Firm Level Determinants Explaining the Utilization of Equity Valuation Models

Erasmus University Rotterdam
Erasmus School of Economics
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Name: Peter James
Student number: 306012
Supervisor: Dr. W.L.J. Schramade

Abstract

This thesis examines which firm level determinants influence equity research analysts in valuing midcap firms around the world. The reason to understand the valuation process of equity research analysts on a firm level instead of industry level are caused by the obvious conflict of interest faced by sell-side equity research analysts and the limited amount of theoretical recommendations to apply certain equity valuation methods under different circumstances. By conducting a descriptive analysis on the 412 equity research reports it is found that the DCF method (181) is most frequently applied and shortly followed by the P/E method (168). Through logistic regressions, firm level determinants influencing valuation techniques are identified. It is shown that firm level determinants in terms of operating performance stock return volatility and firm size influence research analysts in their valuation methodology. Furthermore, economic indicators and geographic as well as brokerage house classification are decisive in the choice of a particular valuation model. This paper shows that indeed firm level determinants explain equity research analyst's valuation behavior which decreases ambiguity surrounding the objectives of equity research analysts.

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Chapter 1

Introduction

As stated by the Financial Times in early April from this year[1], in the ideal world of equity research straightforward analysis of company's operating performance would result in an impartial estimate of the intrinsic equity value. However, the surplus of buy recommendations and reluctance to incorporate falls in corporate earnings by sell-side equity research analysts demonstrates that this ideal world is far from reality.

The reason why an optimal equity investment environment has not emerged is due to the conflicts of interest faced by sell-side equity research analysts. On the one hand, biased positive recommendations are desired since this strengthens the relation between the research analyst and the company under research. Dechow, Hutton, and Sloan (2000); Dugar and Nathan (1995) show that positive recommendations results in a higher involvement in investment banking activities. On the other hand, equity research analysts are paid when the trading activity is high in the stocks they cover. Equity research analysts discuss with fund managers to trade in a certain company and pays trading commission to the brokerage house or investment bank. Fund managers therefore pay for a solid and just company analysis and anticipate their investment behavior according to the recommendations released by sell-side analysts. However, in the paper of Boni and Womack (2002), buy-side equity research analysts were interviewed and acknowledged that they sometimes pressure sell-side analysts not to revise a recommendation and that the content of detailed equity research reports is valuable, while positive biased recommendations are just present to satisfy corporate executives.

The research objectives developed in this thesis are derived from this ambiguity faced by sell-side equity research analysts and two other observation in global equity markets and discussed in the next paragraph.

[1] http://www.ft.com/intl/cms/s/0/1851c84c-8159-11e1-b39c-00144feab49a.html#axzz1v6vQZVCh

Research objectives

Firstly, the true purpose of sell-side equity research analysts is difficult to identify for outside investors. Is their main goal to define underperforming or overperforming stocks and, as a result, operate as journalists which are able to evaluate the operating performance of a company in an objective unbiased manner? Or do they mainly concentrate on maintaining a strong corporate relationship to secure investment banking activities? Secondly, trading activities in stocks during the 1980s was mainly passive and focused on dividend income. However, during the 1990s and 2000s investors concentrated on stock price increases and stock trading activity became global and very liquid. Valuing shares was not conducted anymore via a dividend based valuation model, but by using singleperiod and multiperiod valuation techniques. A third development is the increased academic literature how to value shareholders equity. Yet, recommendations and discussions within the literature are lacking about what valuation technique to apply when valuing a certain company with specific firm level characteristics.

From these observations in the current landscape two research objectives are identified. Firstly, through logistic regressions on firm level determinants, in terms of operating efficiency, capital structure, stock return volatility and firms size , it is analyzed what the main drivers are for equity research analysts to apply a certain valuation technique. Identifying those firm level determinants is the main objective of this paper and gives a further insight into the valuation behavior of sell-side equity research analysts.

Secondly, the sample period in this study, between 2006 and 2010, is characterized by peaks in economic standards (2006 and 2007), a financial crisis only comparable to the Great Depression during the 1930s (2008) and subsequent volatile stock markets and muddling economies. These circumstances confronted by the financial industry could have impacted the valuation procedure. Moreover, the increased liquidity and accessibility of global stock markets since the mid-1980s has been enormous. As a result, the attention on stock markets and operating performances of firms has never been this intense.

From the above described ambiguities and developments in the global economy and financial industry two research questions are aimed to be answered:

1. *How do sell-side equity research analysts select the valuation methods to estimate firm's market value of equity?*

2. *To what extent did the global credit crunch and reputation influences affect the employment of equity valuation techniques?*

Before elaborating on the contributions to the academic literature and main findings of this thesis, it is crucial to shortly describe how equity valuation techniques are classified in this thesis.

Equity valuation techniques

Theoretical literature on equity valuation methods is divided into multiperiod valuation techniques and singleperiod valuation methods. Multiperiod valu-

ation techniques incorporate a more fundamental thorough analysis of future firm performance. Future operating figures are forecasted, including assumptions on capital expenditures and growth levels, and a final terminal value is calculated. Most familiar multiperiod valuation methods are the discounted cash flow model, residual income model and the dividend discount method. Singleperiod valuation methods are divided into multiples numerated by the market value of equity or numerated by the total enterprise value. Singleperiod valuation methods are generally regarded as being more simple and straightforward since the quality of the company is evaluated against a peer group, the comparison is done on a single year and the mathematical estimation is basic. Most familiar singleperiod equity valuation techniques are the P/E methods, EV/EBITDA method and EV/EBIT method.

Contributions to academic literature

This thesis makes three contributions to the existing academic literature. First, a thorough analysis on the employment of equity valuation techniques is done on a firm level. Previous studies empirically analyzed the employment of equity valuation methods on an industry level (see Demirakos, Strong, and Walker (2004); Imam, Barker, and Clubb (2008)). Yet, industry level analysis is too broad and does not incorporate crucial firm level determinants influencing an equity research analyst to apply a certain valuation technique.

Secondly, all equity valuation models used by financial analysts are classified and categorized into the data set. The procedure to only identify the dominant valuation model (again see Demirakos, Strong, and Walker (2004); Imam, Barker, and Clubb (2008)) is obsolete, since sell-side equity research analysts deliberately and frequently use two or more valuation models to estimate the final target price. A mix of all these valuation models is normally used to calculate the final estimation. Instead of determining which equity valuation model is dominant, all valuation techniques are identified irrespective of the weights assigned to the valuation methods.

The third contribution is the statistical methodology used to analyze the likelihood of applying a certain valuation model. Due to the fact that the response variable in this thesis is a dummy variable, categorical data analysis is required. Consequently, logistic regressions are implemented to directly estimate the probability that an equity research analyst increases or decreases the utilization of an equity valuation technique under certain circumstances. Logistic regression models are relatively unknown in financial data analysis and is mostly used in medical or marketing research. Roosenboom (2007) applied a similar technique in his paper, yet he only described which predictor variables were positively or negatively affecting the probability of applying a specific equity valuation technique. Through the interpretation of log odds ratios and the subsequent probabilities of the dependent variable being one over the probability of being zero, the strength of the sign of the predictor variables are captured as well.

Main findings

From the descriptive analysis it is shown that the DCF, P/E and EV/EBITDA are the mostly applied equity valuation models. The limited use of accrual based multiperiod valuation models is contradicting to theoretical literature. However, theoretical recommendations on singleperiod valuation models are follow by equity research analysts. Through binary logit regressions it is found that firm level determinants explain the decision making in the valuation process of research analysts. Moreover, economic indicators like negative GDP growth and reputation of the stock exchange on which firms are listed also explain the behavior of equity research analysts. Yet, the firm level determinants and economic indicator better explain the probability of employing the DCF method and singleperiod equity based models (for instance P/E) compared to singleperiod enterprise based valuation models (for instance EV/EBIT).

Further focus on industry and regional difference imply that these classifications also influence equity research analysts. The differences are especially strong for regional differences. Nevertheless, it must be remarked that the sample size significantly declines when cutting the sample size for specific regional analysis. This causes the results of these logistic regressions to be fairly unreliable.

Structure of thesis

The paper is organized as follows. Chapter 2 describes the theoretical background on equity valuation models. This section is split in a theoretical overview of multiperiod and singleperiod equity valuation techniques. Chapter 3 develops the hypotheses derived to answer the main research questions in this study. Chapter 4 reports the data set with its descriptive statistics and the utilized methodology. In chapter 5 a descriptive analyze combined with the results of the empirical analysis are presented and tested on their robustness. The discussion and conclusion sections in chapter 6 summarize the findings and produce recommendations for further research on equity valuation models.

Chapter 2

Equity Valuation Techniques

In order to understand the valuation process of sell-side equity research analysts it is important to identify the different equity valuation methods. Abundant theoretical literature on equity valuation is present. Yet, in practice the provided theory is not always translated into research reports. The question remains whether equity research analysts deliberately ignore recommendations given in academic literature, or whether theoretical literature is lacking any kind of useful proposal for the employment of equity valuation models?

This chapter described which main equity valuation methods are brought forward in theoretical literature. Section 2.1 describes multiperiod valuation techniques which forecast operating performance on a midterm or long term horizon and includes a terminal value estimation. Section 2.2 discusses singleperiod equity valuation techniques, which are based on a comparable peer group valuation.

2.1 Multiperiod valuation analysis

As already stated in the introduction, during the 1990s investors became more interested in equity capital gains instead of periodic dividend income streams. As a result, equity valuation models were developed based on discounted free cash flow streams or discounted accrual earnings figures instead of dividend flows. From the academic literature three main multiperiod valuation techniques are presented which are dividend based (2.1.1), cash flow based (2.1.2) and accrual earnings based (2.1.3) (see Soffer and Soffer (2003); Lundholm and Sloan (2003); Penman (2010)).

1. *Dividend Discount Model (DDM)*: The DDM values the firm as the present value of the dividend streams the firm is expected to generate. The future dividend stream is discounted against the cost of common equity or rate of return demanded by equity shareholders.

$$DDM = \sum_{t=1}^{\mathrm{N}} \frac{div_t}{(1+k_e)^t} + \frac{div_n}{k_e - g^{div}} \tag{2.1.1}$$

2. *Discounted Free Cash Flow model (DCF)*: Within the DCF free cash flow streams are discounted against the weighted average cost of capital (WACC) resulting in the value of core operations. By adding the value of net assets and subtracting debt claims and other capital claims (not shown in formula) the final equity value is defined.

$$DCF = \sum_{t=1}^{\mathrm{N}} \frac{fcf_t}{(1+WACC)^t} + \frac{fcf_{n+1}}{WACC - g^{fcf}} \tag{2.1.2}$$

3. *Residual Income Model (RIM)*: This model breaks the value of core operations into two components, which are book value and the net present value of residual income. Residual income is the earnings related to core operations less base income. Base income is the book value equity at the beginning of the period multiplied by the cost of equity. Lastly, there is an adjustment for net assets, debt claims, and other capital claims (not shown in formula).

$$RIM = BV_0 + \sum_{t=1}^{\infty} \frac{ni_t - k_e * BV_{t-1}}{(1+k_e)^t} \tag{2.1.3}$$

Two issues arise from the above described valuation techniques. Firstly, the debate on either focusing on cash flow based valuation models or accrual based valuation models. Secondly, to what extent does the terminal value[1] estimation influence the choice to apply a certain equity valuation technique.

2.1.1 Cash flow analysis versus accrual earnings analysis

The discussion on the employment of either cash flow or accrual earnings based methods consist of proponents of cash flow based methods, proponents of accrual earnings based methods and academics who are indifferent between both methods. The three groups are discussed below.

Proponents of cash flow based multiperiod valuation

Copeland, Koller, and Murrin (2000) argues that the focus of corporate managers and equity research analysts should be on cash flow drivers, since free cash flow streams and market capitalization are highly correlated[2]. This relation was

[1] Formula 2.1.3 does not show a terminal value estimation since different approaches in valuing the terminal value for accrual earnings based models are correct (see Soffer and Soffer (2003) page 269).

