutical sectors in UK. It examines 141, sell-side analysts' equity reports issued by international brokerage houses, covering 9 banking and 15 pharmaceutical firms listed on the London Stock Exchange. It provides a descriptive analysis of the range of valuation models appearing in these reports and the factors that drive analysts' choices. It postulates and tests four, discrete hypotheses related to their preferences for specific valuation methods and the variations of these across the two sectors. The statistical analysis performed on these hypotheses leads to the following conclusions: firstly, valuation by single-period comparatives is more often in the banking than the pharmaceutical industry. The valuation models financial analysts most often adopt as dominant are the PE multiple and the multi-period DCF model. Analysts do not include dividends in the value-relevant features of banking firms they seek to predict and base their valuations on; the dividend yield along with the DDM and GGM models only seldom appear as dominant in analysts' banking reports. Finally, the different nature of assets comprising the firms of the two sectors does not seem to induce a variation in the methodologies analysts adopt when valuing them; it is their expertise as well as investors' familiarity with certain valuation models that appear to lead their choices instead. These findings shed additional light on the available knowledge on this topic area so far and constitute the basis for further and deeper research on analysts' valuation methodologies.

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About the Author

The author of this study has been employed for the past 4 years by a German multinational gypsum products industry as a financial analyst. In 2006 and 2007, she followed the MSc Programme in Finance of Manchester Business School, where she gained her degree with a merit. She has also gained a first-class Bachelor degree from the Accounting & Finance Department of the Athens University of Economics and Business in Greece in 2006 with a specialization in Finance. Her interests include the financial statement analysis and valuation of securities and these are reflected in the current study. This is the first study the author conducts but she is highly interested in continuing her research in this topic area in the future.

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Chapter 1
Introduction

The analysis of the content and usefulness of sell-side analysts' equity reports has occupied the minds of valuation theorists and investors for decades. Both base their interest in the belief that analysts' earnings forecasts, target prices and stock recommendations play a critical role in the formation of stock prices and prior literature has validated this belief. But it is not only these elements of analysts' reports that have attracted researchers' interest; the various valuation methods analysts employ in order to determine a firm's intrinsic value have also preyed on their minds and have been the subject of numerous studies. Analysts have at their disposal a large variety of models ranging from simple valuation multiples to explicit, multi-period techniques. While the former models appear to be favored by analysts in general, recent evidence suggests that the latter category of models appears to be constantly gaining ground.

As a continuation to earlier research on this topic area, this study examines the valuation models sell-side analysts employ in order to value firms from the banking and pharmaceutical sectors in the UK. The research undertaken is based on a structured, positive approach. This study intends to shed light on the value-relevant features on which analysts focus and the methodologies they finally adopt in order to determine the intrinsic value of the firms comprising the two sectors. Based on prior literature, four discrete hypotheses related to the frequency with which analysts adopt specific categories of models in the two sectors and the ways these models vary across the two industries are examined. The content analysis conducted includes reading thoroughly each sampled report, recording the frequency with which each model appears and conducting statistical analysis. A random sample of 141, sell-side analysts' equity reports regarding banking and pharmaceutical firms listed on the London Stock Exchange is investigated. The sample runs the period from June 2005 to December 2006.

The statistical analysis of the hypotheses leads to illuminating conclusions. First of all, single-period, comparatives is the most popular category of valuation techniques in the evaluation of both banking and pharmaceutical companies, with the price to earnings multiple (PE) ranking first in analysts' preferences. Nevertheless, whereas valuation by comparatives is also dominant in the majority of banking reports, analysts appear skeptical about using this category of techniques to assess the intrinsic value of pharmaceutical firms. Instead, they appear to prefer sophisticated, multi-period valuation methods and especially the discounted cash flow (DCF) model. Price-to-book value, sales multiples, accrual accounting, hybrid

models and real option style models are also used as dominant in a number of cases. However, no instance of use of the RIV model in any of the reports is recorded. The findings also suggest that despite the signaling role dividends are believed to play and the high and steady payout ratios that banking firms maintain, analysts valuing the specific industry hardly ever take dividends into consideration in their evaluations. Banking reports may often contain the use of the dividend yield model as a first approximation of a firm's intrinsic value but this model hardly ever plays a dominant role in their reports. Similarly, analysts preferring sophisticated, multi-period models to value banking firms rarely employ the dividend discount (DDM) or Gordon's growth model (GGM) in their reports and even more rarely constitute these models their dominant valuation methods. Finally, analysts appear to disregard the different nature of assets comprising the firms of the two sectors and the extent to which they can base their analysis on accounting information. Instead, they appear to rely on models that both themselves and investors are well acquainted and content with.

The remainder of this study proceeds as follows: section 2 reviews, compares and contrasts prior literature on this area. Section 3 discusses the methodology followed and the specific hypotheses set, whereas section 4 describes the data and sample collection and the scoring system adopted in the content analysis. Section 5 presents and discusses the findings of this study. Section 6 outlines the sensitivity analysis and section 7 denotes the limitations of this study. In section 8, the conclusions reached through this study and the suggestions for further research are discussed. Finally, the appendix cites an example of the statistical tests performed on the hypotheses.

Chapter 2
Prior Research

The theoretical properties and the application of the various valuation models that sell-side analysts employ in order to determine the intrinsic value of securities, has been the subject of substantial amount of research over the last few decades. Despite the plethora of these practices and the extensive research on this issue, no consensus has been reached on a universally applied model that produces accurate and indisputable results under all conditions whatsoever.

Copeland, Koller and Murrin (2000), Palepu, Healy and Bernard (2000) and Penman (2003) apparently stress on the superiority of explicit multi-period models over single-period valuation methods in their financial statement analysis textbooks. All of them refer to comparatives as oversimplified models that relative to the DCF and RIV methods can rarely produce accurate valuations. Copeland et al. (2000) generally promote the use of DCF and RIV models to which they refer to as Entity DCF and Economic Profit Models respectively in their book (p.131). They state that the two methods can produce identical results when properly applied but suggest that the DCF model is the most suitable instrument for defining the long-term value of a company as a firm's cash flows are the element that fundamentally defines its real value. Palepu et al. (2000) and Penman (2003) support also that the two methods produce identical results in certain occasions. Nevertheless, while Palepu et al. (2000) do not differentiate between the DCF and RIV model suggesting that the use of one approach over the other depends on the availability of the required data, Penman (2004) prefers the RIV over the DCF and DDM models. The author explicitly commends on the model's ability to appreciate the value of firms simply by replacing dividends with earnings and book values.

Penman and Sougiannis (1998) compare the DDM, DCF and accrual earnings techniques under finite-horizon valuations. They prove that the investigated methods are equivalent when forecasting to infinity, but certain problems arise when forecasting over finite horizons. On this condition, their results indicate that the accrual earnings techniques provide more accurate valuations than the DCF or DDM model. They also assert that the DDM model has certain problems in practice with DCF accounting for a popular substitute, but designate the limited empirical evaluation of these techniques despite their inherently superior characteristics. For the abovementioned reasons, they advocate the RIV model over the other two models.

Frankel and Lee (1998) add to Pennman and Sougiannis (1998) by assessing the efficiency of the RIV model in predicting cross-sectional stock returns in the USA. The authors estimate the intrinsic value of stocks based on the RIV model and evaluate the performance of a trading strategy based on stocks sorted according to their V/P ratio. Results suggest that the use of V/P proves superior to B/P ratio in predicting stock returns. Residual earnings are indeed found to explain the intrinsic value of stocks above and beyond book value. The authors come up also with a method for correcting predictable forecast errors. Although their approach is grounded on a simplistic implementation of the RIV model, Frankel and Lie (1998) suggest that further studies could be based on alternative earnings prediction models.

The evidence on valuation methods used in practice seems not to support the theoretical elegance of the multi-period valuation models whatsoever. In their study on the valuation accuracy of multiples, Lie and Lie (2002) state that despite the fact that valuation theorists emphasize on DCF, the model appears to be sensitive to the assumptions on which it is grounded and its application proves thus often cumbersome. This is the reason why investment bankers and analysts generally favor comparatives over the DCF models despite the fact that all of them generate results which are to some degree negatively biased. The main message to emerge from their study is, however, the fact that valuation multiples lack proficiency and generally produce less accurate results for companies rich in intangibles due to their inability to capture companies' value and growth prospects.

In a series of survey-based approaches performed on countries such as the UK, USA and Germany, the aversion of analysts towards sophisticated, multi-period methods is largely proven. Pike, Meerjnssen and Chadwick (1993) build on Arnold and Moizer (1984) by performing a two-country survey of the methods and the information used by investment analysts. The survey specifically examines the presence of any differences in the evaluation methods German and British analysts adopt, as well as their objectives and sources of information. Relative to Arnold and Moizer (1984), Pike et al. (1993) discover that the PE ratio constitutes the principal valuation method employed in fundamental analysis. Despite their theoretical superiority, alternatives to the PE multiple, the DCF model and beta analysis are of limited use. The authors, finally, foresee that the use of PE ratio will remain favored by analysts in the future.

A few years later, Barker (1999) comes to verify Pike et al.'s (1993) prophecy. He presents in his paper the summary of all previous research on the valuation methods employed by financial analysts and professional investors. He concludes that both make extensive use of the PE ratio and that DCF models, technical analysis and beta analysis only play a trivial role in their investment decisions. Likewise, in the survey Barker (1999) performs himself on UK, finance directors, analysts and fund managers, he reveals that all groups place the PE and the dividend yield models in the front rank of the models they use, whereas the DCF and DDM models rank last in their

preferences. Analysts maintain that the latter models depend overly on the assumptions on which they are based and therefore often yield dubious results. He generally concludes that formal valuation models appear to be rarely adopted as a means for the valuation of companies.

In a similar way, Block (1999) carries out a survey on the analytical methods financial analysts practically use. He selects as participants of the study members of the Association for Investment Management and Research (AIMR) in the USA. Consistent with Barker (1999), only half of the participants in his study claim to use PV techniques regularly. The author suggests that the selection of a suitable discount rate and the difficulties arising from the prediction of future cash flows might be two possible reasons for the limited use of PV analysis. Moreover, the answers the participants give to a number of questions imply that the dividend-paying policy of a firm is rather trivial in the analytical process they follow. He presumes, however, that this attitude may be just attributed to the environment tested.

The potential bias of the abovementioned survey studies, attributed to their being based on questionnaires and personal interviews, is of great importance. The subjectivity resulting from the low response rate and the limited samples may indeed affect the accuracy of the results. As reported by Schipper (1991), Rogers and Grant (1997) and Breton and Taffler (2001), interview-based research entails a lot of subjectivity problems, which can hardly be overcome. For this reason, several studies are instead based on a content analysis of analysts' equity research reports themselves.

Govindarajan (1980) performs a content analysis of US, security analysts' reports and assesses the weight they place on earnings and cash flow information. He performs the study a few years after the FASB tentatively acknowledges that the cash flows to the enterprise should be the dominant focus of the financial reports. The results suggest that analysts still focus on earnings rather on cash flow information despite the recommendations of the FASB. Likewise, Previts, Bricker, Robinson and Young (1994) examine the information needs of sell-side, financial analysts, by directly assessing the content of US, analysts' reports. The authors infer that analysts' recommendations rely extensively on earnings and performance related information rather than on accounting based information. Results also indicate that non-financial information related to company risks and concerns, anticipated changes, firm's competitiveness, strategy and management are of primary importance to analysts. The study does not, however, specify the information quoted by analysts for their recommendations, neither its sources.[1]

Rogers and Grant (1997) conduct a content analysis of US, sell-side analyst reports in order to detect the different types of information disclosed. In addition, they inspect the full text in order to discover the possible sources of

[1] For example: basic GAAP financial statements notes; management discussion and analysis (MD&A) and narrative sources such as the president's letter.

this information. Their study builds on Previts et al. (1994) by employing a sounder approach than the single-word searches. Evidence suggests that only 26 percent of the information quoted by analysts is provided by financial statements. Surprisingly, almost half of the information disclosed by analysts is irrelevant to the financial reporting process. Breton and Taffler (2001) perform also a content analysis examining the set of information utilized by UK, sell-side equity analysts in their stock recommendation decisions. In particular, they evaluate the relative importance of accounting versus non-financial information items. Along with Previts et al. (1994) and Rogers and Grant (1997), the authors conclude that accounting information is indeed of fundamental value to analysts. It is not, however, the only or the most important source of information. Non-financial information regarding the firm's management and strategy and its trading environment, is in fact of equal or even greater importance to analysts' recommendations.