[2] See Copeland, Koller, and Murrin (2000), page 77, exhibit 5.5.

empirically proved by Hirschey and Spencer (1992) between 1975 and 1990 and held over all periods and firm size classes. In addition, cash flow based analysis is able to ignore cosmetic accrual earnings effects and better captures the long run focus of capital markets.

In the equity valuation case presented by Soffer and Soffer (2003)[3] two reasons are given to approve cash flow over accrual analysis. First, when changing the accounting methodology the equity value is not adjusted, while adjustments in free cash flow forecasts affect the equity value. Second, albeit a smaller portion of the residual income valuation is attributed to the terminal value, the potential error in the valuation as a percentage of the terminal value estimation is smaller for cash flow based models. As a consequence, the net effect of the potential mistake is similar in both methods.

Proponents of accrual based multiperiod valuation

Supporters of accrual based multiperiod valuation models argue that accrual accounting corrects for the deficiencies encountered in free cash flow analysis in terms of value added. Firms reduce free cash flow streams by investing activities while accrual analysis treats operating and financing activities as part of book value. Likewise, accrual earnings are not influenced by dividends or share issues or repurchases (see Penman (2010); Feltham and Ohlson (1995)).

Furthermore, according to Francis, Olsson, and Oswald (2000) accrual analysis is superior because distortions in book values, resulting from accounting procedures, are to a lesser extent affecting equity value compared to measurement errors in discount rates or growth rates. Also given that valuation estimates are over a relatively short forecast horizon, through the book value analysis, accrual earnings are better able to explain a large portion of intrinsic value and has a higher predictability of accrual forecasts (see Palepu, Healy, and Peek (2010)).

Indifference between cash flow and accrual based valuation

The last group believes that, as long as identical assumptions or inputs are applied, similar equity value estimates should be obtained (e.g. Lundholm and Sloan (2003)). These errors in the employment of different assumptions are clearly presented by Lundholm and O'Keefe (2001). They first argue that inconsistent forecasts errors, originated by calculating the terminal value attributes with incorrect amounts, causes the equity value estimation of the RIM and the DCF to move in opposite direction. The second error is the usage of an incorrect discount rate error. No diverging equity valuations should arise when calculating the equity value discounted by the cost of equity or when calculating the equity value using the enterprise value discounted against the WACC. When the cost of equity and cost of after-tax debt are constant there is only one internally discount rate applicable. The last error concerns missing cash flows. This error occurs when the forecasts of net income subtracted with dividends is not equal to the change in shareholders' equity.

[3]See Soffer and Soffer (2003) page 278-279.

2.1.2 Terminal value estimation

The second issues which must be addressed by research analysts before deciding which multiperiod equity valuation model to use, is the terminal value estimation. According to Copeland, Koller, and Murrin (2000) there are three general mistakes which affect the terminal value significantly. Firstly, naive base year extrapolation reveals wrong forecast assumptions at the terminal value base year. Additionally, naive over conservatism incorrectly assumes that firms equal the return on invested capital (ROIC) with the WACC for the terminal value period. Lastly, purposeful over conservatism states that analysts tend to be too conservative due to future uncertainty and the significant impact of the terminal value.

Penman (1998) regards the terminal value as an error attribute to the finite horizon valuation. Persistent measurement errors arise from reoccurring biases in finite accounting calculations. As long as finite accounting forecasts are correct, a terminal value estimation is not required. Courteau, Kao, and Richardson (2001) tested the sign and the absolute prediction error of the RIM and the DCF, while using the ideal terminal value brought forward by Penman (1998), and found that the measurement error is neutral across equity valuation models.

The above described subsection shows that the terminal value estimation is often poorly estimated and used as an error attribute to the finite horizon estimation. As a consequence, reliance on the terminal value should be avoided as much as possible. Since the DCF puts more weight on the terminal value than the RIM, multiperiod accrual based valuation methods are slightly preferred over cash flow based analysis.

2.1.3 Empirical findings on multiperiod valuation

In the paper by Penman and Sougianis (1998) four valuation techniques are analyzed, namely the DCF, DDM, RIM and Capitalization Method (CM)[4]. From the analysis it is concluded that accrual accounting provides the possibility to better bring the future forward in time. Moreover, accrual accounting balances investment cost through depreciation allocation, which facilitates valuing firms forecasts over a relatively short horizon.

By applying identical data sources as Penman and Sougianis (1998), Francis, Olsson, and Oswald (2000) also showed that accrual earnings based valuation techniques dominate the DDM and the DCF in terms of forecasting accuracy and explainability. Furthermore, no differences in accuracy were observed between exercising high or low accounting discretion or high and low R&D expenditure. So different accounting methodologies are stable and do not lead to inferior estimates of the market value of equity.

[4]The Capitalization Method is defined by Penman and Sougianis (1998) as the forecasted sum of earnings added to the sum of reinvesting dividends paid out, and multiplied by the cost of capital

Empirical analysis of valuation in practice reveals that the DCF is still the main valuation method. Through semi-structured interviews, conducted by Glaum and Friedrich (2006), it was concluded that the DCF was the main applied multiperiod equity valuation technique. Furthermore, the use of multiperiod accrual based methods was rarely used and most often a singleperiod valuation method was used as alternative to the DCF. The dependence on multiperiod equity valuation techniques within IPO dimensions is tested by Roosenboom (2007); Deloof, De Maeseneire, and Inghelbrecht (2009) for IPO processes on the Paris and Brussels stock exchange. It was found that the DCF was mainly used as multiperiod valuation technique and more likely to be applied when the market return and market return volatility were high.

2.1.4 Conclusions on multiperiod valuation methods

The analysis on multiperiod valuation techniques reveals that in the academic literature no agreement is present whether to focus on cash flow or accrual based valuation models. Yet accrual earnings based valuation seems to be slightly more plausible to employ as multiperiod equity valuation method for the following reasons.

First, empirically it is shown that different accounting methodologies do not distort the final equity estimation, which is often used as disadvantage by proponents of cash flow based models. Second, free cash flow streams are affected by investing activities, which are necessary to generate value. In addition accrual earnings based models are not influenced by dividend payments or share issues. Third, the relation between free cash flow streams and market value of equity is relatively vague and best explained by a market error instead of theoretical rational. Fourth, the reliance on terminal value estimation is poor and should be avoided as much as possible. Last, empirically it is shown that accrual based models posses a higher accuracy and are better able to capture forecast estimates.

2.2 Singleperiod comparative valuation

A singleperiod valuation technique is a division between the equity or enterprise value as numerator and a financial figure derived from the income statement, balance sheet or cash flow statement as denominator. The reasoning behind singleperiod valuation techniques is that the multiple derived from singleperiod comparative valuation is equal over a comparable group of firms.

Income statement or accrual earnings denominators consist of either earnings before interest, taxes, depreciation and amortization (EBITDA), EBITA, EBIT or net earnings (E). Goedhart, Koller, and Wessels (2010) argues that EBITA dominates the other possibilities since net earnings includes non-operating items. Amortization could be an accounting bias which arises from completed acquisitions. Depreciation charges are equivalent to future capital expenditures and in order to capture the true value this figure must be subtracted from net earnings.

Table 2.1: **Overview singleperiod valuation methods**

		Numerator	
		Market value of equity	**Enterprise value**
Denominator	**Income statement**	E (earnings)	EBITDA EBITA EBIT
	Balance sheet	Book value of equity	Total assets Invested capital
	Cash flow	Operating cash flow Dividend payments	

Balance sheet denominators are mostly utilized in capital intensive industries and consist of either total assets, invested capital or book value of equity. Soffer and Soffer (2003) and Schreiner (2007) recommend the usage of the book value of equity since it controls for growth rates, capital structure and accounting methods. Invested capital dominates total assets because invested capital only incorporates assets which generate future value.

The last group are cash flow based denominators representing singleperiod methods denominated by either operating cash flows or dividend payments. Income statement denominators dominate operating cash flow based multiples and dividend based singleperiod equity valuation is overshadowed by its multiperiod counterpart.

The framework of applied singleperiod equity valuation techniques is shown in table 2.1.

Equity research analysts must address some issues before utilizing singleperiod equity valuation methods and are discussed in subsection 2.2.1. A crucial element in employing singleperiod valuation methods is the collection of a peer group. Nonetheless, no further empirical analysis is conducted how equity research analysts construct a peer group so this is not further discussed in this section. Subsection 2.2.2 shortly describes counterarguments for applying singleperiod valuation models. However, the aim of this thesis is not to parallel singleperiod and multiperiod valuation methods, so further elaboration on this comparison is not given.

2.2.1 Issues for applying singleperiod valuation models

The main issues regarding the utilization are the adjustment of leverage, consistency in applying multiples and leading versus trailing multiples.

Adjusting for leverage

Textbooks on equity valuation using multiples address an important element in terms of leverage adjustments (e.g. Soffer and Soffer (2003); Palepu, Healy, and Peek (2010)). For instance, a financial analyst who applies a singleperiod

valuation analysis between two companies with identical operating income, free cash flow figures and growth prospects, but with different debt percentages as part of total capital makes the valuation incomplete when equity based valuation method is applied. The difference in leverage levels causes a distortion leading to biased equity valuation. To avoid this issue it is crucial for a research analyst to preserve consistency between the numerator and the denominator when using singleperiod equity valuation analysis.

Consistency in applying multiples

The second issue in singleperiod equity valuation is consistency between applying the numerator and denominator. If an equity research analyst applies the enterprise value as numerator the denominator item should affect debt and equity holders of a firm. To illustrate, from the net earnings figure interest and taxes are already deducted. Therefore, net earnings only affect equity holders. When utilizing net earnings as denominator, consequently the market value of equity should be used as numerator. This consistency is crucial to ensure that singleperiod equity valuation is not biased.

More important is the discussion which numerator is preferred. Copeland, Koller, and Murrin (2000) proposes the use of enterprise value as numerator because firms can manipulate the P/E ratio due to the systematic relationship between unlevered P/E multiple and leverage. When the unlevered P/E ratio of a firm is larger then the reciprocal of the cost of debt, the P/E multiple rises when a higher level of debt is attained. In contrast, when the reciprocal cost of debt is larger than the unlevered P/E ratio, then the levered P/E multiple decreases when total debt increases. Only when the reciprocal cost of debt equals the unlevered P/E multiple no effect will arise when more (less) net debt is obtained (abandoned).

In contrast, according to Schreiner (2007) two practical difficulties arise when applying the enterprise value as numerator. Firstly, public available data on enterprise value is not available, while public data on total equity value is easily obtained. Second, the calculation of net debt contains biased assumptions and derivations from the balance sheet which could cause further distortions.

Although recommendation are present to use a certain denominator within a category, a comparison between categories is still thin. Only Schreiner (2007) analyzed the three groups and recommends accrual earnings figures since those are more stable and better comparable across firms. In addition, negative or low numbers are occurring more frequently for free cash flow figures resulting in unusable multiples. The usefulness of balance sheet multiples is only present for industries in which the market value of assets in place is frequently marked-to-market, like the financial and oil & gas sector. However, the limitation to capture operating margins, efficiency or earnings momentum makes balance sheet multiples subordinate to accrual earnings multiples.

Leading versus trailing multiples

The final issue on singleperiod equity valuation concern the utilization of trailing (backward looking) or leading (forward looking) denominators. Since equity estimation focuses on the net present value of a firm's future expected earnings or cash flows it is reasonable to focus on leading financial figures. Moreover, leading data on accrual earnings or cash flows are normalized which better reflect future expectations.

In determining which forward looking year is used, firms must be categorized in terms of sales growth or earnings volatility. If the predictability of these figures is high, leading multiples at $t+2$ or $t+3$ are recommended (see Goedhart, Koller, and Wessels (2010)), since multiple variation across a peer group is decreasing the further out the estimation year[5].

2.2.2 Counterarguments for applying multiples

Academic literature on the disadvantages of implementing singleperiod valuation methods is quite sufficient. Three clear arguments emerge from theoretical literature why singleperiod valuation models are impractical in estimating shareholders equity (see Soffer and Soffer (2003); Palepu, Healy, and Peek (2010); Penman (2010)).

First, singleperiod equity valuation methods ignore future value drivers. Second, firms encountering a bad performing year, due to impairment or restructuring charges, face useless negative multiples. Third, regularly competitive firms are selected as comparable, however when one firm dominates the other within an industry, a direct comparison is flawed.

2.2.3 Empirical findings on singleperiod comparative valuation

Most singleperiod valuation studies concentrate on the accuracy of valuation models. Liu, Nissim, and Thomas (2002) and Schreiner (2007) found that leading multiples explain stock prices better than trailing multiples and sales multiples gives the worst estimation for accrual earnings based multiples. In the paper by Agnes Cheng and McNamara (2000) it was found that valuation accuracy for the P/E methods is higher than the P/B method, however a combination of the P/E and P/B is most accurate in predicting future stock prices. This finding is consistent with the growing importance of the book value of equity in estimating shareholders equity. Moreover, regardless of the peer group definition and valuation technique, the accuracy increases with firm size.

Empirical research on applied equity valuation techniques during the 1990s by sell-side equity research analysts showed a strong preference for singleperiod valuation models. Arnold and Moizer (1984) and Pike, Meerjanssen, and Chadwick (1993) conducted interviews with respectively U.K. and German based equity research analysts and found that the dominant equity valuation tool was

[5]See Goedhart, Koller, and Wessels (2010) exhibit 14.6, page 322.

the singleperiod P/E ratio. Block (1999) conducted similar research by sending questionnaires to members of the Association for Investment Management and Research and showed that investment analysts hardly use present value techniques to determine mispriced stocks.

2.2.4 Conclusions on singleperiod valuation methods

From the above analysis it is recommended that equity research analysts focus on leading multiples, denominate the singleperiod valuation method with accrual earnings figures (preferably the EBITA) and numerate it with the market value of equity. These conclusions are both theoretically and empirically proven, except for the usage of EBITA denominators.

Although the accuracy in applying singleperiod valuation methods and multiperiod valuation techniques is identical, there are some disadvantages in using singleperiod valuation techniques which must be overcome. These disadvantages are the ignorance of future value drivers, useless multiples after a loss making year, finding firms with identical leverage levels.

The theoretical recommendations for applying singleperiod valuation techniques are also not provided on a firm level. Yet a broader theoretical framework, compared to the usage of multiperiod valuation techniques, is provided for equity research analysts when applying singleperiod valuation techniques.

Chapter 3

Literature Review & Hypotheses

From the observations discussed in the introduction section, and the theoretical background on valuation methodologies, the hypotheses are formulated. The hypotheses on firm level determinants explaining the valuation behavior of equity research analysts is given in section 3.1. Section 3.2 discusses economic indicators affecting research analysts decision to apply certain valuation methods.

3.1 Firm level determinants

The first research objective aims to define firm level determinants influencing equity research analysts in their valuation behavior. The hypotheses on firm level determinants influencing sell-side equity research analysts are divided into operating performers, capital structure, stock return volatility and firm size.

Operating performance

Firms experiencing relatively higher historical and forecasted sales growth could be exposed to a lot of growth opportunities. Valuing those firms using singleperiod equity valuation does not capture the upside potential incorporated by multiperiod equity valuation models. Demirakos, Strong, and Walker (2004) and Glaum and Friedrich (2006) already showed that sales growth is indeed influencing the employment of the discounted cash flow model. Therefore it is hypothesized that firms experiencing high historical and forecasted sales growth are valued using the DCF method.

Firms which report negative or low operating margins in the forecast year experience a low profitability. This indicates that a singleperiod valuation method would be inappropriate since it results in low or negative estimations of the market value of equity. For IPO underwritings Roosenboom (2007) demonstrated

that higher profitability increase the use of singleperiod valuation models. Thus, a positive relation is expected between profitability and the likelihood of applying singleperiod equity based valuation models.

Although Demirakos, Strong, and Walker (2004) reported that a higher historical volatility in earnings corresponds to a more frequent use of multiperiod equity valuation models, in this thesis the opposite is hypothesized. High volatility in earnings indicates that future forecasting of earnings is more difficult. In order to estimate the market value of a company analysts will apply enterprise based financial figures, like total sales or EBITDA, or switch to a multiperiod equity valuation. As a results, it is hypothesized that high earnings volatility negatively influences the use of singleperiod equity based valuation methods.

Capital structure

According to Demirakos, Strong, and Walker (2004) a positive relation between research and development (R&D) investments and multiperiod equity valuation models is existing and implies the presence of future growth opportunities. Yet, data sources on R&D figures are poor, hence the more general definition of intangible assets as part of total assets is used. Intangibles include R&D, information technology or customer acquisition and is expensed instead of capitalized (Lev (2001)). This indicates that accrual earnings based models do not capture true firm value, so firms are expected to be valued using cash flow based models. Since cash flow statement singleperiod valuations methods are seldom applied, it is assumed that high intangibles are positively related to the discounted cash flow model.

Theoretical background on the employment of equity based multiples or enterprise based multiples is widespread and described in chapter 2. When leverage is not controlled for, biased singleperiod equity based valuation estimates arise. Equity research analysts are assumed to understand this shortcoming and as a results ignore the usage of singleperiod equity based valuation models. Accordingly, it is hypothesized that highly leveraged firms are valued according to singleperiod enterprise based valuation methods.

Instead of investing the retained earnings in tangible or intangible assets firms may chose to pay out dividends. Empirical and interview based evidence from Roosenboom (2007); Imam, Barker, and Clubb (2008) and Deloof, De Maeseneire, and Inghelbrecht (2009) show that high dividend paying firms are willing and confident to maintain paying out dividends in the future. Consequently, it is predicted that high dividend paying firms are inclined to be valued using multiperiod equity valuation models, which could either be the DCF or DDM.

The maturity hypothesis developed by Grullon, Michaely, and Swaminathan (2002) states that in the transition from the growth phase to the mature phase competitors enter the industry causing a decline in investment opportunities and an abundance of free cash flows. For mature firms, measured as the founding year until the year of the equity research report release, the risk of volatility in future income streams is low and the predictability of free cash flow streams is large. This leads to the expectation that mature firms are valued according to

the DCF method.

Stock return volatility

Daily stock return volatility on a historical 90-day trading interval ending on the day of the equity research report release is included in the empirical model. It is argued that when the share price is very volatile the market is uncertain regarding future operating performance of the company. This volatile share price could be an indicator of economic uncertainty, be an indicator of weak sector performance or be an implication that a significant one write-off has to be conducted. In all circumstances the use of singleperiod equity valuation model is too limited. Therefore, it is hypothesized that, due to the uncertainty, the employment of singleperiod equity based valuation methods is negatively related to high historical share price volatility.

Firm size influences

Even though Roosenboom (2007) showed that firm size, in terms of total assets, does not influence the choice of applied valuation model within an IPO context, Alford (1992) and Lie and Lie (2002) empirically found that the estimation accuracy for singleperiod equity based models is higher compared to small and medium size firms. This indicates that a profound analysis on constructing a peer group is more beneficial for large firms than for medium or small firms. The estimation accuracy of large firms is high and, assuming equity research analysts are aware of this relation, it is hypothesized that large firms are valued using singleperiod enterprise based valuation methods.

Womack (1996) and Chan and Chang (2008) found that the relation between excess market return after a recommendation revision and firm size, defined as market value of equity, is negative. This indicates that small firms outperform (underperform) large and medium size firms after a stock price upward (downward) revision. If research analysts are informed about this effect a singleperiod valuation would be irresponsible. Multiperiod equity valuation models are more appropriate since they better explain a stock price recommendation revision. By including an interaction term between firms experiencing a recommendation revision and a dummy for small firms, based on the market value of equity, it is hypothesized that the interaction term is positively related to the usage the DCF.

Control variables

Two control variables are included to increase the power of the tests. As shown by Bradshaw (2002), favorable stock recommendations (and target prices) are explained by P/E ratios, while less favorable recommendations are not justified by any particular equity valuation approach. However, Asquith, Mikhail, and Au (2005); Bertinetti, Cavezzali, and Rigoni (2006) disprove this explanation and show that there is no relation between the delta (i.e. the relative difference

between the current stock price and recommended target stock price)[1] and the applied equity valuation technique. No relation is expected beforehand, yet the inclusion of this control variable will increase the robustness of the other predictor variables.

The second control variable accounts for the length of an equity research report. Although statistical evidence is lacking Demirakos, Strong, and Walker (2004) found that multiperiod equity valuation models were less frequently applied in shorter research reports. Normally, shorter reports tend to focus on income statement items and non-financial information instead of valuation remarks (see Previts, Bricker, Robinson, and Young (1994); Breton and Taffler (2001)). Since multiperiod valuation models normally require more space, it could be expected that longer reports more frequently apply multiperiod valuation models.

Hypothesis 1: The probability of applying the discounted cash flow model increases for higher sales growth, intangibles, dividends and firm age.

Hypothesis 2: The likelihood of employing singleperiod equity based valuation models increases for high profitability and decreases for high earnings volatility.

Hypothesis 3: Leveraged firms are more likely to be valued using singleperiod enterprise based valuation models.

Hypothesis 4: High historical stock price volatility decreases the probability of applying singleperiod equity based valuation methods.

Hypothesis 5: Singleperiod enterprise based valuation models are more likely applied for large firms in terms of total assets.

Hypothesis 6: The probability of using a multiperiod equity valuation technique or the DCF method is higher for small firms experiencing a stock price recommendation revision.

3.2 Global financial crisis

The second research objective in this thesis analyzes the effects of the global credit crisis on the employment of equity valuation models. The hypothesized economic indicators capture GDP growth levels, market index return and market return volatility, and reputation influences comprising of stock exchanges reputation and involvement in investment banking activities.

Global economic crisis

After the collapse of Bear Stearns and Lehman Brothers in September 2008 a financial shock evolved throughout the global financial community. Other

[1] $Delta = \left(\frac{target\,price - current\,price}{current\,price}\right)$

financial institutions were uncertain about their exposure to these two financial conglomerates, and as a result, nobody could foresee to what extent they were affected. Global stock markets plummeted and global GDP levels decreased.

No previous literature has analyzed the effect of negative GDP growth on the utilization of equity valuation models. However, Glaum and Friedrich (2006) surveyed analysts after the dot.com bubble and concluded that analysts were more focused on fundamentally driven cash flow based methods and valuation became more conservative, indicating a deeper analysis of the company its strategy and risk factors.

Research analysts are expected to change their behavior and focus on a more fundamental multiperiod valuation technique when negative economic indicators become public. By gathering data on quarterly GDP) percentage changes of the countries in which the firms are headquartered, it is hypothesized the either the use of the DCF increases or the use of on singleperiod models decreases. Since negative quarterly economic indicators are released one quarter later, the effect of the applied equity valuation model is analyzed one quarter before the disclosure of the equity research report.

Stock exchange volatility and return

Besides GDP growth possibly influencing the employment of equity valuation techniques, stock index return and index return volatility could also affect the valuation process. Roosenboom (2007) analyzed the stock market return and stock market volatility 90 days prior to the IPO and concluded that the utilization of multiperiod equity valuation models is more frequent when stock market returns are high and when the stock market is relatively volatile.

When reasoning from an equity research analysts perspective it could be reasoned that first, when the equity market is rising investors are more easily willing to accept the assumptions underlying multiperiod equity valuation models. Second, higher volatility, and therefore uncertainty, in the financial markets requires a more in-depth equity valuation technique based on a multiperiod valuation forecast. By analyzing stock market returns and stock market volatility on a 90 day interval, ending on the day of the equity research report release, it is hypothesized that rising stock markets and higher stock market volatility increase the usage of multiperiod equity valuation models or the DCF method.