In contrast to Govindarajan (1980), Previts, et al. (1994), Rogers and Grant (1997) and Breton and Taffler (2001) who explicitly focus on the general information needs of analysts and the disclosure of financial information, Bradshaw (2002) adopts a positive approach in order to identify how frequently US, sell-side analysts justify their stock recommendations by disclosing target prices. He documents that analysts' target prices are strongly based on earnings forecasts and projected, long-term earnings growth. Consistent with Previts et al. (1994) and Barker (1999), the results indicate that analysts indeed assess target prices making use of price-multiples, such as the price-earnings to growth (PEG). These heuristics appear, however, incapable of justifying the stock recommendations quoted in reports, where target prices are not disclosed. Moreover, Bradshaw (2002) finds that analysts' valuations grounded on PE models and expected growth are more likely to be employed in support of favorable recommendations, while qualitative analysis of firm's attributes, such as firm's management, is more likely to be used to back less favorable recommendations.

Demirakos, Strong and Walker (2004) extend Bradshaw (2002) by adopting a structured, positive approach and highlighting the particular valuation models that analysts employ. The authors perform a content analysis of UK, sell-side analysts' reports, testing specific hypotheses related to the variations of valuation models across three, different industrial sectors (beverages, electronics and pharmaceuticals). Evidence suggests that analysts appear to adapt their valuation styles to the attributes of the industry investigated.[2] PE models appear to be their dominant valuation tool; they do, however, appear to make use of DCF models or more detailed versions of price-to-sales multiples, growth options and profitability analysis, but only in certain cases. Results suggest that analysts only rarely apply the RIV model. Surprisingly, the authors indicate that although some analysts make use of multi-period valuation methods, they still employ comparative methods as their dominant techniques. They conclude that analysts' selection of valuation models is not only driven by the companies' attributes, but also from the degree to which

[2] Such as growth prospects and intangible assets

investors are pleased and familiar with these methods. The exclusion of reports of less than fifteen pages from the study may indeed introduce a bias to the study. The authors have, however, taken this into consideration in the paper's sensitivity analysis.

Bradshaw (2004) builds on Womack (1996) by examining the link between earnings forecasts and stock recommendations. The author examines the frequency with which analysts justify their stock recommendations with disclosure of target prices and the degree to which higher or lower target prices are associated with the favorableness of stock recommendations. He specifically focuses on four valuation models: two specifications of the RIV model, the price-earnings-to-growth (PEG) and the long-term earnings growth (LTG) model. Consistent with Bradshaw (2002) and Demirakos et al. (2004) and despite its theoretical elegance, evidence suggests that analysts' recommendations are hardly ever explained by either specification of the RIV model. In contrast, results imply that stock recommendations are explained by either of the two alternative valuation methods. The author does not, however, exclude the possibility that analysts make use of either the RIV or the DDM model in their analysis, despite the results of the study. Additionally, in contrast to Womack (1996) and Barber et al. (2001), Bradshaw (2004) indicates that investors are likely to disregard analysts' recommendations. This fact can be attributed, though, to the different methodologies used in the studies. In overall, the findings of the study are in line with many earlier papers on stock recommendations, such as those of Diefenbach (1972), Logue and Tuttle (1973) and Wright (1994); they clash, however, with those of other recent studies.

Asquith, Mikhail and Au (2005) examine the information content of sell-side, security analyst reports and the response of the market to the constituents of those reports. The authors build on previous studies by conducting an extensive analysis of US analyst reports in their whole entity, covering 46 industries.[3] Consistent with abovementioned studies, results indicate that analysts, in their majority, make use of simple earnings multiples, while net present value (NPV) or DCF approaches are used by only a few of them. Moreover, analysis suggests that price target revisions almost always reveal new information. Asquith et al. (2005) indicate that the market responds more eagerly to analysts' price target revisions than to a change in earnings forecasts of the same magnitude and that investors are found to pay extra attention to reports containing downgrades. Finally, they find that no correlation exists between the valuation models used by analysts and the response of the market to the issuance of a report or the realization of a particular target price.

While most of the earlier literature documents the extensive use of unsophisticated, single-period valuation tools, some of the contemporary studies highlight the switch of analysts to advanced, multi-period valuation

[3] Such as those of Bradshaw (2002), Brav and Lehavy (2003) and Bradshaw and Brown (2006).

methods. Glaum and Friedrich (2006) examine the analysis performed and the valuation methodologies adopted by analysts valuing the European Telecommunications companies right after the "high-tech bubble". Relative to Pike et al. (1993), Barker (1999) and Block (1999), the study is based on a series of interviews given by analysts. Surprisingly, results suggest that analysts, in their majority, appear to adopt the DCF model as their dominant valuation tool. Some of them still complement their results by the use of multiples, but only as a means for validating the results of the DCF model. Company representatives and financial statements of the companies appear to be the main sources of information financial analysts utilize. Finally, consistent with Previts (1994), Block (1999) and Demirakos et al. (2004), the authors observe that other than the valuation results alone, factors such as the quality of management and other analysts' opinion on the stock, contribute to the formation of analysts' stock recommendations as well. Whether the use of more sophisticated valuation tools has led to the generation of more accurate earnings forecasts and stock recommendations remains unanswered whatsoever.

Demirakos, Strong and Walker (2007) complement Demirakos et al. (2004) and Glaum and Friedrich (2006), by verifying their findings associated with analysts wisely adapting their valuation methodologies. The authors examine the various factors that affect the forecast accuracy of target prices set by investment analysts working for international brokerage houses in their equity research reports for UK-listed firms. The authors particularly focus on whether the valuation methods employed affect target price accuracy. They make use of four measures of accuracy and based on these contrast the accurateness of earnings multiples and DCF models. After controlling for variables that capture the complexity of the valuation process, Demirakos et al. (2007) find that the two models perform equally well, as tools of forecasting target prices, with DCF even outperforming earnings multiples in one of the cases. The most interesting finding of the paper, however, is that analysts appear to employ DCF models considerably more often than earnings multiples in difficult and challenging cases, such as those of valuing risky firms, small firms, loss-making firms, firms with a limited number of peers or firms with extreme negative or positive sales growth rates. Size, profitability and number of industry peers are found to play an important role in the valuation task.

Summarizing, an extensive amount of literature can be retrieved dealing with the reports sell-side analysts produce and the valuation practices they employ to assess firms' intrinsic value. While the inherent superiority of multi-period, sophisticated tools is advocated in financial texts, most of prior empirical evidence shows that analysts employ comparatives as their dominant valuation model in the majority of cases.[4] Recent literature seems, however, to bridge the gap between theoretical and practical valuation of the firms.[5] This study constitutes an attempt to extend Barker (1999), Block (1999) and

[4] Such as Copeland et al. (2000), Palepu et al. (2000) and Penman (2003)
[5] Such as Glaum and Friedrich (2006) and Demirakos et al. (2007)

Demirakos et al. (2004), by providing further evidence on the valuation methods used by analysts in the banking and pharmaceutical sectors in the UK nowadays.

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Chapter 3
Methodology and Empirical Hypotheses

3.1 Methodology

This study discusses the valuation models sell-side analysts employ in order to assess the real value of dissimilar firms. In order to identify the valuation tools analysts use, it examines the content of each report individually. It employs a structured content analysis, as this methodology is considered to be the most suitable for the analysis of context specific information.[6] Survey-based papers like Pike et al. (1993), Barker (1999) and Block (1999) suffer potential biases induced by limited samples, low response rates or even the fact that interviewees may not fully reveal information to researchers.[7] In contrast, content analysis can be claimed to be significantly more objective and impartial in the analysis of information included in sell-side analysts' reports.

Although content analysis is widely used in literature, it yields no uniform definition. A general definition given to it is that of "a research tool used to determine the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of which these are a part".[8]

Carney (1972) segregates content analysis into Classical and Theoretically Orientated but admits that most content analyses constitute a combination of these. Classical content analysis requires the use of computer programmes that document the frequency with which the words or concepts are met in the text. Theoretically orientated content analysis entails conducting the content analysis of the text manually, in order to identify specific words and concepts. On the other hand, Janis (1949) classifies content analysis into Pragmatical, Semantical and Sign-vehicle analysis. According to Pragmatical analysis, signs in the text are categorized according to their possible causes and effects, along with the frequency with which they appear in the text. Semantical analysis sorts signs according to their meanings, assessing, at the

[6] As suggested by Previts et al. (1994).
[7] As documented by Pike et al. (1993), Rogers and Grant (1997) and Breton and Taffler (2001).
[8] http://writing.colostate.edu/guides/research/content/. Accessed on 13/06/2007.

same time, the regularity with which they are mentioned in the text. Finally, Sign-vehicle analysis categorises the signs according to their psychological attributes, estimating how frequently they are met in the text.

As opposed to the approaches mentioned above, this study conducts only a limited content analysis of the reports of sell-side equity analysts, in order to identify the valuation tools used by them. It examines each report of sell-side, equity analysts individually and collects the inquired data (types of valuation methods) manually. It sorts valuation methods into categories and detects the frequency with which each valuation method appears in the reports.[9] Based on the models analysed in the financial textbooks, on the findings of this study and on prior comparable literature, such as Demirakos et al (2004), it is expected that analysts employ three different types of valuation methods: "unsophisticated", single-period comparatives, hybrid models and "sophisticated", multi-period models. Specific hypotheses are postulated relating to the valuation tools sell-side, equity analysts employ when valuing firms from the banking and pharmaceutical sectors in the UK. Finally, these hypotheses are statistically tested.

3.2 Industry Sectors Selection

Although most studies are conducted on a random sample of firms, there are a few that focus on firms with special attributes. Barker (1999) adopts a survey-based approach and examines the valuation practices used by finance directors, sell-side analysts and fund managers employed by firms and institutions in the UK. Block (1999), on the other hand, carries out a survey on the analytical methods members of the AIMR practically employ. Likewise, Demirakos et al. (2004), employ a structured, positive approach, analysing the valuation methods employed by analysts in search of the intrinsic value of firms in certain industry sectors in the UK. The present study constitutes an attempt to extend Barker (1999), Block (1999) and Demirakos et al. (2004) by examining firms from the banking and pharmaceutical sectors, listed on the London Stock Exchange (LSE) in 2005 and 2006. According to the official site of the London Stock exchange, 3,256 public companies were listed on the LSE at the end of 2006.[10] In terms of market capitalisation (£1,938.5 billion), the LSE ranks first in Europe and fourth in the world and is regarded as one of the most efficient stock markets in the world.[11] Some of the firms listed on it even rank among the largest in the world. Companies' stocks listed on the LSE are followed by investors globally.

The two sectors are deliberately selected in order to highlight the possible discrepancies identified in the valuation methods used by sell-side, equity analysts on their attempt to define the intrinsic value of firms comprising them. Similar to Demirakos et al. (2004), Table 2 presents the aggregate

[9] As Demirakos et al.(2004) do.
[10] www.londonstockexchange.com. Accessed on 15/06/2007.
[11] www.world-exchanges.com. Accessed on 14/07/2006.

characteristics of the two sectors and verifies thus their profound diversities. For each of the two sectors, the average and median range of annual sales growth, the volatility of earnings, the R&D to sales ratio and the market to book value ratio, as well as the dividend yield and the dividend payout ratio for 2005 and 2006 are tabulated. On one hand, the banking sector can be claimed to be a quite stable and balanced sector experiencing high but steady growth and minor volatility of earnings. Firms comprising this sector are mainly comprised of tangible assets and follow a steady and generous dividend policy. On the other hand, the pharmaceutical sector can be claimed to be a relatively unstable and risky sector experiencing unsteady and uneven growth and volatile earnings. It generally consists of firms, relatively smaller than those comprising the former sector, which are rich in intangibles that are difficult to value. The discrepancies Table 2 reveals between the average and median values of all the estimates regarding this sector is also indicative of the lack of homogeneity among the pharmaceutical firms. Palepu, Healy, Bernard and Peek (2007, 490) report that the pharmaceutical sector is identified among those sectors that deliver a median dividend payout ratio of zero percent and this coincides with the results reported in Table 2 with regards to the average, annual dividend yield and payout ratio of these firms. The two abovementioned sectors differ significantly in their proportion of value on the LSE as well. The banking sector constitutes the dominant sector of the exchange, while the pharmaceutical sector, along with biotechnology, is only recorded among the fairly profitable sectors of the exchange. The December 2006 Trading Summary of the official LSE website reports that the banking sector is worth approximately £35.23 billion. The pharmaceutical sector is, in contrast, reported to be worth of only £15.23 billion. The Thomson One Banker database, reports that among the top ten listed firms on the LSE in 2006, three are banks and two are pharmaceutical companies. Table 1 displays these top ten firms listed on the LSE at the end of 2006, five of which are included in the companies investigated in this study.