Reputation influences

Another crucial element in the comparison between large and small firms is the information set available to equity research analysts. According to Grant (1980); Collins, Kothari, and Rayburn (1987) the information release of firms listed on high liquidity stock markets is more frequent and broader and, due to the higher amount of research analysts following these firms, estimates of permanent earnings changes are more accurate and efficient. In addition, Brennan, Jegadeesh, and Swaminathan (1993); Lang and Lundholm (1996) showed that the dispersion among analysts is negatively related to firm size and in-

formation is more quickly translated into the stock price. Since stock prices are fairly reflecting firm value on reputable stock exchanges and constructing a peer group is more beneficial for larger firms, financial analysts following firms on established stock exchanges are inclined to use singleperiod equity valuation techniques. Therefore, it is hypothesized that firms listed on established stock exchanges employ singleperiod equity based valuation methods.

Although the so-called Chinese Wall should prevent interaction between equity research analysts and investment bankers, it is understandable that equity research analysts tend to be more positive about firms when they are aware that the bank is involved in investment banking services for the same corporate client. From the literature it is shown that equity research analysts are more optimistic when their employer is involved in investment banking services (see Dugar and Nathan (1995); Hong and Kubik (2003)). Optimistic research reports are usually supported by multiperiod equity valuation models (like the DCF) since they are better able to capture optimistic forecasts. Therefore, the second interaction term combines a dummy for top investment banks heavily involved in investment banking services and a dummy for a peak quarter in M&A and equity issuing activity. It is hypothesized that the interaction term is positively related to the employment of multiperiod equity valuation models.

Control variable: bankruptcy Lehman Brother

The findings on the employment of equity valuation models shows a preference for multiperiod valuation models at the beginning of the 2000s (Demirakos, Strong, and Walker (2004); Imam, Barker, and Clubb (2008); Glaum and Friedrich (2006)) and a focus on singleperiod equity valuation analysis during the 1980s and beginning of 1990s (Arnold and Moizer (1984); Pike, Meerjanssen, and Chadwick (1993)). This shift is possibly explained by the dot.com bubble in March 2000. The bankruptcy of Lehman Brother in September 2008 generated a shock through the financial industry and worked as a catalyst for the global economic recession. By including a dummy for equity research reports released after September 2008 it is analyzed whether equity research analysts abruptly changed their valuation behavior.

Hypothesis 7: Negative GDP growth increases the probability of using the discounted cash flow method or decreases the probability of using singleperiod valuation models.

Hypothesis 8: Rising stock markets and high stock market volatility enlarge the probability of applying the discounted cash flow model.

Hypothesis 9: Firms listed on reputable stock exchanges are more likely to be valued using singleperiod equity valuation methods.

Hypothesis 10: The chance of using multiperiod equity valuation models for top investment banks is higher during peak seasons in M&A and IPO activity.

Chapter 4

Data & Methodology

In this chapter the data set and applied methodologies are discussed which are used for the empirical testing conducted in chapter 5. In section 4.1 the scoring convention and selection criteria are explained and an elaborate examination of the applied methodology, including the empirical model estimation, is given in section 4.2.

4.1 The data set

Scoring convention

A crucial distinction between previous academic research on applied equity valuation techniques and this paper is the scoring convention. While Demirakos, Strong, and Walker (2004); Bertinetti, Cavezzali, and Rigoni (2006) and Imam, Barker, and Clubb (2008) only classify one equity valuation method for each equity research report, this thesis identifies every equity valuation model used to determine the target price. In a wide array of equity research reports analysts deliberately stated that different equity valuation techniques have been applied to estimate the target price. In these cases all applied valuation models are classified and included into the data set, regardless of weights assigned to different valuation methods[1].

Furthermore, when an equity research report used several different equity valuation techniques for a sum-of-the parts analysis all the different methods are identified[2]. Demirakos, Strong, and Walker (2004) analyzed the effects of the use of alternative equity valuation models. Yet, in this data set the use of alternative equity valuation models is only present in 78 equity research reports

[1] To illustrate, the equity research report of Usiminas by Citibank on 1 July 2007 attached weights of 40% on EV/EBITDA, 30% on P/E and 30% on DCF model, yet all valuation models are classified into the data set.

[2] To illustrate, the equity research report of Equitable Resources by Deutsche Bank on 20 August 2007 valued two divisions separately according to the net-asset-value technique and EV/EBITDA method.

which is equal 18.9% of the data set. Logistic regressions on such a small sample size are untrustworthy.

Compared to Demirakos, Strong, and Walker (2004); Imam, Barker, and Clubb (2008), who only covered a total of 104 equity research reports and 98 equity research reports, this sample size is significantly larger with 412 equity research reports. Table 4.1 gives an overview of the equity valuation techniques utilized by sell-side equity research analysts.

Selection criteria & summary statistics

The selection of this data set is based on 108 midcap firms with a market value ranging between $2 bn. and $5 bn. in January 2005. Between 2006 and 2010 equity research reports are collected from the same companies which exceeded a minimum length of 15 pages and resulted in a final data set of 412 equity research reports. The volatile stock markets experienced during the sample period caused market capitalization of the total data set to vary between $0.77 bn. and $28 bn. Due to the positive skewness, 84% of the data set falls within the range of $1 bn. and $10 bn and 47% is between $2 bn. and $5 bn. (not tabulated).

Table 4.2 reports the summary statistics. Panel A and panel B reveal that the sample is characterized by balanced and unbalanced data. The equity research reports are grouped in sectors according to two-digit Standard Industrial Classification (SIC) codes. The covered sectors include consumer (25), energy (10), healthcare (35), industrials (20), materials (15), staples (30), technology (45), telecom (50) and utilities (55)[3]. The nine different industries are represented by 12 firms except for healthcare and materials with respectively 11 and 13. Column 4 shows that the amount of average firm-year observations between sectors is less fairly distributed compared to number of firms. However, with an average of amount 9.2 firm year observation and a standard deviation of 1.4 over all sectors, the research reports are considered to be fairly distributed over the sector and per year.

In addition, the distribution of large established investment banks and relatively smaller brokerage firms is shown in column 5. Large investment banks represent on average 57% of total reports with relative outliers in the energy and industrials sector. This observation shows that also the distribution of broker reports per industry is equally divided between top investment banks and relatively smaller financial services companies.

Panel B illustrates the part of the data set which is unequally distributed. In total 30 countries are represented in the sample and on average 34% of the data set is based in the United States, only the staples sector deviates with most companies headquartered in Japan. In column 8 and 9 it is demonstrated that the stock exchanges are unevenly spread due to high presence of New York Stock Exchange (NYSE). In total the firms under research are listed on 29 different stock exchanges which makes the 34% representation of the NYSE

[3]Number in brackets represent the two-digit SIC codes.

Table 4.1: **Definitions of applied equity valuation models**

Table shows the equity valuation models utilized in the 412 researched equity reports. Column 2 gives the abbreviation of the definitions in column 1.

Definition	**Abbr.**	**Description**
Discounted cash flow	DCF	Net present value of a firm's future cash flows over multiple periods
Economic valued added	EVA	Net earnings subtracted by the total capital multiplied by the WACC[1]
Dividend discount model	DDM	Net present value of a firm's future dividend payments over multiple periods
Residual income model	RIM	Book value of equity plus the net present value of residual earnings over multiple periods
Cash flow return on enterprise value[2]	CFRoEV	Free cash flow after tax divided by a firm specific hurdle rate applied on an enterprise value wide level
Lease valuation	-	Net present value of a firm's future cash flows of the lease contracts over multiple periods
Regulated return on invested capital correlation[3]	RRC	The RRC plots estimated return on invested capital against the ratio of current enterprise value over current invested capital
Cash flow return on invested capital[4]	HOLT	Cash flow return on invested capital over the borrowing costs of the invested capital
Net asset value	NAV	Net present value of future production from the existing reserve base, plus other assets, less debt and other liabilities
Return on invested capital	ROIC	Historical EV / net-capital-invested multiples divided by return-on-invested-capital / cost-of-capital excess return multiple
Price-to-earnings	P/E	Market value of equity divided by firm's current net income
Price to earnings growth	PEG	Price to earnings ratio divided by long term earnings per share growth rate
Price-to-book	P/B	Market value of equity divided by firm's book value of equity
Price-to-sales	P/Sales	Market value of equity divided by firm's total sales
Price to operating cash flow	P/OCF	Market value of equity divided by firm's operating cash flow
Price to net asset value	P/NAV	Market value of equity divided net asset value
Enterprise value to earnings before interest, taxes, depreciation and amortization	EV/EBITDA	Enterprise value divided by firm's net earnings before interest, taxes, depreciation and amortization
Enterprise value to earnings before interest and taxes	EV/EBIT	Enterprise value divided by firm's net earnings before interest and taxes
Enterprise value to sales	EV/Sales	Enterprise value divided by firm's total sales
Enterprise value to earnings	EV/E	Enterprise value divided by firm's net earnings
Enterprise value to free cash flow	EV/FCF	Enterprise value divided by the firm's current free cash flow
Enterprise value to capital employed	EV/CE	Enterprise value divided by the total capital employed
Earnings yield	EY	Firm's net earnings divided by market value of equity (inverse of P/E ratio)

[1] WACC refers to the weighted average cost of capital.
[2] Cash flow return on enterprise value is only applied by the Berenberg Bank.
[3] Regulated return on invest capital correlation is only applied by Credit Suisse.
[4] Cash flow return on invested capital (HOLT) is designed and applied by Credit Suisse (https://www.credit-suisse.com/investment_banking/holt/en/).

Table 4.2: **Summary statistics**

Table gives an overview of the distribution of the data set categorized per industry. Numbers in brackets are the standard deviation of the average firm year observations. LSE stands for the London Stock Exchange and TSE stands for the Tokyo Stock Exchange. The second column refers to the number of unique firms per sector and the third column refers to firm-industry observations.

			Panel A: Balanced			Panel B: Unbalanced			
Industry	**n.**	**Obs.**	**Average firm-year observation**		**Investment bank[1]**	**Country**		**Stock Exchange**	
Consumer	12	49	9.8	(0.8)	55%[2]	US	53%	NYSE	39%
Energy	12	44	8.8	(0.4)	68%	US	36%	NYSE	41%
Healthcare	13	53	10.6	(1.3)	53%	US	64%	NYSE	45%
Industrials	12	45	9.0	(2.2)	67%	US, UK, Japan	20%	LSE	29%
Materials	11	42	8.4	(1.9)	48%	US, Canada	24%	NYSE	57%
Staples	12	50	10.0	(0.7)	58%	Japan	30%	TSE	30%
Technology	12	44	8.8	(1.3)	50%	US	36%	NASDAQ	32%
Telecom	12	45	9.0	(1.0)	60%	US	31%	NYSE	58%
Utilities	12	40	8.0	(1.2)	58%	US	30%	NYSE	38%
Total	108	412	9.2	(1.4)	57%	US	34%	NYSE	36%

[1]Investment bank include top investment bank, which are Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, Macquarie, Merrill Lynch, Morgan Stanley and UBS

[2]Percentages shows the amount of equity research reports released by top investment bank

too substantial. This over representation is in particularly observed for the materials, 57%, and telecom sector, 58%. However, within the industrials sector the London Stock Exchange (LSE) dominates, while the Tokyo Stock Exchange (TSE) prevails, as expected, in the staples sector.

From the above summary it is concluded that the sample consists of balanced data items in terms of equal spread over industries, years, industries and equity brokerage firms. And unbalanced data items for country of residence and the stock exchanges.

4.2 Methodology

The aim of this section is to elaborate on the applied statistical methodologies. The first subsection described the usage of logistic regression. Although the utilization of ordinary least square regressions is common in financial data analysis, logistic regression enable an empirical analysis to be conducted on binary response variables. Subsection 4.2.2 elaborates on the empirical model derived from the logistic regression and this section completes with an overview of the descriptive statistics of the used predictor variables.

4.2.1 Logistic regressions

In this thesis logistic regressions, or binary logit models, are utilized to study the decision making process of an equity research analyst when assessing which equity valuation method to apply. The response variable in the empirical models is the choice of a particular equity valuation technique, which is a limited independent variable or binary response variable. The limitations of simply running ordinary least square (OLS) regressions, with a dummy variable as dependent variable, is that through the process of truncation too many estimated probabilities result in values which are either zero or one. Yet, it is not plausible to suggest that the probability of the dummy variable is exactly zero or one and as a consequence these outcomes are likely to happen under all circumstances. A logit or probit estimation model is able to overcome the limitations of the linear probability model with a binary response variable and is explained by Brooks (2008).

Logit and probit models compared

The logit model, similar to the probit model, produce probabilities which transform the regression model so that the fitted values are estimated within the (0,1) interval. A fitted regression model appears as an s-shape instead of a straight line. The difference between both models is that the logit model constructs a cumulative logistic function to transform the model, while the probit method applies a cumulative distribution function. Mostly, both models produce similar characteristics of the data since the densities are very similar, moreover the current computational possibilities makes the choice of either model even more arbitrary. The non-linearity of the logit and probit models means that a regular OLS estimation model cannot be used. Therefore, the parameters are estimated using the maximum likelihood (ML) approach. As stated by Heij, De Boer, Franses, Kloek, and Van Dijk (2004) no compelling reasons exist to apply either a probit or a logit model. The difference is that the cumulative distribution function of logit models is computed explicitly, while the cumulative distribution of the probit models is computed by approximating the integral. Furthermore, the marginal effects in the logit models are larger in the tails and around the mean and for the probit model this effect is larger in the two regions in between. However, the statistical software models are currently vastly developed that computational errors are low and the estimation of probit and logit models is comparable.

4.2.1.1 Interpretation of predictor variables

One pivotal distinction of logistic regressions in categorical data analysis is the interpretation of the parameters of the independent variables described by Agresti (2002). In normal ordinary least squares regression the response variable has a linear relation with its predictor variables. The response variable in logistic regression exists of values which are either one or zero and therefore a

non-linear relationship with its independent predictor variables exists. In binary regression models the response variable has a non-linear relationship with its predictor variables indicating that a higher (lower) value of the predictor variable results in a higher (lower) probability that the response variable will be one (zero). The shape of the curve becomes an s-shape and is captured according to formula 4.2.1 indicating a logistic regression model.

$$\pi(x) = \frac{exp\,(\alpha + \beta x)}{1 + exp\,(\alpha + \beta x)} \tag{4.2.1}$$

Where $\pi(x)$ is the probability of the response variable being one, $\alpha + \beta x$ is the generalized linear probability model for a binary response regression.

$$\frac{\pi(x)}{1 - \pi(x)} = exp\,(\alpha + \beta x) \tag{4.2.2}$$

Formula 4.2.2 shows the odds ratio of the predictor variable and through formula 4.2.3 the logistic regression is substituted to a log odd linear relationship.

$$logit\,[\pi(x)] = log\frac{\pi(x)}{1 - \pi(x)} = \alpha + \beta x \tag{4.2.3}$$

The sign of the β in formula 4.2.3 determines the log odds ratio. If the sign is positive the predictor variable increases the likelihood of the response variable being one, similarly when the sign of the predictor variable is negative the likelihood of the response variable reaching zero increases.

Explanation of log odds coefficients

The odds ratio is the probability of success divided by the probability of failure and is an exponential function of x. This indicates that the odds increase multiplicatively by $exp(\beta)$ for a one-unit increase in x, so $exp(\beta)$ is therefore the odds ratio. If the parameter of a predictor variable is (i.e. the log odds ratio) 0 the odds ratio is $1[exp(0)]$, which indicates a 50/50 probability of success. For example, if parameter β_1 is 0.631, the odds ratio is $[exp(0.631)]$ 1.879, denoting that a one-unit increase in x_1 increases the odds of success by 87.9%. Likewise if a parameter β_2 is -0.487, the odds ratio is 0.614 $[exp(-0.487)]$ which indicates that a one-unit increase in x_2 changes the odds of success of the dependent variable by a multiplication of 61%[4]. In the appendix (see appendix A) an overview is given on the relation between the log odds, odds ratios and probabilities of success.

The above described interpretation of the parameters in logit models is referring to continuous variables, yet in this thesis the use of dummy variables are applied as well. The interpretation of dummy variables is relatively straightforward. If the parameter of dummy variable β_3 is 0.849 with an odds ratio of

[4] Alternative interpretations of negative log-odds coefficients are given by DesJardins (2001)

$exp(0.849) = 2.337$ the probability of the dependent variable being a success is 133% higher when the dummy variable has a value of one instead of zero.

4.2.1.2 Specification errors

The last section of the logistic regression elaboration discusses the characteristic of applied logistic regressions. Straightforward in regression analysis is the use of a dependent variable and a variety of independent variables. A researcher directly analyzes the sign and magnitude of the parameters, significant levels and goodness of fit tests. The dependent variables in the logit models are the used type of equity valuation technique.

Previous academics have analyzed the utilization of equity valuation methods, but either researched significant differences between industries (Demirakos, Strong, and Walker (2004); Imam, Barker, and Clubb (2008)) or analyzed the estimation accuracy of different valuation techniques (Bradshaw (2002)). Roosenboom (2007) is the first who utilized binary logit models to test which firm level determinants affect the utilization of a specific equity valuation method.

Before the empirical model is estimated it is important to consider the four step procedure presented by Studenmund (2011) on the inclusion of independent variables into a regression model. Through this four step procedure specification errors should be neutralized. The first step focuses on the theoretical logic of including an independent variable. The second step analyzes whether the coefficient of the variable is significant according to the z-statistic in logistic regressions. The third consideration argues whether the goodness of fit, or R^2, of the model improves and lastly, does any bias occur in terms of decreased significance and sign of other variables.

In order to test the robustness of the logistic regression the goodness of fit test and likelihood ratio test are analyzed. In logit models the goodness of fit test is classified as the McFadden's R^2or pseudo R^2, which is different from the regular R^2. McFadden's R^2calculates the maximum log-likelihood (LLF model) for the logit and probit model and divides it by LLF_0 (log likelihood) of the restricted model in which all the parameters are set to zero. McFadden's R^2 tends to be smaller than normal R^2 and therefore values between 0.2 and 0.4 are considered to be highly satisfactory. The second test on model robustness is the likelihood ratio test (lr-statistic). This test assess the individual contribution of the predictor variables to the overall model and determines whether the overall model is statistically significant. The test is basically a chi-square test on the overall regression model.

4.2.2 Empirical model

The cross-sectional empirical models applied in this thesis are explained in this section. By using logistic regressions, or binary logit models, it is tried to understand which determinants explain the choice of a particular valuation model. The binary logit models are concentrated on three equity valuation categories

which are the DCF (DCF), singleperiod equity based model (S-EQ) and singleperiod enterprise based technique (S-EN). The reasons why the logistic regressions are only conducted on these three equity valuation categories is further explained in section 5.1.

Model 1 [2,3] shows the estimation of the first model including the firm level determinants explaining the choice to use a certain valuation technique. Because the data set is relatively small, observations with large outliers have not been deleted, but have been replaced by the mean value of the variable. Observations are classified as outliers when the value is three standard deviations away from the mean value. This procedure has been applied for sales growth (SGROW) and earnings volatility (EVOL) and significantly improves the normality of the predictor variables. In addition, to control for heteroskedasticity, Brooks (2008) recommends to transform size variables into logs, so that extreme variables are 'pulled-in'. This transformation is conducted for the variable firm size (LnSIZE) measured in total assets. As a result the following model is estimated:

Model 1 [2,3]:

$$DCF_i\ [UNSOP-EQ_i, UNSOP-EN_i] = \beta_0 + \beta_1 SGROW_i + \beta_2 PROF_i + \beta_3 EVOL_i + \beta_4 INTANG_i + \beta_5 LEVERAGE_i + \beta_6 DIV_i + \beta_7 AGE_i + \beta_8 SVOL_i + \beta_9 LnSIZE_i + \beta_{10} REVISION * MCAP_{small\,i} + \beta_{11} DELTA_i + \beta_{12} LENGTH_i + \epsilon_i$$

In model 4 [5,6] economic indicator variables are incorporated to analyze their influence on the implementation of equity valuation methods. Firm level determinants are included in the model to test their robustness and analyze the effect of economic indicators given that other variables stay the same. The model is estimated as follows:

Model 4 [5,6]:

$$DCF_i\ [UNSOP-EQ_i, UNSOP-EN_i] = \beta_0 + \beta_1 SGROW_i + \beta_2 PROF_i + \beta_3 EVOL_i + \beta_4 INTANG_i + \beta_5 LEVERAGE_i + \beta_6 DIV_i + \beta_7 AGE_i + \beta_8 SVOL_i + \beta_9 LnSIZE_i + \beta_{10} REVISION * MCAP_{small\,i} + \beta_{11} DELTA_i + \beta_{12} LENGTH_i + \beta_{13} CRISIS_i + \beta_{14} MRET_i + \beta_{15} MVOL_i + \beta_{16} EXCHANGE_i + \beta_{17} BANK * PEAK_i + \beta_{18} LEHMAN_i + \epsilon_i$$

Table 4.3 describes variable definitions for the response and predictor variables used in the empirical models.

4.2.3 Descriptive statistics

Descriptives of continuous variable

Table 4.4 shows the descriptive statistics which are derived directly from the equity research reports or through external data sources like Thomson One Banker for related financial figures and Datastream for the relevant information regarding stock prices and indices.

Table 4.3: **Variable definitions**

Variable name	Description
Response variable	
DCF	Dummy variable equal to one if the underwriter uses a discounted cash flow method.
S-EQ	Dummy variable equal to one if the underwriter uses an singleperiod equity based valuation technique.
S-EN	Dummy variable equal to one if the underwriter uses an singleperiod enterprise based valuation technique.
Predictor variables	
SGROW	Sales growth five years prior to the first estimation year $(t-5)$ until two forecasted years $(t+2)$, historical sales level derived from Thomson One Banker.
PROF	Percentage of current year's (t) forecasted earnings before interest and taxes (EBIT) to current year's (t) sales level, data derived from Thomson One Banker.
EVOL	Standard deviation of earnings growth during the period five years prior to the first estimation year $(t-5)$ until two forecasted years $(t+2)$. Historical net earnings are derived from Thomson One Banker.
INTANG	Percentage of prior year's $(t-1)$ total intangible assets to prior year's $(t-1)$ total assets, data derived from Thomson One Banker.
LEVERAGE	Percentage of prior year's $(t-1)$ total debt to prior year's $(t-1)$ total capital, data derived from Thomson One Banker.
DIV	Percentage of prior year's $(t-1)$ dividend payout per share to prior year's $(t-1)$ net earnings per share, data derived from Thomson One Banker.
AGE	Difference between the founding year (derived from company website) and the release year of the equity research report.
SVOL	Stock return volatility on a 90 trading day interval ending on the date of the equity research report disclosure. Closing stock prices are derived through Datastream.
DELTA	Percentage difference between the current stock price and target price stated on the equity research report.
LENGTH	Total pages of equity research report.
CRISIS	Dummy variable equal to one if the country of the located company's headquarter experienced negative GDP growth one quarter before the quarter of the report release. Data derived through the statistics database from the International Monetary Fund website.
MRET	Market index return on a 90 trading day interval ending on the date of the equity research report disclosure. Stock indices are derived through Datastream.
MVOL	Market index return volatility on a 90 trading day interval ending on the date of the equity research report disclosure. Stock indices are derived through Datastream.
LEHMAN	Dummy variable equal to one if the equity research report is released after September 2008, corresponding to the bankruptcy of Lehman Brothers.
LnSIZE	Natural logarithm of assets (in millions of \$) for the year in which the equity research report is released.
EXCHANGE	Dummy variable equal to one if the stock exchange, on which the company is listed, belongs to the top 75% of the global top 10 most reputable global stock exchanges. Reputation is based on size and trading activity and statistics on a yearly basis are downloaded from the World Federation of Exchanges (WFE).
REVISION * $\text{MCAP}_{\text{small}}$	Interaction dummy variable equal to one if a firm experienced a recommendation revision stated in the equity research report and if the company is based in the lowest quartile in terms of market capitalization, market value derived from the equity research report. Quartiles are constructed on a yearly basis.
BANK * PEAK	Interaction dummy variable equal to one if the broker releasing the equity research reports is ranked within the top 10 of the M&A league table or equity issuing league tables, and if total M&A value and equity issuances within a quarter is higher than the average plus one time the standard deviation over the period between 2002 and 2011, data downloaded from Thomson One Banker.