Table 1. Top Ten Firms Listed on the London Stock Exchange in 2006

This table presents the top ten firms listed on the London Stock Exchange in December 2006 rated by their Market Capitalisation. This data is recovered from the December 2006 Trading Summary of the official LSE website. 5* of these firms are included in the sample of firms.

	Companies	Market Capitalisation (MC) in million £
1.	HSBC Holdings*	10,650,016.517
2.	BP	9,903,965.792
3.	VODAFONE GROUP	9,305,594.378
4.	GLAXOSMITHKLINE*	6,980,750.298
5.	ROYAL BANK OF SCOTLAND*	6,756,049.358
6.	ASTRAZENECA*	6,526,623.454
7.	BARCLAYS*	6,135,474.094
8.	RIO TINTO	5,395,943.583
9.	BHP BILLITON	4,713,312.226
10.	ANGLO AMERICAN	3,967,808.269

Table 2. Aggregate Characteristics of the Banking and Pharmaceutical Sectors

This table presents the aggregate characteristics of the sectors investigated. The data concerns the firms that comprised the banking and pharmaceutical sectors of the LSE in 2005 and 2006. The data is sourced from DataStream Database.

Sector	Annual Sales Growth (%)		Volatility of Earnings (%)		R&D/Sales (%)		MTBV		Dividend Yield (%)		Dividend Payout Ratio (%)	
	'05	'06	'05	'06	'05	'06	'05	'06	'05	'06	'05	'06
Bank.	17.27 (19.51)	19.11 (18.78)	0.12 (0.12)	0.11 (0.12)	- -	- -	1.95 (1.92)	1.94 (1.91)	4.26 (4.35)	4.10 (4.25)	52.80 (51.80)	52.40 (56.10)
Pharm.	1.18 (0.00)	12.37 (6.54)	1.22 (0.18)	2.80 (0.18)	115.09 (24.06)	334.51 (16.18)	5.13 (2.86)	5.30 (3.64)	0.87 (0.00)	1.26 (0.00)	8.98 (0.00)	16.90 (0.00)

Annual sales growth = the average, annual sales growth of each firm (cross-firm median sales growth);
Volatility of earnings = mean annual change in earnings divided by average annual sales (cross-firm median value);
R&D/Sales = average annual R&D expenses divided by average annual sales (cross-firm median value). No data was available regarding the annual R&D expenses for the banking sector; It is presumed, however, that an established and stable sector like this most probably dedicates trivial amounts to this kind of expenses;
MTBV = average market to book value of equity of each firm (cross-firm median value);
Dividend Yield = the average dividend yield of each firm (cross-firm median value);
Dividend Payout Ratio = the average dividend payout ratio of each firm (cross-firm median value).

3.3 Hypotheses

In order to examine the valuation practices used by sell-side equity analysts, a structured, positive approach is adopted. For this purpose four, discrete hypotheses related to the valuation tools analysts employ in specific cases are developed and which are tested individually through the outlined methodology. This study extends Demirakos et al. (2004) by adopting this kind of approach. It differs from their study, however, by examining the banking and pharmaceutical sectors in the UK.[12] Additionally, the study builds on Barker (1999) and Block (1999) by investigating the role of dividends and dividend-based models in the evaluation of banking firms.

The first hypothesis under examination is related to the selection between single-period comparatives and explicit, multi-period models. Despite the fact that financial textbooks extol "sophisticated", multi-period models and recommend using them over "unsophisticated", single-period models, the abovementioned empirical literature reveals the gap between theory and practice. Evidence suggests that the use of comparative valuation methods by financial analysts is extensive, with the PE method being their principle valuation tool. Survey-based studies such as those of Pike et al. (1993) and Barker (1999) as well as studies based on content analysis such as those of Bradshaw (2002) and Demirakos et al. (2004), document that the PE multiple ranks first among the valuation tools analysts employ due to its simplicity and cost effectiveness and despite its technical shortcomings.

The single-period, comparative techniques target at determining the intrinsic value of a firm by comparing benchmark multiples of companies with similar fundamentals. The PE model, in particular, is grounded on the comparison of firms from the same industry, facing the same level of risk and experiencing equal earnings growth. When these assumptions prove to be robust, this method yields accurate results equivalent to those generated by sophisticated, multi-period models. Lie and Lie (2002) suggest that relative models generally produce biased valuations and are incapable of capturing firms' growth prospects, when these are mostly comprised of intangibles. Moreover, according to Demirakos et al. (2004), the PE multiple can be successfully applied only among firms that are supposed to grow at a similar, steady pace, have equivalent costs of capital, accounting methods and capital structures and generate transitory earnings that are easily identifiable and excluded from the analysis. A further limitation of this technique is related to the fact that it cannot be applied in cases where firms report losses.

Based on the evidence recording the popularity of comparatives, the arguments of Demirakos et al. (2004) and Lie and Lie (2002), the limitations of the PE model and the results provided in Table 2 regarding the characteristics

[12] Although Demirakos et al. (2004) examine the pharmaceutical sector as well, this study differs from theirs by comparing it with a different sector and examining a different period.

of each sector, it is presumed that the use of single-period comparatives might prove more effective in the banking than the pharmaceutical sector. The former sector seems to meet the conditions set by Demirakos et al. (2004) for the successful use of the models, whereas the latter does not. The firms comprising the banking industry experience uniform and steady growth, they hardly ever report losses and are rich in tangibles. The pharmaceutical sector comprises, however, firms with volatile earnings and intangible assets and seems inappropriate for the use of single-period comparatives. This leads to the first hypothesis:

Hypothesis 1. Financial analysts more often use single-period comparatives to assess the intrinsic value of firms from the banking than the pharmaceutical sector.

The second hypothesis draws on the first and on Barker's (1999) findings with regards to the use of the dividend yield model by analysts. Barker (1999) summarizes in his article the views and valuation practices of analysts and fund managers employed by specific firms in UK. Results suggest that both groups classify the dividend yield as the second most important valuation tool after the PE model. As opposed to what would be expected, both groups characterise the dividend discount model (DDM) as the least important valuation method. Despite the fact that the dividend yield constitutes a naïve simplification of the DDM model, exploiting the least information that can be integrated in the DDM, the former is far more favoured by both analysts and fund managers. They all appreciate the ease of use of the dividend yield and the potential it offers for simple and direct comparison of firms, without the need to make any assumptions. This is in line with the perception of dividends as an indication of the value of the firm and as a means of signalling this value to investors but contradicts the advocated superiority of the DDM over the dividend yield model.[13]

This hypothesis relies on the evidence provided by Barker (1999) on the popularity of comparatives and especially the use of the dividend yield model and the fact that firms comprising the banking sector are considered rather stable and deliver steady and generous dividends. Analysts valuing these firms are, therefore, expected to utilise this information in the assessment of their intrinsic value. Hypothesis 2 investigates whether analysts employing comparatives to value firms from the banking sector use a dividend-based, comparative as their main valuation model. To the author's knowledge, nobody so far has looked into the topic that Barker (1999) initiated. Results will provide further insight into his findings and will constitute the basis for further research. Based on the aforementioned points, the derivation of the second hypothesis is as follows:

Hypothesis 2. Analysts using comparables to value firms from the banking sector will employ the dividend yield as their main valuation model.

[13] As suggested first by Miller and Modigliani (1961)

The third hypothesis postulated builds on Barker (1999) and Block (1999) and seeks to provide evidence on the significance financial analysts covering banking firms place on dividends and the ways and extent to which they utilise dividend-based, "sophisticated", multi-period models. One of the questions Barker (1999) sets to financial analysts and fund managers taking part in his survey concerns the way they incorporate dividend information in the valuation procedure. Surprisingly, both groups agree on the use of a two-part DDM model, which bears little resemblance to the common DDM model. Instead of forecasting the perpetual value of dividends and the cost of capital, as required by the original model, both groups appear to utilise the dividend yield tool to construct a substitute for the DDM model. This consists of the estimation of the anticipated dividend yields in a two-year horizon plus the estimation of future yields, taking into consideration factors such as the future growth and level of risk of the analysed company. Financial analysts and fund managers appear to appreciate the astuteness of the original model but realise the limitations imposed on its use, due to the nature and the lack of information required. Instead, they appear to combine the available information with personal judgement into a model that resembles the original DDM model but has, in essence, little in common with it.

Block (1999) proves through the questionnaires posed to AIMR members that the dividend policy of the analysed firms hardly ever enters the analytical process they follow in the evaluation of these firms. Surprisingly enough, only 3 out of 297 respondents include dividends among the most critical inputs in the determination of a firm's intrinsic value. The author attributes this attitude of participants to three possible reasons. One of them has to do with the ambiguity the dividends theory of Modigliani and Miller (1961) has been met ever since postulated. Another possible explanation Block (1999) gives is grounded on the high taxation of dividends and the low profits that investors eventually realise. The most possible rationale the author gives, however, is the tendency of firms to buy back shares instead of delivering dividends nowadays.

Although a considerable number of papers can be retrieved in support of the use of single-period, comparative valuation methods, like those documented by Barker (1999), recent literature seems to provide evidence in support of "sophisticated", multi-period valuation tools. Bradshaw (2004, 27) suggests in his study that despite prior literature hardly ever documents the presence of multi-period models, such as the RIV or the DDM models in analysts' reports, this does not exclude the possibility that analysts indeed make use of these models, or some form of them, in their analysis. More recently, Glaum and Friedrich (2006) document the switch of financial analysts towards the use of advanced valuation methods such as the DCF model. The study focuses on the valuation techniques employed by analysts valuing the Telecommunications sector, right after the "high-tech bubble" took place. They suggest that analysts are not confident with the use of simple comparatives anymore; they still apply these methods, but only as

complementary tools. Likewise, Demirakos et al. (2007) document the ability of financial analysts to wisely adjust their valuation methodology to the attributes of the firm they analyse. Similar to Glaum and Friedrich (2006), they suggest that analysts still make use of earnings multiples; in challenging cases, however, such as those of small firms, risky firms or in other difficult cases, they appear to employ the DCF model significantly more frequently than earnings multiples.

The aforementioned arguments can also be combined with the status of the stock exchange inspected in this study. The size of the LSE and its status as one of the largest stock exchanges in the world speak for its global importance and the number of people following its listed stocks worldwide. Sell-side, analysts' equity reports covering popular stocks like those listed on the LSE are under incessant scrutiny. Analysts covering these stocks are expected to justify their estimations and recommendations attentively and accurately, making use of reliable valuation methods. On the other hand, people wishing to invest in these stocks expect to be supplied with reliable information and highly professional analyses and they are expected to fully conceive and comprehend the use of advanced valuation models. Taking into account all of these factors, as well as the considerably high and steady payout ratios that banking firms maintain (Table 2) and the signalling role the dividends are believed to play, it is expected that a certain number of analysts following banking firms listed on the LSE will conduct an analysis based on dividend-related, multi-period valuation methods and more specifically on the DDM or Gordon's Growth Model (GGM). In contrast to Barker (1999) and Block (1999), it is anticipated that analysts willing to incur the cost and time of sophisticated analysis, explicitly use dividend-based, multi-period valuation techniques such as the DDM or GGM models, but in their original, full form. This hypothesis seeks to shed light on the degree of importance analysts place on dividends and the ways they integrate them in their analysis, when this consists of "sophisticated", multi-period valuation tools. Based on these arguments Hypothesis 3 is obtained:

Hypothesis 3. Analysts employing multi-period valuation models to evaluate firms from the banking sector will use the DDM or GGM as their predominant valuation model.

The last hypothesis under consideration builds on the findings of Demirakos et al. (2004). It seeks to verify their results on analysts adjusting their valuation methodology to the attributes of the analysed firms and the data available. More specifically, it investigates the conditions under which analysts choose methods based on accrual accounting over methods based on cash flows. The two sectors under investigation are apparently dissimilar. Their major discrepancy lies in the structure of the firms comprising them. The banking sector consists of firms rich in tangible assets, whereas firms in the pharmaceutical sector are mostly comprised of intangibles. This fact induces variation in the valuation methods under which an accurate estimation of their intrinsic value can be made.