Table 4.4: **Descriptive statistics of continuous variables**
Table shows descriptive statistics for each continuing variable. Variable definitions are given in table 4.3.

			Percentiles					
	Mean	**Min**	**25th**	**50th**	**75th**	**Max**	**St. dev.**	**N.**
SGROW (%)	15.12	-16.78	5.21	11.60	18.68	370.71	24.62	412
PROF (%)	15.01	-93.35	6.13	13.07	21.48	109.60	17.71	403
EVOL (%)	227.16	0.00	19.70	43.84	162.00	8274.85	788.80	412
INTANG (%)	15.85	0.00	1.41	7.83	27.28	69.00	17.87	412
LEVERAGE (%)	29.32	0.00	8.77	27.80	43.45	131.06	23.72	411
DIV (%)	26.49	-9.50	3.33	21.52	37.31	126.20	25.27	412
AGE (years)	57.09	2.00	19.00	39.00	97.00	163.00	46.08	412
SVOL (%)	2.43	0.00	1.65	2.16	2.86	7.92	1.20	412
DELTA (%)	15.90	0.00	8.27	15.35	21.81	64.68	10.51	412
LENGTH (pages)	30.28	2.00	20.00	27.00	36.00	96.00	14.03	412
MRET (%)	2.36	-40.04	-5.76	3.87	10.69	73.09	13.76	412
MVOL (%)	1.40	0.44	0.94	1.21	1.59	4.88	0.73	412
SIZE (millions $)	5,619.22	357.80	1935.26	3,843.09	6817.62	51,392.13	6,243.62	412

Sales growth (SGROW) is estimated five years prior $(t-5)$ to the release of the equity research report until three years forward $(t+2)$. Historical sales figures are derived from Thomson One Banker and forward looking sales level are derived from the equity research report. In case firm specific data was not available five years backward or an equity research analysts only forecasted two or one year forward, the calculation was adapted to a shorter time period. The table shows the average [median] sales growth level equals 15.1% [11.6%]. Profitability is measured as the firstly forecasted EBIT (t) divided by forecasted sales, directly testing the relationship between profitability level estimated by the analyst and the configuration into the equity valuation model. The average [median] PROF has a relative value of 15.0% [13.1%]. Earnings volatility (EVOL) is similarly constructed as sales growth, and therefore covers a sample period of maximum eight data points, has is an average [median] value of 227.2% [43.8%].

Continuous variables based on capital structure begins with total intangibles (INTANG). This value is defined as total intangibles divided by total assets one year prior to the equity research report estimation year $(t-1)$ and the average [median] value is 15.9% [7.8%]. The firms in the sample experienced and average [median] level of 29.3% [27.8%] of leverage (LEVERAGE), which is defined as total debt level divided by total capital one year prior the first estimation year. It is found that the average dividend payout ratio (DIV) in the sample equals 26.5% [21.5%] which is again based on one year prior the estimation year. The maturity (AGE) of the firms is measured from the year of existence until the year in which a report is released. The table shows the average [median] age is 57.1 [39.0] years.

Stock return volatility (SVOL) is calculated as the percentage volatility of daily stock returns on a 90-day trading basis from the date of the equity re-

search report release. Through Datastream daily closing prices are downloaded from the 108 companies within the data set. Table 4.4 shows that the average [median] value of stock price volatility equals 2.43% [2.16%].

The relative difference between the target price and current price (DELTA) is directly drawn from the equity research report and has an average [median] difference of 15.9% [15.4%]. The average [median] size of the equity research reports (LENGTH) equals 30.3 [27.0] pages.

Market return (MRET) is measured on a historical 90 day trading interval ending on the date of the equity research report release, resulting in approximately a four months period. Daily closing prices of the 26 different stock indices are downloaded through Datastream and linked to the companies which are listed on that particular stock exchange. The average [median] MRET equals 2.36% [3.87%]. The market index return volatility (MVOL) is based on a similar sample period and is measured as the standard deviation of the stock index return over the 90-trading day interval. The average [median] MVOL is 1.4% [1.2%].

Information on total assets (SIZE) are downloaded from Thomson One Banker and represent the balance sheet figure one year prior to the estimation year stated within the analyst report. Table 4.4 shows an average [median] size of $5,619.2 [$3,843.1] million.

Descriptives of dummy variables

Next to the bundle of continuous variables also a group of dummy variables is utilized in the empirical models. The first dummy is one if the country, in which the company its headquarters are located, experienced negative quarterly GDP growth (CRISIS). Because the data in this thesis consists of companies headquartered in 30 different countries, it would not suffice to analyze GDP levels of Europe or the United States. Hence, GDP percentage change data, at constant prices, on a country level are downloaded from the International Monetary Fund database[5]. Since economic data is released afterwards on a quarterly basis it is expected that analysts will adapt their behavior one quarter after the release of negative GPD growth. Table 4.5 shows that 81 equity research reports are released after the companies headquarters experienced negative GDP growth.

The second dummy is one if the stock exchange, on which the company is listed, belongs to the top 75% of total trading activity compared with the 10 largest global stock exchanges (EXCHANGE). The reputation of stock exchanges is based on total size and trading activity of the stock exchange, which indicates the success level of stock exchanges (see Pagano, Randl, Roell, and Zechner (2001)). Statistics on trading activity on a yearly basis are downloaded from the World Federation of Exchanges database (WFE)[6]. In appendix B an overview is given which stock exchanges were regarded as reputable stock exchanges over the sample period. The table reports that 225 equity research reports are listed on high reputable stock exchanges. Equity research reports

[5]Data is downloaded through http://www.imf.org/external/data.htm.

[6]see for data on global stock exchanges http://www.world-exchanges.org/statistics.

Table 4.5: **Dummy variable overview**

Table shows descriptive statistics for each dummy variable. Variable definitions are given in table 4.3.

Dummy	Success rate		
	Obs.	Yes	No
CRISIS	412	81	331
EXCHANGE	412	225	144
LEHMAN	412	182	230
REVISION	412	73	339
$MCAP_{small}$	412	105	307
BANK	412	212	200
PEAK	412	112	300
Interaction terms			
REVISION * $MCAP_{small}$	412	21	391
BANK * PEAK	412	55	357

released after September 2008, which corresponds to the bankruptcy of Lehman Brothers, is found on the third row (LEHMAN). The table shows that 182 equity research reports are disclosed after September 2008 and 230 before this month.

The first interaction term is a multiplication of two dummy variables. The first dummy variable is one if firms experienced a recommendation revision (REVISION). From table 4.5 it is shown that this is the case in 73 equity research reports. The second dummy is one if the company is in the lowest quartile in terms of market value of equity ($MCAP_{small}$). To control for the decrease in stock markets during 2008 and 2009 the procedure of Hirschey and Spencer (1992) is followed. This means that the sample is divided in quartiles for every year in the sample period, and as a result quartiles are constructed in 2006, 2007, 2008, 2009, and 2010 separately. Total amount of small cap firms is 105. The interaction variable shows that 21 small firms experienced a stock price recommendation revision.

The second interaction term consists of a dummy for top investment banks (BANK) and peak quarters in M&A and equity issuing activity (PEAK). The first dummy variable is one if the bank releasing the equity research report is an investment bank heavily involved in M&A deals and equity issuing. Through Thomson One Banker league tables are downloaded for M&A deal value and equity issuing value per investment banks for every year in the sample period[7]. If an investment bank releasing the equity research report in a particular year is ranked within the top 10 of either M&A or equity issuing league table the dummy is one. In appendix B an overview is given which investment banks are regarded as top investment banks over the sample period. In table 4.5 it is reported that 212 equity research reports are released by top investment banks.

[7] Equity league tables are only available for 2008, 2009 and 2010.

The second dummy is one if total M&A value and equity issuances within a quarter is higher than the average plus one time the standard deviation over the period between 2002 and 2011. This sampling period begins just after the dot.com bubble. In total five quarters within the sample period are defined as peak quarters. The interaction term is one for 55 equity research reports indicating that 55 reports are released by top investment banks within a peak quarter in M&A and equity issuing activity.

Chapter 5

Results

This chapter describes the main findings of the descriptive and empirical analysis conducted on the 412 equity research reports and is split up in five sections. The first section reports the descriptive analysis on the utilized equity valuation techniques from the data set. Section 5.2 and 5.3 show the results of the binary logit models and accept or rejects the developed hypotheses. Section 5.4 discusses the effect of industry classification and geographic location. Although the latter is not hypothesized, previous academics have analyzed the implementation of equity valuation models cross industry. By constructing logistic regression with firm level determinants and industry and regional dummies the relative importance is analyzed. Finally, section 5.5 reports several sensitivity analysis on the data set.

5.1 Descriptive analysis

Table 5.1 presents the descriptive analysis on the different equity valuation techniques applied within the sell-side equity research reports. In total 553 valuation models are employed over 412 equity research reports indicating an average of 1.34 valuation methods.

The three dominant valuation methods are the DCF, P/E and EV/EBITDA accounting for 82% of the total data set. The DCF is used in 181 equity research reports and from the industry analysis it is shown that the DCF is mostly applied in the telecom industry. P/E models are used in 168 equity research reports and most frequent in the consumer, healthcare and technology sector and avoided in the energy and telecom sector. The singleperiod valuation model EV/EBITDA is with 102 times less often applied and equally distributed over the sectors, except for the technology and telecom sector which are dominated by the P/E and the DCF method. Other valuation techniques which are more then 10 times applied are the NAV method utilized in 25 equity research reports, the EV/EBIT method 15 times and the P/B model 12 times.

Accrual based multiperiod valuation models, like the RIM and EVA, are only

Table 5.1: **Valuation model usage**

Table gives an overview of the valuations models applied in total and per sector. M-CF means multiperiod and cash flow based, S-CF mean singleperiod and cash flow based, M-AC means multiperiod and accrual earnings based, S-AC means singleperiod and accrual earnings based, M-AS means multiperiod and asset based and S-AS means singleperiod and asset based.