Demirakos et al. (2004) suggest that when selecting between the RIV and DCF models, analysts assess a number of factors. They consider which method they are best acquainted with and which method their clients are most content with, as well as the degree to which available data can be used effectively in the evaluation. Financial textbooks suggest that despite the different inputs their application requires, the RIV and DCF models can theoretically generate identical valuations. But while the former is a quite fresh model that has only recently gained recognition from valuation theorists, the latter is already a rather established method widely taught and promoted in financial journals and textbooks. Among a number of researchers, Lev (2001) highlights the fact that accounting is fairly reliable in the evaluation of tangibles but proves weak in capturing the real value of intangible assets; it can thus be inferred that RIV and accrual-accounting-based models are ineffective in valuing firms such as those comprising the pharmaceutical sector but their estimations can successfully reflect the value of steady firms such as those of the banking sector. Copeland et al. (2001, 73) proclaim that "cash is king" and recommend the use of the DCF model in the case of all firms. They admit, however, that an advantageous attribute of the RIV model is that it quantifies the ability of a firm to produce returns higher than the cost of capital. They imply, in this way, that applying the RIV and other hybrid models based on accrual accounting is probably most effective in cases where accounting can successfully encapsulate the essence of a company.
Drawing evidence from the figures reported in Table 2 for the two sectors and the abovementioned arguments, it is expected that pharmaceutical firms can be identified in the category of firms whose intangibles are their prominent characteristic, whereas banking firms can be identified as their reverse counterpart. It is anticipated, consequently, that compared to accrual-accounting-based, multi-period or hybrid models, analysts will more often be comfortable and confident with the application of cash-flow-based, multi-period or hybrid models in pharmaceutical rather than banking reports. This results in the fourth Hypothesis:

Hypothesis 4. Compared to accrual accounting-based multi-period or hybrid models, sell-side equity analysts apply cash-flow-based multi-period or hybrid models more often in the pharmaceutical than in the banking sector.

Chapter 4
Data Collection, Sample Selection and Scoring System

4.1 Data Collection

The data consists of a random sample of sell-side, analysts' equity reports produced by international investment firms concerning banking and pharmaceutical companies listed on the London Stock Exchange. The list of firms comprising the banking and pharmaceutical sectors is sourced from the official site of the London Stock Exchange.[14] The company data is collected from the Investext Plus database. The particular database provides full access to original reports and forecasts for companies all over the world.[15] The range and reliability of data that it provides and its ease of use, makes Investext Plus very popular among investment banks as well as among consulting and law firms. The reports provided are classified in four categories as company, industry, geographical and topical reports and are generated by the most prominent investment banks, brokerage firms and trade associations in the world. The Database provides data from more than 500 investment banks and 190 trade associations and enables access to three information collections: Investment Research, Trade Association Research and FIS/Mergent.

4.2 Sample Selection

This study examines sell-side analysts' equity reports issued by several investment houses from the period June 2005 to December 2006. These reports are on both large and smaller firms drawn from the banking and pharmaceutical sectors of the London Stock Exchange. The sample selection is mainly random. Certain choices are, however, made in order to avoid possible biases. The Investext Plus database includes reports of different lengths. Most of the very brief reports constitute earnings or recommendation revisions, lacking any analysis. In order to ensure that the sample consists of reports that can provide clear evidence on the hypotheses tested, really small reports, which do not exceed a four-page-length, are excluded from the sample. Moreover, in order to avoid including in the sample more than one reports of the same brokerage house published in one year, only the most recent report published by a brokerage house in this year is included. When

[14] www.londonstockexchange.com. Accessed on 18/06/07
[15] http://www.galegroup.com. Accessed on 17/06/2007.

this report falls in the category of samples excluded due to length limitations, the report issued immediately before the last one is taken into account.

The sample comprises reports issued by various investment houses so that the result of the analysis remains impartial. At the same time, it is required, if possible, that the investment houses taken into consideration cover firms from both sectors, so that variation of valuation methods is attributed to the discrepancies between the two sectors and not to the methodology each investment house follows. Additionally, it is ensured that the number of investment houses covering each sector is held approximately equal.

Of the reports meeting the conditions set above, a total of 141 sell-side analysts' equity reports issued by 20 different investment houses is selected. The reports are picked so as a reasonable number of banking and pharmaceutical firms is included in the sample. 75 reports covering the former and 66 reports covering the latter sector are examined. In total, the selected reports refer to 9 and 15 of the total of companies comprising the banking and pharmaceutical sector respectively. The banking reports investigated are produced by 15 different brokerages, whereas the pharmaceutical reports investigated are produced by 17 different brokerages. As mentioned in section 3.2, five of these companies belong to the top ten listed firms (rated by their Market Capitalisation) in UK in December 2006. Table 3 displays summary statistics of the companies and reports investigated. The length of the reports varies from 5 to 92 pages, while the median length is 11 pages for both sectors. The average number of reports per sell-side brokerage house is 5.00 and 3.88 for the former and the latter sector respectively and the average number of reports investigated is 8.33 pages per each banking and 4.16 per each pharmaceutical firm. It is also presented in this table the average page-length per report containing a valuation by either single-period comparatives or multi-period models. This data is used in the sensitivity analysis undertaken.

4.3 Scoring System

Similar to Demirakos et al. (2004), a structured, positive approach is employed. This involves studying each report individually in order to identify the valuation methods used by sell-side, equity analysts in the evaluation of firms and placing the results into categories. As suggested by Breton and Taffler (2001), who apply a similar scoring approach, greatest importance is placed on the main text of the reports. Only information disclosed in it is considered valuable. Each report takes the score of 1 for each valuation method used and mentioned in the text. Valuation methods that are not discussed in the narrative of the report are not taken into consideration. Nor valuation practices included in tables and charts are scoped unless documentation on these can be found in the main text.

The principal criterion for describing a valuation method as predominant is that this roughly coincides with the stock price recommendation the analyst gives in the report. If a report applies only one method, this is considered as the main method used and gets assigned a score of 1. Where analysts employ more than one valuation tools, the valuation section of the report is firstly examined in order to spot which method the analyst favours. The executive summary of the report, placed on the first page, is also checked in order to see whether any model is particularly emphasized. If no lucid opinion can be formed on the preferred valuation method, the discrepancies between analyst's various price estimations and the quoted target price are assessed. The model whose result most closely approximates the target price is characterized as the dominant model of the report. In cases, however, where analysts do not disclose a target price and valuation methods yield no specific value estimates, other criteria are employed. The amount of space the analysis of each valuation method occupies is assessed and the one with the largest space allocated to it is distinguished as the dominant valuation method.[16] Where only one model is identified as dominant, this is given the score of 1. Where two models are identified jointly as dominant valuation models used in the report, each receives a score of 0.5.

Table 4 reports the valuation perspectives and models located in the analysed reports along with their definitions. Analysts employ three categories of valuation models: single-period comparatives, hybrid models and sophisticated, multi-period valuation models. Price or value multiples fall in the first category of valuation models, real option pricing techniques and value creation indicators in the second and explicit discounted cash flow, residual income valuation, dividend discount model, Gordon's growth model and LEFAC in the third category of valuation models.[17]

[16] I take into consideration the shortcomings of this criterion in the sensitivity analysis section.
[17] LEFAC is the three-year model that analysts working for ING Barings Limited exclusively use.

Table 3. Summary Statistics of the Sampled Reports

This table presents the statistical characteristics of the sample of reports. It mainly goes through the variables that Demirakos et al. (2004, 227) examine. It also includes, however, summary statistics with regards to the average page-length that the analysis of the two most popular categories of models takes up in the sampled reports.

Sector	Number of Reports	TNPg	ANPg	MdVPg	ANRp/SSB	ANRp/F	ANPgVSC	ANPgVM
Banking	75	1,180	15.77	12	5.00	8.33	13.33	18.89
			(5 – 84)		(1 – 10)	(6 – 10)	(5 – 84)	(5 – 53)
Pharm/cal	66	983	14.88	10	3.88	4.16	15.82	14.26
			(5 – 92)		(1 – 10)	(1 – 10)	(5 – 92)	(5 – 60)
Total	141	2,163	15.32	11	4.44	6.24	14.57	16.57

TNPg = total number of pages of the reports investigated;
ANPg = average number of pages per report (range of pages per report);
MdVPg = median value of pages per report;
ANRp/SSB = average number of reports per sell-side brokerage house (range of reports per sell-side brokerage house);
ANRp/F = average number of reports per each sampled firm (range of reports per firm);
ANPgVSC = average number of pages per report containing a valuation by single-period comparatives (range of pages per report containing a valuation by single-period comparatives);
ANPgVM = average number of pages per report containing a valuation by sophisticated, multi-period techniques (range of pages per report containing a valuation by sophisticated, multi-period techniques).

Table 4. Definitions of Valuation Models for Scoring System

This table provides the definitions of valuation perspectives and models located in 141, sell-side analysts' equity reports valuing firms from the banking and pharmaceutical sectors of the LSE. These are essentially grounded on those contained in Demirakos et al. (2004, 228).

Categories of Valuation Models	
	Definition
1. Single-period Comparatives	
Earnings multiples (E)	Under this sub-category fall the following techniques: price to earnings (PE), enterprise value to earnings before interest, taxes, depreciation and amortization (EV/EBITDA), enterprise value to earnings before interest and taxes (EV/EBIT), PEG ratio (PE divided by earnings' growth rate).
Sales multiples (S)	This sub-category includes prise to sales (P/S) and enterprise value to sales (EV/S) ratios.
Price-to-book Value (BV)	Stock price to book value per share ratio. (This model is scored only when analysed distinctly).
Price-to-assets (A)	Stock price to asset value ratio.
Price-to-cash flow (CF)	Price to cash flow ratio.
Enterprise value to R&D (R&D)	Enterprise value to R&D expenditure ratio.
Warranted Equity Valuation (WEV)	WEV assesses the target price to book ratio utilising growth, ROE and cost of equity.
Dividend Yield (DY)	Dividend yield method.
2.Hybrid	
Accounting rates of return (ARR)	This sub-category includes the Return on equity (ROE) and Return on invested capital (ROIC) ratios. These techniques are scored only when analysts use these for the determination of a firm's intrinsic value and not when they use them as indicators of economic profitability.
Cash Recovery Rates (CRR)	This includes the standard cash recovery rate (CRR) and the cash flow return on investment (CFROI™).
Economic value added (EVA)	The return spread multiplied by the book value of a firm's assets. EVA focuses on the estimation of value creation and not on the measurement of value.
Continuing value (Cont. V.)	The capitalised value of a firm's net operating profit (using as a discount factor the weighted cost of capital) minus its current debt.
Technology value (Tech. V.)	The market value of a firm minus cash plus debt, compared to similar firms (used in the evaluation of pharmaceutical/biotechnology stocks).
Options-Pr	Real option style models and simple probability weighted net present value models.

3. Multi-period	
Discounted Cash Flow (DCF)	The present value of a firm's future cash flows.
Residual Income Valuation (RIV)	The value of a firm expressed as its current book value of equity plus the present value of future residual earnings.
Dividend Discount Model (DDM)	The value of a firm's stock expressed as the present value of its predicted, future dividends.
Gordon's Growth Model (GGM)	The value of a firm's stock expressed as the present value of its predicted, infinite, future dividends that are supposed to grow at a constant rate forever.
Liquidity, Earnings quality, Franchise, Asset quality and Capital adequacy model (LEFAC)	This method is used exclusively by ING Barings Limited and roughly involves the forecast of earnings and dividends per share for the next three years, the estimation of target price for each of these years based on the forecasts made and the discount of this price to the present minus the cost of carrying the shares to the end of the period.

Chapter 5
Results of Testable Hypotheses and Main Findings

5.1 Descriptive Analysis

Table 5 presents the selection of valuation models sell-side analysts utilise in their reports regarding the banking and pharmaceutical sectors in UK. A thorough record of the models encountered in each report is provided so that a direct comparison can be made between the models used in each case. The table illustrates the fact that analysts employ a wide range of valuation methods when assessing firms from both sectors. Demirakos et al. (2004) report in their study that analysts employ roughly 16 different models on their attempt to value firms from the beverage, pharmaceutical and electronics industries in the UK. In this study, it is found that analysts employ 19 different models, 13 of which they apply in the evaluation of the banking sector and 11 of which they apply in the evaluation of the pharmaceutical sector.

The content analysis of the sampled reports shows that the majority (106 reports or 75.2 percent) of them refer to a comparative valuation method. Only 4 (5.3 percent) banking reports include no reference to relative techniques, but focus instead on hybrid models. From the 31 (47 percent) pharmaceutical reports that do not contain a valuation by relative models, 19 focus on multi-period models, 10 focus on hybrid and 2 on a combination of these categories of techniques. Table 5 highlights the fact that most (68.8 percent) of the reports comprising the sample include some form of earnings multiple. In 37 (56.1 percent) pharmaceutical and only 7 (9.3 percent) banking reports exists, however, no valuation by this kind of multiple. Four of these banking reports explicitly refer to hybrid models and three to price-to-book value. Nineteen of the pharmaceutical reports focus on the DCF model, ten on hybrid models, four on sales multiples, two on a combination of hybrid and DCF models, two on a combination of hybrid models and sales multiples and one on a combination of the DCF model with a sales multiple.

The figures in Table 5 suggest that while the use of single-period valuation multiples relying on earnings are common practice among sell-side analysts valuing banking firms, their application is not that frequent in the evaluation process of pharmaceutical firms, though still distinctly often. These numbers also indicate that multi-period valuation models are quite popular in both sectors but especially in the pharmaceutical sector. These results generally provide support to Pike et al. (1993), Barker (1999) and Bradshaw (2002)

regarding the extensive use of earnings multiples but similar to Demirakos et al. (2004), they also highlight the fact that the application of comparatives may differ considerably from industry to industry. At first glance, the results also seem to support Barker (1999) and Block suggesting that the dividend yield ranks highly in the preferences of analysts valuing banking firms. In contrast to Barker (1999), however, but in line with Demirakos et al. (2007), these figures suggest that analysts rely considerably often on sophisticated valuation models and particularly on the DCF model. Finally, in line with Demirakos et al. (2004), the use of cash-flow-related hybrid and multi-period models rather than accrual accounting-based hybrid and multi-period techniques seems more prevalent among the pharmaceuticals than among the banking reports. All of these inferences need however to be statistically tested in order to be validated

Table 6 presents the dominant valuation models analysts employ in order to evaluate the sampling firms. The scoring system described in section 4.3, according to which a valuation model is considered as dominant if stated so in the narrative, is thoroughly followed. Where this is not clearly indicated, it is considered as dominant the valuation model that most closely tracks the target price set by the analyst in the report. Table 6 shows that the earnings multiples rank first among the principal valuation methods contained in reports from the banking sector, being closely followed by the DCF model. 22 (29.3 percent) reports contain a valuation by comparatives and 19 (25.3 percent) by the DCF model. The third most popular technique used in banking reports is the price to book value ratio (17.3 percent). The dividend yield appears as dominant in only two reports combined with the use of the PE multiple. On the other hand, in the pharmaceutical sector analysts appear to slightly prefer the DCF model over earnings multiples. The table shows that analysts employ as dominant the former and the latter models in 26.5 (40.1 percent) and 22 (33.3 percent) reports respectively. Valuation by accrual, hybrid models is dominant in 7 (9.6 percent) banking reports, whereas real option pricing and other hybrid models appear as dominant in 11 (16.7 percent) pharmaceutical reports. With regards to the widespread use of valuation multiples and the different degree to which they are used across industries, these findings complement Demirakos et al. (2004). The results relating to the considerable use of the DCF model are also in line with Demirakos et al. (2004), as well as with contemporary studies such as those of Glaum and Friedrich (2006) and Demirakos et al. (2007), who suggest that analysts appear to employ the DCF model significantly more often nowadays. Of particular interest is the fact that the dividend yield and DDM are only scarcely employed as dominant valuation models in the banking sector. This result decisively contradicts Barker's (1999) findings with regards to the frequent use of the former model but complements their study with regards to the rare use of the latter model. The findings suggesting the absence of dividend-related information in the evaluation process analysts follow complement Block (1999) also. Finally, consistent with Barker (1999) and Demirakos et al. (2004), no analyst appears to rely on the RIV model to assess the target price for any firm of the two sectors. According to Bradshaw (2004, 27), however,

the majority of the large investment houses worldwide keep making use of the RIV or similar models in the evaluation process, even if this is not evident in analysts' reports.

5.2 Statistical Analysis

The results of this study are verified by applying formal, statistical analysis. Two out of four of the hypotheses are tested by undertaking a Chi-square test. This kind of test is appropriate in cases of independent samples. Where this test lacks accuracy, due to limited samples, the Chi-square test corrected for continuity (Yates' correction for continuity) is also applied. The results are then discussed and formal conclusions are drawn.

Table 5. Valuation Models Adopted in Sell-Side Analysts' Reports

This table presents the valuation methods analysts employ in the sample of reports regarding the banking and pharmaceutical sectors of the LSE. E stands for earnings multiples, S for sales multiples, BV for price-to-book value, Assets for price to assets, CF for price to cash flow, DY for dividend yield, R&D for enterprise value to R&D, WEV for warranted equity valuation, ARR for accounting rate of return, CRR for cash recovery rate, EVA for economic value added, Options Pr. for options pricing models, Tech. V. for technology value, Cont. V. for continuing value, DCF for discounted cash flow , DDM for dividend discount model, GGM for Gordon's growth model, LEFAC for liquidity, earnings quality, franchise, asset quality and capital adequacy and RIV for residual income valuation.

		Single-period Comparative Valuation Models								**Hybrid Valuation Models**						**Multi-period Valuation Models**				
Sector	No of Reports	E	S	BV	Assets	CF	DY	R&D	WEV	ARR	CRR	EVA	Options Pr.	Tech. V.	Cont. V.	DCF	DDM	GGM	LEFAC	RIV
BNK	75	68	4	25	5	6	20	_	3	13	_	8	_	_	_	22	5	2	6	_
		90.7%	5.3%	33.3%	6.7%	8%	26.7%	_	4%	17.3%	_	10.7%	_	_	_	29.3%	6.7%	2.7%	8%	_
PHRM	66	29	10	_	_	2	_	1	_	1	1	_	9	2	3	35	_	_	_	1
		43.9%	15.1%	_	_	3%	_	1.5%	_	1.5%	1.5%	_	13.6%	3%	4.5%	53%	_	_	_	1.5%
Total	141	97	14	25	5	8	20	1	3	14	1	8	9	2	3	57	5	2	6	1
		68.8%	10%	17.7%	3.5%	5.7%	14.2%	0.7%	2.1%	10%	0.7%	5.7%	6.4%	1.4%	2.1%	40.4%	3.5%	1.4%	4.2%	0.7%

Table 6. Dominant Valuation Models.

This table outlines the valuation methods analysts employ as dominant in each of the sampled reports regarding the banking and pharmaceutical sectors of the LSE. The score of the models reflects the scoring system described in section 4.3. E stands for earnings multiples, S for sales multiples, BV for price-to-book value, DY for dividend yield, WEV for warranted equity valuation, ARR for accounting rate of return, Options Pr. for option pricing models, Tech. V. for technology value, Cont. V. for continuing value, DCF for discounted cash flow, DDM for dividend discount model and LEFAC for liquidity, earnings quality, franchise, asset quality and capital adequacy.

		Single-period Comparative Valuation Models					**Hybrid Valuation Models**				**Multi-period Valuation Models**		
Sector	No of Reports	E	S	BV	DY	WEV	ARR	Options Pr.	Tech. V.	Cont. V.	DCF	DDM	LEFAC
BNK	75	22	_	13	1	3	7	_	_	_	19	4	6
		29.3%	_	17.3%	1.3%	4%	9.3%	_	_	_	25.3%	5.3%	8%
PHRM	66	22	6.5	_	_	_	_	6	2	3	26.5	_	_
		33.3%	9.8%	_	_	_	_	9.1%	3%	4.5%	40.1%	_	_
Total	141	44	6.5	13	1	3	7	6	2	3	45.5	4	6
		31.2%	4.6%	9.2%	0.7%	2%	5%	4.2%	1.4%	2.1%	32.3%	2.8%	4.2%

5.3 Main Findings

This sub-section reports and discusses the main findings of the empirical analysis. The methodology and scoring system outlined earlier in this study in order to analyse the four hypotheses set, are thoroughly followed. The four hypotheses are statistically tested and the results are presented.

5.3.1 Hypothesis 1

According to Hypothesis 1, analysts will more often use comparative valuation methods to determine the intrinsic value of banking rather than pharmaceutical firms. This argument is grounded on the dissimilar growth and volatility characteristics that firms from the two sectors have and the limitations that the application of these models entails. Table 7 presents the results of the formal tests of this hypothesis. Comparative valuation techniques appear to be the most common method encountered in reports referring to banking firms. Analysts use comparative valuation techniques 131 (174.7 percent) times in 75 reports, while they employ other methods only 56 (74.7 percent) times.[18] The results related to the pharmaceutical sector are, however, not equally lucid. Relative valuation techniques and other models appear 42 (63.6 percent) and 52 (78.8 percent) times respectively in 66 reports. At first glance, the figures appear to provide support to the hypothesis set. Nevertheless, the results presented in Panel A of Table 7 of the Chi-square test and Yates' correction for continuity lack significance. The hypothesis suggesting wider use of relative methods in the evaluation of banking rather than pharmaceutical firms is rejected at all significance levels ($\chi^2 = 17.008$; $p\text{-value} = 3.722 * 10^{-5}$). The result remains unchanged after applying Yates' correction for continuity ($\chi^2 = 15.964$; $p\text{-value} = 6.456 * 10^{-5}$).

In order to shed more light on this hypothesis, an additional test examining this time the valuation models used as dominant in analysts' reports is performed. What is investigated is whether analysts employ single-period, valuation techniques only as a starting point in the evaluation process or whether they employ these methods as their principal techniques. The test assesses whether the use of comparatives as main valuation models is more common among the steady firms of the banking industry than among the unstable firms comprising the pharmaceutical industry. The findings of this test are presented in Panel B of Table 7. In the banking sector comparatives appear as dominant in 39 (52 percent) reports, while valuation by other (hybrid and multi-period) models is dominant in the remaining 36 (48 percent) reports. In the pharmaceutical sector, comparatives and other models are used as dominant in 28.5 (43.2 percent) and 37.5 (56.8) reports respectively. Both the Chi-square test ($\chi^2 = 1.093$; $p\text{-value} = 0.296$) and Yates' correction

[18] Number 131 results by summing the entries under E, S, BV, Assets, CF, DY and WEV. In the same way, number 56 results by summing the entries under DCF, DDM, GGM and LEFAC.

for continuity ($\chi^2 = 0.769$; *p-value* $= 0.380$) fail to reject this hypothesis at 4 percent significance level, providing support to the first hypothesis. Valuation by comparatives may serve as a starting point for analysts evaluating both industries, but their use as dominant valuation models is more often in the former than the latter industry. Indeed, analysts appear to trust this form of valuation in general but become skeptical about its use in challenging cases such as those of unstable and risky firms.

A final test of this hypothesis seeks to examine whether, relative to analysts from the pharmaceutical industry, analysts from the banking sector base their intrinsic value assessments more often on single-period comparatives than multi-period valuation models. Panel C of Table 7 illustrates the results of this test. 39 (51.9 percent) reports from the banking and 28.5 (43.1 percent) reports from the pharmaceutical industry use comparatives as their main valuation model. The corresponding numbers for the use of sophisticated multi-period models are 29 (38.6 percent) and 26.5 (40.1 percent). Also, Table 6 shows that out of these 55.5 sampled reports that contain a dominant valuation by explicit, multi-period methods, 45.5 employ the DCF model. The results of the Chi-square test ($\chi^2 = 0.383$; *p-value* $= 0.536$) and Yates' correction for continuity ($\chi^2 = 0.186$; *p-value* $= 0.666$) are consistent with hypothesis one, revealing a significant difference between the use of comparatives in the banking and pharmaceutical sectors at 7 percent significance level. Analysts appear to ground their valuations for the stable, banking firms on comparatives, while they turn to sophisticated, multi-period models to value the risky firms of the pharmaceutical sector.

Whereas the statistical analysis fails to support the general form of the first hypothesis, it succeeds in providing support to the more specific version of it. Consistent with Barker (1999) Brav and Lehavy (2003) and Demirakos et al. (2004) and given the cost-effectiveness and ease of use of these models, valuation by comparatives appears to be extremely popular among financial analysts. Their use as dominant valuation models appears, however, to be limited. In line with Lie and Lie (2002) and Demirakos et al. (2004), in this study analysts appear to be aware of the limitations of these models; valuation by relative techniques is dominant significantly more often in the evaluation of firms that experience steady and uniform growth than in the evaluation of smaller and riskier firms that often report losses and are mostly comprised of intangibles. Similar to Glaum and Friedrich (2006) and Demirakos et al. (2007), analysts appear in this study to make frequent use of the DCF model nowadays and prefer this sophisticated, multi-period method over comparatives in difficult and challenging cases, such as those of pharmaceutical firms. Indeed, the results of Panels A, B and C of Table 7 suggest that analysts may not differentiate between the methods they use to yield a first approximation of the intrinsic value of banking and pharmaceutical firms; they trust, however, different tools for the assessment of the fair value of firms across the two industries.