	Total	Type	Consumer	Energy	Healthcare	Industrials	Materials	Staples	Technology	Telecom	Utilities
DCF	181	M-CF	12	18	18	22	21	14	12	41	23
P/E	168	S-AC	29	5	34	16	15	25	28	3	13
EV/EBITDA	102	S-AC	12	14	16	13	13	14	1	6	13
NAV	25	S-AS	3	12	-	1	6	-	-	-	3
EV/EBIT	15	S-AC	2	2	-	3	1	5	2	-	-
P/B	12	S-AC	2	-	-	2	-	2	4	-	2
EV/Sales	9	S-AC	1	-	2	-	2	-	4	-	-
EV/FCF	6	S-CF	2	1	-	-	-	-	2	1	-
P/OCF	6	S-CF	-	1	-	1	3	-	-	1	-
DDM	4	M-CF	1	-	-	1	-	1	-	1	-
Lease valuation	4	S-AS	-	4	-	-	-	-	-	-	-
EVA	3	M-AC	-	-	-	1	2	-	-	-	-
CFRoEV	3	S-CF	-	-	-	1	-	1	1	-	-
RIM	2	M-AC	-	1	-	-	-	-	1	-	-
RRC	2	S-AC	-	1	-	-	-	-	-	-	1
P/NAV	2	S-AS	1	-	-	-	1	-	-	-	-
PEG	2	S-AC	1	-	1	-	-	-	-	-	-
EV/CE	2	S-AS	1	-	-	-	-	-	1	-	-
P/Sales	1	S-AC	-	-	1	-	-	-	-	-	-
EV/Earnings	1	S-AC	-	-	-	-	-	-	1	-	-
Earnings yield	1	S-AC	-	-	-	-	1	-	-	-	-
Holt	1	M-CF	-	-	-	-	1	-	-	-	-
ROIC	1	S-AC	1	-	-	-	-	-	-	-	-
Total valuation models	553		68	59	72	61	66	62	57	53	55
Total reports analyzed	412		49	44	53	45	42	50	44	45	40

used in five equity research reports. Furthermore, multiperiod and singleperiod dividend based valuation techniques are only applied in four research reports.

The descriptive findings in this thesis are in line with the findings of Demirakos, Strong, and Walker (2004) and Imam, Barker, and Clubb (2008). Although the use of multiples is still strong, since P/E and EV/EBITDA are used 270 times, the focus on the multiperiod DCF method is significant. Although empirical research by Arnold and Moizer (1984); Pike, Meerjanssen, and Chadwick (1993) and Bradshaw (2002) showed a stronger reliance on singleperiod or multiples valuation, equity research analysts are shifting towards a more heavy reliance on multiperiod valuation methods. Glaum and Friedrich (2006) also approved this observation which was even stronger after the dot.com bubble in the beginning of the 2000s. In addition, the usage of the DCF method and P/E model vary systematically across sectors.

Strong recommendation in the theoretical literature on the usage of equity valuation methods is still thin. Academics do not seem to converge to a most preferred multiperiod valuation technique. However, theoretical arguments on the usage of accrual based methods are more plausible and evident advantages when applying accrual based multiperiod methods are given in the literature.

Yet the results in table 5.1 show that the focus of sell-side equity research analysts is mainly on cash flow driven multiperiod valuation techniques. This result could either indicate that equity research analysts still have a strong believe in cash flow based multiperiod valuation models and disagree with arguments in favor of accrual based models. Or equity research analysts are willing to acknowledge the theoretical advantages of accrual based multiperiod valuation techniques, yet it causes computational difficulties or their clients (i.e. readers of the research reports) are unfamiliar with multiperiod accrual earnings based valuation models so the employment is refrained from.

The utilization of singleperiod valuation techniques corresponds better to theoretical literature. The P/E method is most frequently applied which is justified since singleperiod valuation models based on enterprise value are easier biased. In addition, almost all singleperiod valuation models are denominated by an income statement figures which generate the highest accuracy. As a result, cash flow or asset based multiples are rarely applied.

Response variable in empirical models

The estimation of the empirical model demonstrated in subsection 4.2.2 shows that the predictor variables in the logistic regressions are the DCF (DCF) method, singleperiod equity (S-EQ) based methods and singleperiod enterprise (S-EN) based methods. The reason to exclude other equity valuation models from the binary logit is because too low observations make the results of the logistic regressions unreliable.

From table 5.1 it is shown that the main equity valuation techniques used by equity research analysts are the DCF method, singleperiod valuation techniques numerated by the market value of equity, like the P/E and P/B, and singleperiod valuation techniques numerated by total enterprise value, like the EV/EBITDA and EV/EBIT. The last two paragraphs in this section discuss the exact classification of the equity valuation techniques within singleperiod equity based methods and singleperiod enterprise based methods, and it describes the division of the three categories over the sample period and per sector.

Classification of equity valuation techniques

In table 5.2 an overview is given of the number of observations per valuation category. Although the use of the DCF is directly compared to the use of singleperiod equity or enterprise models it is important to note that utilization of one technique does not exclude the usage of another valuation method. To illustrate, if an analyst used the DCF and a singleperiod model (e.g. EV/EBITDA), the DCF and one singleperiod enterprise based valuation models are identified. As a result, the total number of DCF methods, singleperiod equity based and singleperiod enterprise based is 492. The second remark concerns the omittance of certain valuation techniques. If an equity research report applied more than one singleperiod equity based valuation method only one technique is identified. For example, the P/B method is in total twelve times applied, as reported in

Table 5.2: **Categorization of equity valuation models**

Table shows the classification of the equity valuation models, which are categorized in the DCF method, singleperiod equity based methods and singleperiod enterprise based methods. Definitions and description of the models is given in table 4.1.

Category	Valuation models	Obs.	
DCF	DCF	181	85%
Singleperiod equity based	P/E	168	92%
	P/B	10	5%
	Other[1]	5	3%
	Total	183	100%
Singleperiod enterprise based	EV/EBITDA	102	80%
	EV/EBIT	12	9%
	EV/Sales	6	5%
	Other[2]	8	6%
	Total	128	100%

[1]Other models within the singleperiod equity based group refer to P/OCF, PEG, earnings yield, P/Sales and P/NAV.

[2]Other models within the singleperiod enterprise based group refer to EV/E, EV/FCF, and EV/CE.

table 5.1. However, table 5.2 shows that the P/B is only used 10 times. The other P/B classifications are lost since in those reports the singleperiod equity based model is classified as the P/E method.

As shown the DCF method is applied in 181 equity research reports. Singleperiod equity based valuation methods comprises of the P/E and for 5% of the P/B method. As shown the P/E method is the dominant valuation technique in this category. Singleperiod enterprise based valuation models are dominated by the EV/EBITDA for 80% and EV/EBIT for 9%.

Categorized valuation techniques on year and industry

After categorizing the equity valuation models in the DCF, singleperiod equity based and singleperiod enterprise based methods it is of interest to analyze the developments over time and between industries.

Panel A in table 5.3 demonstrates that over time the implementation of the different equity valuation techniques is not deviating much. The insignificant kruskal-wallis test provides evidence that the different types of equity valuation methods have been applied consistently over time. The sample period is possibly too short to observe any differences on increased or decreased implementation of valuation methods. So albeit the sample period is characterized by volatile stock markets and strong economic growth and decline, the different equity valuation techniques have been applied consistently over time.

Table 5.3: **Categorization per year and per sector**

Table shows the division of the equity valuation techniques per year and per industry. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level.

	DCF	**S-EQ**	**S-EN**
Panel A: Model usage over time			
2006	34	34	23
2007	40	41	31
2008	38	35	25
2009	37	33	25
2010	32	40	24
Total	181	183	128
K-W	*1.704*	*1.517*	*1.367*
Panel B: Model usage across sectors			
Consumer	12	30	16
Energy	18	6	17
Healthcare	18	34	16
Industrials	22	19	16
Materials	21	17	16
Staples	14	27	18
Technology	12	31	10
Telecom	41	4	6
Utilities	23	15	13
Total	181	183	128
K-W	*64.662*[a]	*68.929*[a]	*11.289*

The second column of panel B shows that for the DCF method no negative outliers are present. However, in the telecom (41) sector multiperiod valuation models are more often utilized. In contrast to the lacking of negative outliers for the DCF method, singleperiod equity based methods are rarely applied in the energy (6) and telecom (4) sector. Nevertheless, analysts focusing on the consumer (30), healthcare (34) and technology (31) sectors are relying on singleperiod equity based models heavily. For the implementation of singleperiod enterprise based methods no positive outliers are present. A limited usage of enterprise based methods is observed in the technology (10) and telecom (6) industries.

The kruskal-wallis test between the equity valuation techniques and the nine different sectors is significant at the 1% level for the DCF method and singleperiod equity based method, and insignificant for singleperiod enterprise based valuation models. This implies that equity research analysts apply the DCF and singleperiod equity based models deliberately in certain sector. Furthermore, sector classification does not explain the employment of singleperiod enterprise based valuation methods.

5.2 Firm level determinants

Table 5.4 shows the results of the binary logit analysis on the DCF (DCF), singleperiod equity based (S-EQ) and singleperiod enterprise based (S-EN) models.

Consistent with the expectations high sales growth (SGROW) and high dividend payout (DIV) firms are likely to be valued using the discounted cash flow model. Moreover, firm maturity (AGE) and report size (LENGTH) also increase the likelihood of applying the discounted cash flow model. The odds ratio of 8.998 ($exp\,[2.197]$) implies that a one-unit increase in sales growth increases the odds of using a multiperiod equity valuation with 900%, holding the other variables constant. The strong relation of sales growth is in line with the expectation that high historical and forecasted sales growth indicates future growth opportunities which is best captured by multiperiod equity valuation models. For dividend payouts the log-odds ratio is less strong, yet with odds ratios of 3.190 ($exp\,[1.160]$), the probability increases with 219% to employ the DCF for a one-unit increase in dividend levels. In contrast, although firm maturity (AGE) and report size (LENGTH) are significant at the 10% and 5% significance level their influence is very low. Both log-odds ratios are around zero indicating that the maturity and report size do not decrease or increase the odds of applying the DCF method.

Inconsistent to the hypothesis, intangibles as part of total assets (INTANG) is not significantly affecting the DCF method. Analysts obviously do not focus on the value captured in R&D and other intangible assets, which is possibly due to the complexity to translate the value of these assets into free cash flow forecasts. In addition, a recommendation revision for small firms (REVISION * $\text{MCAP}_{\text{small}}$) does not adjust the valuation behavior of equity research analysts, while a shift to the DCF method was expected. Other predictor variables earnings volatility (EVOL), stock return volatility (SVOL), firm size (LnSIZE) and difference between target price and current price (DELTA) do not affect equity research analysts to implement the discounted cash flow method.

Singleperiod equity based valuation techniques are avoided for firms characterized by high profitability (PROF), dividend payout (DIV), firm size (LnSIZE) and stock volatility (SVOL). The odds ratios of 0.162 ($exp\,[-1.820]$) and 0.451 ($exp\,[-0.795]$) for profitability and dividend payouts indicate that a one-unit increase in either one of the variables changes the odds of applying singleperiod equity based models with a factor of 0.16 (or a factor of 16%) and 0.45. High profitability was expected to be positively correlating with singleperiod equity valuation models. Yet, an negative relation is observed, which is possibly explained by the fact that equity research analysts assess high profitability to be part of future growth opportunities. The odds ratio of 0.000 ($exp[-20.104]$) implies that stock volatility is strongly negatively affecting the employment of singleperiod equity based valuation models. A one-unit increase in stock volatility changes the odds to apply equity based singleperiod models with a factor below 1%. Analysts definitely analyze historical stock price volatility before deciding to base their valuation on a singleperiod equity based valuation technique. Firm size (LnSIZE) is significant at the 1% level and has a negative

effect. A one-unit increase in total assets changes the odds to apply equity based multiples to only 54% (odds ratio .541 [$exp\,(-0.614)$]) compared to not applying equity based multiples. Earnings volatility (EVOL) is significant at the 10% but the odds ratio is close to one (0.940 [$exp(-0.062)$]). Earnings volatility cross industry holds, as shown by Demirakos, Strong, and Walker (2004), yet this relation is not robust on a firm level.

It is hypothesized that when firms are highly leveraged analysts would use singleperiod enterprise based valuation models. The last column in table 5.4 shows that leverage levels (LEVERAGE) do not influence the employment of singleperiod enterprise based valuation models. Firm size (LnSIZE) is positively influencing the employment of singleperiod enterprise based valuation models. The table shows that a one-unit increase in total assets makes the probability of applying singleperiod enterprise based valuation 67% higher (odds ratio 1.674 [$exp\,(0.515)$]). Against expectations, total intangibles are positively affecting singleperiod enterprise based valuation methods. The probability increases by 215% for a one-unit increase in total intangibles. No other predictor variables are significantly influencing the choice to apply singleperiod enterprise based valuation models.