5.3.2 Hypothesis 2

The second hypothesis states that analysts employing single-period comparatives to value banking firms use the dividend yield as their main valuation method. This hypothesis extends the first and builds on Barker's (1999) findings with reference to the widespread use of the dividend yield by analysts. According to Table 5, analysts covering banking firms employ comparatives 131 times in 75 reports. The dividend yield appears, however, in only 20 (26.7 percent) reports and ranks third in the preferences of analysts for relative valuation models right after the PE and BV multiple and fourth in their general preferences for valuation methods after the PE (89.3 percent), BV (33.3 percent) and DCF (29.3 percent) models. Moreover, according to Table 6, the dividend yield appears as dominant in only two reports. In none of these two reports is, however, the dividend yield the sole dominant valuation model used. In both cases, analysts combine its use with the PE multiple. Whereas the total score of dividend yield is only 1 (1.3 percent), PE, DCF and BV models bear the total scores of 22 (29.3 percent), 19 (25.3 percent) and 13 (17.3 percent) respectively, suggesting the greater significance analysts appear to place on these three models. These figures suggest that hypothesis 2 is rejected at all significance levels. Although Table 6 indicates that relative valuation multiples constitute the most prevalent category (51.9 percent) of valuation methods among banking reports, it appears that analysts almost never trust the dividend yield in order to assess the fair value of banking firms. [19]

In general, these findings complement Barker (1999). Analysts appear to ground their evaluations primarily on relative valuation methods and especially on the PE multiple. These figures are not, however, in line with Barker's (1999) findings regarding the ranking of dividend yield in analysts' and fund managers' preferences. Analysts appear to disregard the high and stable payout ratios of the banking companies, the significance investors place on dividends and the simplicity with which the model appears to integrate all this signaling information; instead, they only appear to employ the model in order to yield a first approximation of the fundamental value of firms. Despite its numerous attributes and its independence of assumptions, the figures in Table 6 suggest that the dividend yield is the single-period comparative model that analysts use the least in the evaluation process of banking firms.

All in all, these findings do not provide support to hypothesis 2. In spite of the fact that 20 out of 75 banking reports refer to the use of the dividend yield, only two of them justify the assessment of the fair value with the use of this model. In general, analysts appear to take advantage of the features of the method and its ease of use in 26.7 percent of reports; they trust, however, its results in extremely few cases (1.3 percent). On the whole, this study fails to

[19] This is the sum of frequencies with which analysts employ the PE, BV, DY and WEV multiples as dominant.

back Barker's (1999) findings and provide further insight into his findings. This sample of firms is, however, limited and it cannot claim to be indicative of analysts' preferences in general. Further research into the matter may prove more fruitful.

Table 7. Formal Tests of Hypothesis 1 and Hypothesis 4

This table presents the results of the statistical tests related to hypotheses 1 and 4. Panels A, B and C report the results of Chi-square tests and Yates' correction for continuity with regards to hypothesis 1 and Panels D and E report the results of Chi-square tests for hypothesis 4. Yates' correction does not apply in the last hypothesis since the frequencies of some cells are less than 5.

Panel A: Frequency of Valuation Models.

Models / Sector	Single-period Comparative Valuation Models	Hybrid & Multi-period Valuation Models
Banking	131	56
Pharmaceutical	42	52

χ^2 test of banking vs pharm/cal firms: $\chi^2 = 17.008$; p-value = $3.722 * 10^{-5}$.
Yates' correction for continuity: $\chi^2 = 15.964$; p-value = $6.456 * 10^{-5}$.

Panel B: Frequency of Dominant Valuation Models.

Models / Sector	Single-period Comparative Valuation Models	Hybrid & Multi-period Valuation Models
Banking	39	36
Pharmaceutical	28.5	52

χ^2 test of banking vs pharm/cal firms: $\chi^2 = 1.093$, p-value = 0.296.
Yates' correction for continuity: $\chi^2 = 0.769$; p-value = 0.380.

Panel C: Frequency of Dominant Valuation Models.

Models / Sector	Single-period Comparative Valuation Models	Multi-period Valuation Models
Banking	39	29
Pharmaceutical	28.5	26.5

χ^2 test of banking vs pharm/cal firms: $\chi^2 = 0.383$, p-value = 0.536.
Yates' correction for continuity: $\chi^2 = 0.186$; p-value = 0.666

Panel D: Frequency of Valuation Models.

Models / Sector	Hybrid and Multi-period Cash-flow-based Valuation Models	Hybrid and Multi-period Accrual Valuation Models
Banking	22	21
Pharmaceutical	36	2

χ^2 test of banking vs pharm/cal firms: $\chi^2 = 15.755$, p-value = $4.253 * 10^{-5}$.

Panel E: Frequency of Dominant Valuation Models.

Models / Sector	Hybrid and Multi-period Cash-flow-based Valuation Models	Hybrid and Multi-period Accrual Valuation Models
Banking	19	7
Pharmaceutical	26.5	0

χ^2 test of banking vs pharm/cal firms: $\chi^2 = 8.200$, p-value = $4.189 * 10^{-3}$.

5.3.3 Hypothesis 3

Hypothesis 3 suggests that analysts utilizing multi-period valuation models in their analysis of banking firms, will adopt a DDM or GGM model as their main valuation model. The arguments underpinning this hypothesis relate to the recent evidence of growing popularity of multi-period valuation models, the size and status of the LSE, the signaling role of dividends and the generous and steady dividend policy of banking firms. Table 5 illustrates the frequency with which financial analysts use sophisticated, multi-period models in the evaluation of banking firms. Multi-period valuation models are the second most popular category of the three among banking reports. In overall, analysts appear to employ such models 35 (46.7 percent) times in 75 reports. The DDM and GGM models do not rank, however, among the models they utilize the most. In fact, these models are only used 5 (6.7 percent) and 2 (2.7 percent) times respectively. The rest of the times, the DCF (29.3 percent) and LEFAC (8 percent) models appear to monopolize analysts' interest.

According to Table 6, valuation by multi-period models is dominant in 29 (38.6 percent) out of 75 reports. Once again, this class of models is the one that analysts employ most frequently right after the single-period, relative valuation models. Nevertheless, valuation by the DDM is only dominant in 4 (5.3 percent) reports and GGM is never the main valuation model of any report. Out of the 5 reports that record the use of the DDM model, only one precludes it from being its dominant valuation model and employs the ARR model instead. What is worth of attentions is, however, the fact that whenever analysts decide to use the DDM model, they apply it in its full form. Out of the 2 reports recording the use of the GGM model, none bases the valuation of the firm's intrinsic value on this model, but on the PE multiple instead. Analysts favoring the PE multiple over the GGM model ground their preference on the ease of use of the PE model and the numerous assumptions the use of the GGM model requires. The figures tabulated in Table 6 obviously fail to provide support to Hypothesis 3 at any significance level. Although more than one third (1/3) of the banking reports ground their valuations on a multi-period valuation model, only 5.3 percent of the reports favor the DDM and none of these the GGM model. In contrast, the majority of the reports focusing on multi-period models launch the DCF (25.3 percent) as their main valuation model.

An additional test of this hypothesis involves the inclusion of the LEFAC model that exclusively ING Barings Limited uses, among the sophisticated, multi-period models that exploit dividend information. LEFAC stands for Liquidity, Earnings quality, Franchise, Asset quality and Capital adequacy and involves roughly the forecast of earnings and dividends per share for the next three years, the estimation of target price for each of these years based on the forecasts made and the discount of this price to the present, minus the cost of carrying the shares to the end of the period. The purpose of this test is to examine over whether analysts preferring sophisticated models, will employ

one of the dividend-related, multi-period valuation methods to value the firms of the banking sector. Although the application of LEFAC involves the consideration of factors, which the DDM and GGM do not control for and it only has a limited time horizon, its inclusion in the dividend-related, multi-period models might shed more light on the extent to which analysts appreciate and utilise dividend-related information. Tables 5 and 6 reveal that out of the 35 times that dividend-related, multi-period valuation models appear in analysts' reports, 10 (76.9 percent) times analysts use these as dominant. This is not surprising though, since LEFAC is the sole model analysts working for ING Barings Limited employ in their reports to assess the intrinsic value of banking firms and which is thus assigned the score of 6. However, these results are still not robust enough to provide support to this generalised form of hypothesis 3 and the arguments underpinning it. Even if LEFAC is equated to the DDM and GGM models, the study fails to provide evidence of favourable attitude of analysts towards sophisticated, multi-period models utilising dividend information.

In overall, these results do not back hypothesis 3. In contrast to what encountered, these findings indeed complement Barker (1999) and Block (1999) regarding the unfavorable attitude of analysts and fund managers towards dividend-related information and the DDM model and fail to support the hypothesis suggesting that analysts ground their evaluations on dividend-based, multi-period models. Analysts do not appear to take into account the superior attributes these models are claimed to have and generally avoid using the GGM or DDM model either as their dominant or nondominant, even in the simple form suggested by analysts and fund managers in Barker (1999). Where they do so, however, they apply the original, full forms of the models. The impulsive inclusion of LEFAC model into the dividend-related, multi-period models does not alter much the results of this test. But even if it did, the result would still remain ambiguous, since this method faintly resembles the DDM or GGM model, its origin and precision are vague and it is only used by a sole company.

The results of hypothesis 2 revealing the rare use of the dividend yield model as dominant, along with the results of this hypothesis regarding the insufficient instances of dividend-related, full-blown, multi-period models in their reports, imply the indifferent opinion analysts have of these models and dividends, in general, and their refusal to integrate dividend information in the fundamental analysis of firms. Despite the reputation of the LSE, the expected efficiency of analysts covering stocks listed on it and the effects that dividends have on analysts' mood, the results are not indicative of the utilization of dividend-related information and its integration in the category of neither multi-period nor single-period models. Analysts appear to rarely take dividend information into consideration in the evaluation process of banking firms, even though relevant data is both available and accessible.

The rationale with which Block (1999) justifies analysts' and investors' opinion about dividends may be indeed not far from reality; although the argument

relating to the tendency of firms to buy back shares instead of delivering dividends nowadays is not valid in this case (according to table 2), the explanation on which Block (1999) grounds analysts' indifference towards dividends seems rather plausible. The censure of Modigliani and Miller's (1961) dividends theory along with the high taxation of dividends may indeed vindicate their attitude. The figures of Tables 5 and 6 fail to contradict Barker (1999) and Block (1999) and support hypothesis 3 at all significance levels. They meet, however, the expectations of this study with regards to the use of sophisticated models. Combining the results of this hypothesis with those of Hypothesis 1 (Panel C of Table 7), the conclusion that a considerable number of analysts employ the DCF model and a sufficient number of these analysts appear to favour this model over single-period, comparatives is reached. This is in line with Glaum and Friedrich (2006) and Demirakos et al. (2007) regarding the popularity that the DCF model constantly gains but clashes with Barker (1999) and Block (1999).

5.3.4 Hypothesis 4

The last hypothesis states that valuation by the DCF and other cash-flow-based, hybrid models, relative to the RIV and other accrual accounting-based, hybrid methods is more often in the pharmaceutical than the banking sector. This hypothesis is primarily based on the different nature of the assets comprising the two categories of firms, the extent to which financial statements reflect the value of these assets and the degree to which the evaluation of firms can be based on this data. Similar to Demirakos et al. (2004), Accounting Rate of Return (ARR) and Economic Value Added (EVA) techniques are classified as hybrid accrual models and Cash Recovery Rate (CRR) as hybrid cash flow model. Table 5 reveals that analysts employ the DCF model significantly more often to value firms from the pharmaceutical (53 percent) than from the banking (29.3 percent) industry. Surprisingly enough, there is only one instance of use of the RIV (1.5 percent) model in the pharmaceutical industry, but none in the banking industry. Valuation by accrual-accounting-based, hybrid models takes place in 21 (28 percent) banking and only in 1 (1.5 percent) pharmaceutical reports. On the other hand, cash-flow-based, hybrid methods are only applied once (1.5 percent) in the latter and never in the former industry. While at first sight, the results seem to support Hypothesis 4, the statistical analysis performed does not. Panel D of Table 7 presents the results of the Chi-square test performed. The results ($\chi^2 = 16.755$, $p\text{-value} = 4.253 * 10^{-5}$) utterly fail to provide support to Hypothesis 4. Although there exists a difference between the times that accrual-accounting and cash-flow-based, multi-period and hybrid models appear in pharmaceutical and banking reports, it lacks statistical significance.

An alternative test to this hypothesis examines how more often analysts covering the pharmaceuticals, relative to analysts covering the banking sector, prefer cash-flow-based, multi-period and hybrid models over accrual-accounting-based, multi-period and hybrid models as their dominant valuation

tools. Although the results of the previous test are not indicative of the ability of analysts to adjust properly their methodologies to the features of the firms they examine, the discrepancies between the use of accrual and cash flow models as dominant across the two sectors may prove more illuminating. The figures presented in Table 6 suggest that the DCF model appears as dominant significantly more often in pharmaceutical (40.1 percent) than banking (25.3 percent) reports, whereas the RIV model never plays a predominant role in the evaluation of any firm. The sole time analysts apply the RIV model (in a pharmaceutical report) is in a combination with the PE multiple and it is the latter they base their valuation on. The former method indeed appears to be far more popular than the latter. This is indicative of the fact that analysts are either not familiar with RIV or thoughtful about its competence and the degree to which investors are pleased with its application. On the other hand, valuation by hybrid accrual models is dominant in 7 (9.3 percent) banking and in none of the pharmaceutical reports. Finally, in none of the reports do analysts base their valuations on a hybrid, cash-flow-based model. These figures appear to be in favor of Hypothesis 4. The results presented in Panel E (Table 7) of the statistical analysis performed lack, however, the power to support it. The Chi-square test ($\chi^2 = 8.200$; $p\text{-value} = 4.189 * 10^{-3}$) fails to validate Hypothesis 4.

Differences in the use of cash-flow-based, multi-period and hybrid models or accrual accounting-based, multi-period and hybrid models are never significant between the two sectors.

All in all, the results from the investigation of hypothesis 4 are not robust and consistent with the arguments underpinning it. In contrast to Demirakos et al. (2004), this study fails to prove that the discrepancies in the structure of the firms comprising the two sectors, induce a variation in the methods analysts adopt to evaluate these firms. Similar to Barker (1999) and Demirakos et al. (2004), it is found that the RIV model does not seem to be established in analysts' minds yet. Moreover, although the use of DCF models is more prevalent in the pharmaceutical than the banking industry and valuation by accrual, hybrid methods is dominant only in banking reports, these differences are not statistically significant and cannot be used in favor of this hypothesis. Indeed, some analysts appear to take into consideration the different characteristics of the firms comprising the two industries and adjust their methodologies properly; for the majority of analysts, however, it is their expertise in the application of specific models and the degree of investors' comfort with these techniques that appear to drive their valuation methodologies.

Chapter 6
Sensitivity Analysis

The purpose of this study is to provide accurate and impartial results regarding the investigation of sell-side analysts' equity reports. One of the certain strengths this study has compared to prior relevant studies is that the average page-length (15.35 pages) of the reports it investigates differs significantly from that of previous studies.[20] As suggested by Demirakos et al. (2004, 235), the extent of a report can be a serious limitation for the use of sophisticated, multi-period models. Brief reports are more likely to include a valuation by single-period comparatives rather than a valuation by multi-period valuation methods. Although previous research in this field is grounded upon brief reports comprised of only a small number of pages, this study sets no upper limits to the length of the reports it examines and this adds to the credibility and validity of its findings.

In order to ensure that the conclusions drawn regarding the hypotheses set are valid, it is essential, however, to control for factors that may induce bias in the results. Among the factors that may influence the results of this study and need to be controlled for, is the exclusion of reports of certain page-length, as well as the certain evaluation styles that each investment house adopts. Although no upper limits are set to the extent of the reports investigated, reports of no more than four pages in length are excluded, based on the assumption that these may just constitute earnings or recommendation revisions. Bearing in mind the suggestion of Demirakos et al. (2004, 235), with regards to the frequent use of comparatives and the rare use of sophisticated models in brief reports, this exclusion may affect the variations in the valuation methods analysts employ when valuing firms from the banking and pharmaceutical industry. In order to prove that the analysis of multi-period models does not only take place in extended reports, the average page-length of reports including a dominant valuation by comparatives and the average page-length of reports including a dominant valuation by multi-period models are estimated.

Table 3 illustrates that the average page-length per report is 15.77 and 14.88 for the banking and pharmaceutical sectors respectively, with the average page-length of the sample being 15.32 pages. The range of pages of the reports including either of the two categories of models reveals that the most extended reports of the sample include a valuation by comparatives and not

[20] This average page-length does not exceed the mean page-length of 32.6 pages per report that Demirakos et al. (2004) use. It does, however, exceed that (7.3 pages per report) of Previts et al. (1993) and that (4.3 pages per report) of Breton and Taffler (2001).

by sophisticated models. The average page-length of reports including a valuation by comparatives is 13.33 pages for the former and 15.82 pages for the latter sector. While the first figure does not exceed the mean page-length of the two sectors, the second is slightly higher. The extent of reports using a sophisticated, multi-period model is, on the other hand, much larger in the banking (18.89 pages per report) than in the pharmaceutical (14.26 pages per report) industry on average. The overall, mean page-length of reports consisting of a valuation by comparatives and sophisticated valuation methods is 14.57 and 16.57 pages respectively. Indeed, these figures reveal no vast differences between the extent the analysis of the two categories of models requires. Moreover, none of these figures is significantly different from the average page-length of the sample being 15.32 pages. These findings indeed contradict Demirakos et al. (2004), suggesting that sophisticated, multi-period models are equally likely to be found in longer and shorter reports.

An additional test is carried out in order to ensure that the page-length does not induce a bias into the results of this study is similar to that employed by Demirakos et al. (2004). More specifically, the sample gets divided into two sub-samples. The first contains all the reports that are up to fifteen pages long while the second contains the rest of the reports.[21] Among the 94 reports comprising the first group, 50.5 (53.7 percent) reports include a valuation by comparatives, while 33.5 (35.6 percent) and 10 (10.6 percent) reports include a valuation by multi-period and hybrid models respectively.[22] Of the 47 reports comprising the second group, 17 (36.2 percent) use comparatives, 22 (46.8 percent) use multi-period models and 8 (17 percent) use hybrid models. Comparative valuation models appear reasonably more often in the sub-sample comprised of brief reports, while sophisticated, multi-period models appear with a moderately different frequency in the two sub-samples. This finding contradicts also the sensitivity analysis Demirakos et al. (2004) perform, suggesting that analysis of sophisticated models is equally likely to be conducted in brief reports.

A further test involves the inspection of the evaluation styles that each investment house adopts and the possibility that some of the investment houses dominate the sample. In reality, it is quite common for analysts working in the same brokerage house to apply the same methodology and follow the same structure when analyzing companies from any sector. This feature may induce a bias in the results which is most times uncontrollable. Table 8 demonstrates the number of reports investigated from each investment house and the weighting these have in the overall sample. The sample consists of reports of large (rated by equity issuance) as well as of smaller brokerage houses. The results show that a large number of the reports investigated are issued by Credit Suisse Europe (13.5 percent), ING Barings Limited (11.3 percent), Deutsche Bank (9.2 percent) and ABN Amro

[21] This number is chosen as it is the number closest to the overall, mean page-length of the reports investigated.
[22] Some of the reports contain a dominant valuation by both categories of models.

Bank (9.2 percent). The rest of the investment houses issue between 8.5 and 0.7 percent of the reports in this sample. On average, each investment house issues 7.05 reports.[23] It is obvious that while some investment houses retain large weightings in the sample, others have marginal weightings. No particular brokerage house appears, however, to dominate the sample.

Additionally, Table 9 illustrates the frequency with which the 20 investment houses adopt each of the three categories of valuation models. As suggested by Bradshaw (2002, 40), it is of interest to investigate the degree to which analysts' reports vary across investment houses. The results tabulated tally with those found in the descriptive analysis of section 5.1 of this study and with those appearing in Table 6, suggesting that comparatives are in general the most common valuation method. In most cases analysts working for these investment houses appear to differentiate between the methods they employ in the analysis of the two different sectors;[24] in some cases, however, they appear to apply a uniform methodology without discriminating between these two different categories of firms. It is worth noting that some of the brokerages that follow a uniform methodology in all cases belong to the list of the largest investment houses with the highest equity issuance. Indeed, some analysts appear to conduct more professional and reliable analysis than others. Once again, however, the results are not indicative of any variations that the investment styles of brokerages may have induced into the results.

[23] This number differs from the average number of reports per each sell-side brokerage house that is presented in Table 3, as it results by dividing the total number of reports investigated by the total number of investment houses.
[24] For example Credit Suisse Europe, ING Barings Limited, Bear Sterns and others.

Table 8. Number of Reports Issued by Each Investment House

This table presents the number of reports investigated from each investment house and the weightings these have in the sample. In total, 75 banking reports issued by 15 brokerage houses and 66 pharmaceutical reports issued by 17 brokerage houses are investigated.

Brokerage House	Banking Sector	Pharm/cal Sector	Total	Weighting (%)
1. Credit Suisse Europe	10	9	19	13.5%
2. ING Barings Limited	6	10	16	11.3%
3. Deutsche Bank	9	4	13	9.2%
4. ABN Amro Bank	9	4	13	9.2 %
5. Citigroup	9	3	12	8.5%
6.HSBC Global Research	7	4	11	7.8%
7. Piper Jaffray	-	10	10	7.1%
8. Société Générale	6	4	10	7.1%
9. West LB	5	3	8	5.7%
10. Bear Sterns	6	1	7	5%
11. Natexis Bleichroeder	-	4	4	2.8%
12. Prudential-Bache Limited	-	3	3	2.1%
13. Evolution Securities	1	2	3	2.1%
14. Goodbody Stockbrokers	1	1	2	1.4%
15. NCB Stockbrokers Limited	1	1	2	1.4%
16. BNP Paribas	2	-	2	1.4%
17. Core Pacific Group	2	-	2	1.4%
18. Davy Stockbrokers	-	2	2	1.4%
19. DBS Vickers Securities	1	-	1	0.7%
20. A. G. Edwards	-	1	1	0.7%
Total	75	66	141	100%

Table 9. Discrepancies in the Use of Valuation Models across Investment Houses[a]

This table presents the discrepancies in the frequency with which each investment house adopts the three categories of valuation models as dominant in each sampled report regarding the banking and pharmaceutical industries.

Dominant Valuation Models								
	Banking Sector				**Pharmaceutical Sector**			
	Comparative	Hybrid	Multi-period	Total	Comparative	Hybrid	Multi-period	Total
Brokerage House								
1. Credit Suisse Europe	-	40%	60%	10	33.3%	-	66.7%	9
2. ING Barings Limited	-	-	100%	6	20%	60%	20%	10
3. Deutsche Bank	66.7%	22.2%	11.1%	9	75%	25%	-	4
4. ABN Amro Bank	-	-	100%	9	50%	-	50%	4
5. Citigroup	100%	-	-	9	100%		-	3
6. HSBC Global Research	100%	-	-	7	62.5%	-	37.5%	4
7. Piper Jaffray	-	-	-	-	20%	10%	70%	10
8. Société Générale	50%	-	50%	6	25%	-	75%	4
9. West LB	100%	-	-	5	33.3%	-	66.7%	3
10. Bear Sterns	50%	-	50%	6	100%	-	-	1
11. Natexis Bleichroeder	-	-	-	-	50%	-	50%	4
12. Prudential-Bache Limite	-	-	-	-	100%	-	-	3
13. Evolution Securities	-	100%	-	1	50%	-	50%	2
14. Goodbody Stockbrokers	100%	-	-	1	100%	-	-	1
15. NCB Stockbrokers Limited	100%	-	-	1	-	100%	-	1
16. BNP Paribas	100%	-	-	2	-	-	-	-
17. Core Pacific Group	50%	-	50%	2	-	-	-	-
18. Davy Stockbrokers	-	-	-	-	50%	50%	-	2
19. DBS Vickers Securities	100%	-	-	1	-	-	-	-
20. A. G. Edwards	-	-	-	-	-	100%	-	1
Total	39	7	29	75	28.5	11	26.5	66

[a]The models employed by each investment house are tabulated here, even though the number of reports investigated from some of them is too small to denote their valuation style.

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Chapter 7
Limitations

Like every study, this particular study faces certain limitations that constrain the significance of its results. Most of these limitations are, of course, uncontrollable but their acknowledgement is imperative not only for identifying the hazards of generalizing these results but also for providing great aid to future researchers. First and foremost, the restricted size of the sample constitutes a critical constraint of this study. It restricts the accuracy and reliability of its findings and eliminates the potential of making generalizations. A heedless extension of the sample may incur, however, greater hazards and reveal more uncontrollable parameters that researchers need to take into account.[25] The exclusion from the sample of reports not exceeding the four-page-length may also introduce impartiality into this study. Although this act is justified in the data collection and sensitivity analysis section, it is still possible that it affects the accuracy of the results.

An important limitation of this study is also the fact that not all the investment houses publish their sell-side analysts' reports on Investext Plus. Despite the wide range of reports accessible from this database, reports issued by some of the largest brokerage houses globally are not available or accessible through the particular database.[26] Since the reports that are not publicly available are automatically excluded from the sample and brokerages that rank among the top investment houses worldwide (weighted by equity issuance) are not thus taken into account, this incurs a bias in the study that possibly distorts the accuracy of its findings.

Another critical limitation of this study and of every relevant study concerns the cross-correlation that exists among the observations and the effects this has on the results of the study. Since more than one reports issued from the same investment house are usually investigated, this inevitably induces cross-correlation and distorts the independence of the sample. This is, however, unavoidable since the number of investment houses is considerably smaller than the number of existent companies. Brokerages normally cover a large number of companies listed on stock exchanges and thus a sufficient and independent sample cannot always be collected.

[25] For example, many firms are acquired during time and this restricts the number of reports available for them.
[26] Goldman Sachs and Merrill Lynch do not publish their reports on Investext Plus and JP Morgan's reports are not accessible even though they are listed on the darabase.

The independence of analysts' views and methodologies described in their reports constitutes a further crucial limitation that possibly affects this, as well as similar studies. Beckers, Steliaros and Thomson (2004) shed light on the phenomenon of herding of UK analysts by quantifying data gathered between 1993 and 2002. They suggest that in most cases analysts forego their own earnings predictions when these differ from the general consensus just because they fear of expressing a different opinion. Instead of using their earnings forecasts as inputs to the various valuation models, analysts most often utilize the findings produced by popular analysts working for large, influential brokerage houses and thus sacrifice accuracy. But if analysts do not only borrow the earnings forecasts produced by established analysts but also adopt the valuation models they use, then this most probably introduces a bias into the results of this and every similar study on the same topic area.

Identifying the dominant valuation model analysts employ in their sell-side reports also constitutes one of the practical limitations of this study. In line with Demirakos et al. (2004), a content analysis is adopted and thus greater significance is placed on the written part of reports. In doing so, it is presumed that analysts wish to transmit effectively only useful and reliable information in their reports and that the models they mention in these are in fact the ones they base their valuations on. One of the crucial factors in characterizing a model as dominant is the amount of space analysts dedicate to it. Taking for granted that the analysis of multi-period models demands normally more space than that of single-period techniques, then this may constitute an ambiguous criterion. As mentioned in section 4.3, however, this is not the only criterion taken into account when assigning a model its score. It is still possible, though, that this condition set affects the score of the models.

The fact that some firms report losses and that this automatically precludes the use of PE models from the evaluation process, is one of the additional factors that may induce variations in the models adopted by analysts and should be seriously taken into account. This technical limitation of the PE multiple may in some cases constitute the DCF model a viable substitute of it and thus affect the frequency with which analysts employ these models. Since the DCF model is the most popular method among analysts valuing pharmaceutical firms and this sector is the most liable of the two to report losses instead of earnings, this may bring the widespread use of this particular model in the pharmaceutical industry into question.

Last but not least, the content analysis undertaken in this study relates to sell-side analysts' equity reports issued even two years ago. The aim of this study is to reveal the discrepancies existing in the evaluation methodologies sell-side analysts adopt when valuing the stable, banking sector and the volatile, pharmaceutical sector of the LSE between 2005 and 2006. The constant, global, political, financial and other crises have, however, serious affects on the financial markets and the mood of investors. The current turmoil related to the sub-prime lending crisis and the fear of a global, systemic, financial crisis and of another "bubble" have decisively affected the banking and

financial sector worldwide and have definitely altered investors' perception of this sector as stable. A new study on the banking and financial industry of any country cannot thus be based on this characteristic of it. Additionally, the upsurge in mergers and acquisitions that started a few years ago has also modified the size, the power and the stability of firms nowadays. A considerable number of the pharmaceutical firms that are included in this study have already been merged with or acquired by the largest companies of the sector. The profound discrepancies between the level of risk, the stability and profitability of the two sectors that are found in it may indeed be less substantial nowadays. The constantly changing conditions are an uncontrollable factor that has crucial effects on the validity of this and every study. In fact, it is possible that the results of a new research on these industries may bear little resemblance to the ones found in this study.

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Chapter 8
Conclusions

The elaboration on this topic area and the completion of this study intends to extend further relevant research and provide a deeper and wider understanding of the valuation methods that analysts employ in order to assess the fundamental value of firms. The content analysis undertaken in this study concerns the valuation techniques financial analysts apply in the evaluation of banking and pharmaceutical firms listed on the LSE from the period June 2005 to December 2006. The results of this investigation convey important messages, which extend the findings of prior related literature. What it all boils down to is that analysts still favor single-period, comparative valuation methods and especially the PE multiple; sophisticated, multi-period models such as the DCF are, however, constantly gaining ground. In difficult cases such as those of risky firms, that experience volatile earnings analysts appear to rely on these models, rather than on comparatives. Price-to-book-value ratio, sales multiples and hybrid models are also employed but only in limited cases. The RIV model seems, however, not to be established in analysts' and investors' minds yet. The dividend policy that banking firms steadily follow and the implications this has for investors, do not seem to be included in the factors analysts regard as predominant in the determination of a firm's intrinsic value; dividend-related, single-period and multi-period models rank among the least favored valuation methods analysts use as dominant. Finally, the variations in the structure of the two kinds of firms, the quality of accounting information disclosed and the extent to which this can successfully enter the financial analysis of a firm do not seem to concern analysts and affect the valuation methodologies they actually follow. Their expertise as well as investors' familiarity with certain models appears, instead, to be the factors that primarily lead their choices of valuation techniques.

Consistent with Barker (1999), Brav and Lehavy (2003) and Demirakos et al.(2004), this study discovers that single-period, comparative valuation models are the most popular category of valuation methods among analysts covering both sectors, with the PE multiple remaining the most prevalent of all. A more discerning approach to this hypothesis shows, however, that dominant valuation by this category of models is not equally common among the two industries. In line with Demirakos et al. (2004) and the hypothesis set, evidence suggests that analysts appear to be aware of the shortcomings that the application of comparatives has on unstable firms and adjust their methodologies accordingly; indeed, while analysts covering banking firms most often employ comparatives as their dominant valuation models, analysts covering pharmaceutical firms rely mainly on multi-period models and especially on DCF methods. Sales multiples and hybrid models are also used

in a number of pharmaceutical reports. Similar to Glaum and Friedrich (2006) and Demirakos et al. (2007), it is found that analysts utilize brief and unsophisticated models to value steady firms such as those comprising the banking industry but depend on explicit models to rate risky firms, such as those comprising the pharmaceutical industry. Sophisticated, multi-period models such as those recommended in the financial textbooks are in fact gaining ground.

Despite the documentation that Barker (1999) provides about the popularity of the dividend yield model and its frequent use by financial analysts and fund managers, this study fails to provide sufficient instances of its use in banking reports and thus cannot back this hypothesis. Although the model ranks third among the methods analysts apply to yield a first approximation of a firm's intrinsic value, it ranks last among the methods that analysts employ as dominant. The generous and steady dividend policy of banking firms and the signals dividends are believed to convey with regards to the financial state of firms, appear not important enough to capture analysts' interest and be integrated in their dominant valuation methods. Instead, analysts appear to rely extensively on the PE ratio while the Price-to-Book value multiple comes second among the relative valuation techniques analysts use the most.

The inadequate use of DDM and GGM methods as dominant or nondominant valuation models complement Barker (1999) and Block (1999) and reveal the unfavorable attitude of analysts towards these methods. This leads to the rejection of the hypothesis suggesting their frequent use in banking reports at all significance levels. Although sophisticated models are the second most popular category of valuation models after comparatives, it is the DCF and not the dividend-related, multi-period models that analysts prefer. The inclusion of LEFAC model, that ING Barings Limited exclusively applies, in the dividend-related, sophisticated, multi-period models, does not induce much of a change to the results. Indeed, analysts appear to disregard the inherent superiority of these particular, sophisticated, multi-period models, the sharp and steady payout ratios of banking firms and the significance investors place on dividend-related information. In line with Block (1999), the findings of the second and third hypothesis imply analysts' indifferent opinion of the value and role of dividends and the dividend-based models and their refusal to integrate dividend-related information in the determination of firms' intrinsic value.

With regards to the hypothesis on the relative use of accrual-accounting and cash-flow-based methods, either as dominant or nondominant, across the two industries, no sufficient evidence is found in favor of this postulation. While the RIV ranks not among analysts' main valuation methods, the DCF models appear as dominant significantly more frequently in pharmaceutical than banking firms. At the same time, no instance of dominant valuation by cash-flow-based hybrid methods are found; accrual-accounting-based hybrid models appear to be analysts' predominant valuation models only in the banking industry. Nevertheless, the statistical analysis of these figures fails to

provide support to the fourth hypothesis set. In contrast to Demirakos et al. (2004), the discrepancies between the nature of assets comprising the firms of the two sectors and the extent to which their analysis can rely on accounting information do not seem to induce analysts into differentiating between the valuation methodologies they apply in the former and the latter sector. Their expertise in certain models and investors' familiarity with these appear, instead, to be the factors that analysts primarily consider in their choice of valuation techniques.

Despite its limitations, this study sheds additional light on the valuation methodologies analysts adopt and the ways these vary across industries. While some of its findings complement prior studies, some others diverge from these. Further research on this topic area would certainly provide more enlightening results whatsoever. The turmoil in the financial markets that the sub-prime crisis brought about recently has definitely affected the stability of the banking and financial industry worldwide. Some of the largest US, lending banks have already gone bankrupt and others struggle to survive this crisis putting thus the risks of a global, systemic, financial crisis and of another "bubble" into perspective. An investigation of the banking and financial sector in USA, spanning the period between 2007 and onwards would definitely constitute an interesting and essential extension of this study. It would provide findings with respect to the methodologies US analysts adopt before and after the sub-prime crisis and the possible effects this will have imposed on the market. Another motivating extension of this study could relate to the examination of sell-side analysts' reports on dissimilar industrial sectors within the UK or within different countries. The impending effects of the current, financial crisis will most probably affect analysts' attitude and methodologies worldwide. Research on this topic will provide additional insight into the ways they adjust their valuations to the moods of the market and the wariness of investors.

An additional suggestion for further research could relate to the inspection of sell-side analysts' equity reports with regards to the petroleum industry. The war in Iraq and the continuous turbulence in the Middle East have triggered an unprecedented increase in the price of oil and have affected the economies of most nations. As far as the author is aware of, no research has been made on this profitable industry so far. A study revealing the evaluation process and methodologies analysts covering this influential industry adopt and the ways these are affected by the constant turmoil would decisively add to our knowledge on this topic area so far.

Finally, further research could also relate to the valuation methodologies analysts working for independent research companies adopt and the ways these vary within and across different sectors. The results of this study would provide feedback on the perspective of those analysts of the different categories of valuation models and the features of companies they place significance on. Additionally, a comparison of the valuation practices sell-side and independent analysts adopt would be of particular interest. Possible discrepancies found between the methodologies employed by these two categories of analysts would shed additional light on the independence of views that sell-side analysts express in their reports and the impartiality of their valuations.

Appendix

Chi-square Test of Hypothesis 1.

Panel A: Frequency of Valuation Models. Banking vs Pharmaceutical Firms

Valuation Model	Banking	Pharm/cal	Combined
Single-period Comparative Valuation Models	131	42	173
Hybrid & Multi-period Valuation Models	56	52	108
Total	187	94	281

Valuation Model	Banking	Pharm/cal
Single-period Comparative Valuation Models	(173 / 281) * 187 = 115.128	(173 / 281) * 94 = 57.872
Hybrid & Multi-period Valuation Models	(108 / 281) * 187 = 71.872	(108 / 281) * 94 = 36.128

Valuation Model	Banking	Pharm/cal
Single-period Comparative Valuation Models	$(131-115.128)^2 / 115.128 = 2.188$	$(42 - 57.872)^2 / 57.872 = 4.342$
Hybrid & Multi-period Valuation Models	$(56 - 71.872)^2 / 71.872 = 3.505$	$(52 - 36.128)^2 / 36.128 = 6.973$

Chi-square = $\chi^2 = 2.188 + 4.342 + 3.505 + 6.973 = 17.008$

Degrees of freedom = $(I - 1) * (J - 1) = 1 * 1 = 1$

p-value = $3.722 * 10^{-5}$

Yates' Correction for Continuity

$$\chi^2 = \frac{N\left(|\alpha * d - b * c| - \frac{N}{2}\right)^2}{(a+b)*(c+d)*(a+c)*(b+d)} = \frac{281\left(|131*52 - 42*56| - \frac{281}{2}\right)^2}{(131+42)*(56+52)*(131+56)*(42+52)} =$$

15.964

Degrees of freedom = 1

p-value = $6.456 * 10^{-5}$

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NOTES

NOTES

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