Drawing the conclusion that firm level determinants influence singleperiod enterprise based valuation models is unreliable since the lr-statistic, which tests the overall explainability of the model, is insignificant. Firm level determinants do explain the employment of the DCF method and singleperiod equity based valuation models because the lr-statistic is for both models significant at the 1%.

Implication of findings

The above section shows that firm level determinants in terms of operating performance influence the choice of equity valuation method. High historical and forecasted sales growth increase the probability of applying the DCF and higher profitability diminishes the likelihood of applying singleperiod equity based valuation models. Obviously equity research analysts recognize that multiperiod valuation models better translate optimistic forecasts compared to singleperiod valuation models.

Firm level determinants in terms of capital structure report high intangibles assets are not a reflection of future growth opportunities, nevertheless it declines the chance of using other multiperiod valuation models. Furthermore, no support is found to accept hypothesis 3 since no direct relation is observed between the use of singleperiod enterprise based valuation methods and leverage levels. Finally, high dividend paying firms rely on the DCF methods which is in line with the expectations.

Hypothesis 1 is partly accepted since sales growth and dividend payout increase the likelihood of applying the DCF method, yet intangibles as part of total assets and firm maturity are insignificant or relatively weak. No support for hypothesis 2 is observed. Earnings volatility is only marginally affecting the

Table 5.4: **Firm level determinants explaining the employment of valuation methods**

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable and firm level determinants as predictor variables. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF (1)		S-EQ (2)		S-EN (3)	
SGROW	2.217	(2.197)[b]	-1.670	(-1.542)	0.731	(0.730)
PROF	1.164	(1.555)	-1.820	(-1.961)[b]	0.006	(0.009)
EVOL	0.034	(1.092)	-0.062	(-1.912)[c]	0.017	(0.602)
INTANG	-0.077	(-0.120)	0.310	(0.455)	1.148	(1.743)[c]
LEVERAGE	0.676	(1.416)	-0.599	(-1.200)	-0.605	(-1.198)
DIV	1.160	(2.604)[a]	-0.795	(-1.707)[c]	-0.063	(-0.132)
AGE	-0.005	(-1.842)[c]	0.003	(1.178)	0.001	(0.342)
SVOL	-3.074	(-0.330)	-20.104	(-1.990)[b]	-4.383	(-0.478)
LnSIZE	-0.056	(-0.429)	-0.614	(-4.580)[a]	0.515	(3.853)[a]
REVISION * $MCAP_{small}$	-0.657	(-1.270)	-0.730	(-1.301)	0.099	(0.205)
DELTA	0.342	(0.490)	0.027	(0.037)	0.256	(0.362)
LENGTH	0.015	(2.012)[b]	0.001	(0.080)	-0.003	(-0.418)
Intercept	-0.865	(-0.772)	6.050	(5.154)[a]	-5.002	(-4.377)[a]
McFadden R^2	0.055		0.096		0.033	
LR-statistic	31.214[a]		54.514[a]		17.091	
Observations	412		412		412	

use of singleperiod equity based models and profitability is negatively influencing the usage of singleperiod equity based models, while a positive influence was expected. The rejection of hypothesis 2 indicates that sales growth levels is dominating profitability and earnings volatility when equity research analysts have to employ a specific equity valuation technique.

The uncertainty of high historical stock return volatility in relation to the avoidance of singleperiod equity based valuation models leads to the acceptance of hypothesis 4. Research analysts strongly refrain from applying singleperiod equity based methods when they observe huge fluctuations in historical stock price chart.

Equity research analysts recognize the advantages of valuing larger firms, in terms of total assets, with singleperiod valuation models. Although no direct relation is found between leverage levels and the usage of equity or enterprise based valuation methods, equity research analysts may approve that leverage does play a role for larger firms and singleperiod enterprise valuation models only suffice. For small firms leverage levels are obviously less important. This finding implies that hypothesis 5 is accepted. In contrast, analysts do not deliberately apply multiperiod valuation methods for small firms, in terms of market capitalization, experiencing a recommendation revision. So no support is found

to accept hypothesis 6. This rejection is either explained by the knowledge gap between academics and equity research analysts or the sample size consisting of only midcap firms is too narrow to find differences in valuation methods after a recommendation revisions.

To conclude, table 5.4 demonstrates the firm level determinants are important for equity research analysts and explain the implementation of equity valuation techniques. Operating performance, stock return volatility and firm size explain the valuation behavior of equity research analysts while capital structure does not have an influencing effect. Furthermore, all significant firm level determinants influencing singleperiod equity valuation methods have a negative affect. This implies that equity research analysts acknowledge that singleperiod equity based valuation methods are not useful as soon as diverging firm level characteristics are observed.

5.3 Global financial crisis

In order to ensure that not only firm level determinants explain the choice of employing certain equity valuation techniques, economic indicator variables are analyzed in binary logit models as well. Table 5.5 demonstrates that the overall fit of the three models increases and the lr-statistic on the DCF method and singleperiod equity based models remains significant at the 1% level. This observation indicates that economic indicator variables contribute to the overall explainability why equity research analysts apply certain valuation techniques.

The second and third column report that only the dummy for reputable stock exchanges (EXCHANGE) significantly influences the employment of the DCF method. The odds ratio of 0.625 ($exp\,[-0.470]$) implies that probability of using the DCF method for a listing on a reputable stock exchange is only 62% compared to the probability of firms listed on non reputable stock exchange. In contrast to the hypothesis, negative economic growth (CRISIS), stock market return (MRET), stock market volatility (MVOL) and the second interaction term (BANK*PEAK) do not affect the employment of the discounted cash flow, so obviously the use of the DCF is resistant to most economic conditions. The firm level determinants significant in model 1 in table 5.4 are all robust to the inclusion of economic indicator variables.

The employment of singleperiod equity based valuation models is affected by negative GDP growth (CRISIS). The negative coefficient indicates that the chance of applying singleperiod equity based valuation models is only 57% of the probability of using singleperiod equity based valuation models after positive GDP growth quarters (odds ratio 0.572 $[exp(-0.559)]$). As expected from hypotheses 9, firms listed on reputable stock exchanges (EXCHANGE), with a high amount of analysts following the firm and a high frequency of information disclosure, are inclined to use singleperiod equity based methods. The odds of applying equity based multiples is 114% higher (odds ratio is 2.136 $[exp\,(0.759)]$). Additionally, the significance of the second interaction term (BANK * PEAK) indicates that the odds of using singleperiod equity based valuation models

by top investment banks during peak seasons is only 56% (odds ratio 0.563 $[exp(-0.575)]$) compared to a situation in which no peak season is present or the bank is not heavily involved in investment banking activities. Market return (MRET) and market volatility (MVOL) are not influencing the choice of singleperiod equity based valuation models. The firm level predictor variables significant in logit model 2 are robust to the inclusion of economic indicator variables, except for stock volatility (SVOL) and dividend payout (DIV). The finding on stock return volatility is possibly caused by the high correlation between stock index return volatility and stock return volatility[1].

The last two columns of table 5.5 demonstrate that the use of singleperiod enterprise based valuation methods is negatively influenced by negative GDP growth. Other economic indicators do not affect the usage of singleperiod enterprise based valuation models. The predictor variables intangible assets relative to total assets (INTANG) and firm size (LnSIZE) are robust to the inclusion of economic indicators. Drawing conclusions on economic indicators influencing singleperiod enterprise based valuation models is unreliable since the lr-statistic is still insignificant.

Implication of findings

The above described findings imply that hypothesis 7 is accepted since the probability of using singleperiod equity based valuation models declines after a country experienced negative economic growth.

Hypothesis 8 is rejected since both high stock market return and higher stock market return volatility do not affect the use of the DCF method. Moreover, the chance of using singleperiod valuation techniques is also unadjusted by stock market conditions. The insignificant relations of both economic predictor variables is probably explained by the diffused international data set. Stock market returns and volatility have been very unstable within developed world. However, emerging regions like Asia Pacific and Americas, have to a lesser extent experienced volatile stock market movements. These opposite relations makes it hard to identify whether equity research analysts adapt their valuation behavior, since the influence of more moderate equity markets could affect the parameter estimations.

The reputation of stock exchanges clearly affect the utilization of equity valuation methods. The finding that firms listed on a reputable stock exchange are valued using singleperiod equity based valuation techniques leads to the acceptance of hypothesis 9. Higher analyst following, more frequent information release and ease to construct an effective peer group results in a higher probability of applying singleperiod equity based valuation methods and refrain from the usage of the DCF method.

Hypothesis 10 is rejected since the DCF method is not applied more heavily by top investment banks during peak seasons in M&A and equity issuing. However, the use of singleperiod equity based models is avoided to ensure that

[1] Further discussion on multicollinearity is found in section 5.5.1.

Table 5.5: **Economic indicators explaining the employment of valuation methods**

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable and firm level determinants as well as economic indicators as predictor variables. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF (4)		S-EQ (5)		S-EN (6)	
SGROW	1.989	(1.949)[b]	-1.518	(-1.347)	0.413	(0.407)
PROF	1.356	(1.583)	-2.141	(-1.816)[c]	-0.085	(-0.130)
EVOL	0.036	(1.184)	-0.068	(-2.046)[b]	0.020	(0.705)
INTANG	0.149	(0.220)	0.249	(0.342)	1.556	(2.258)[b]
LEVERAGE	0.655	(1.328)	-0.663	(-1.245)	-0.657	(-1.255)
DIV	1.018	(2.171)[b]	-0.363	(-0.724)	-0.232	(-0.455)
AGE	-0.004	(-1.876)[c]	0.003	(1.209)	0.001	(0.501)
SVOL	8.365	(0.618)	-21.128	(-1.545)	1.811	(0.128)
LnSIZE	-0.029	(-0.210)	-0.654	(-4.527)[a]	0.584	(4.206)[a]
REVISION * $MCAP_{small}$	-0.731	(-1.309)	-0.764	(-1.313)	-0.028	(-0.061)
DELTA	0.434	(0.611)	-0.088	(-0.114)	0.399	(0.568)
LENGTH	0.013	(1.662)[c]	0.005	(0.611)	-0.005	(-0.676)
CRISIS	0.210	(0.630)	-0.559	(-1.653)[c]	-0.587	(-1.680)[c]
MRET	-0.582	(-0.648)	0.988	(1.083)	0.338	(0.369)
MVOL	-31.147	(-1.196)	27.975	(1.132)	16.807	(0.693)
EXCHANGE	-0.470	(-1.981)[b]	0.759	(3.031)[a]	-0.384	(-1.511)
BANK * PEAK	0.358	(1.106)	-0.575	(-1.663)[c]	0.205	(0.568)
LEHMAN	-0.227	(-0.863)	0.023	(0.082)	-0.283	(-1.044)
Intercept	-0.568	(-0.461)	5.546	(4.099)[a]	-5.443	(-4.299)[a]
McFadden R^2	0.070		0.124		0.047	
LR-statistic	39.530[a]		70.216[a]		24.044	
Observations	412		412		412	

the more optimistic valuation of the DCF method is not negatively influenced by the less optimistic singleperiod valuation models.

Firm level determinants are robust to the inclusion of economic indicators for the DCF method and singleperiod enterprise based models. Only dividend payout and stock return volatility become insignificant in the singleperiod equity based valuation models. The dummy variable for the fall of Lehman Brothers is insignificant, which was expected since the kruskal-wallis test in table 5.3 already demonstrated insignificant differences of employing equity valuation methods over the sample period.

To conclude, the usage of the DCF method by equity research analysts is resistant to economic indicators affecting the valuation process. Nevertheless, singleperiod equity based valuation methods are influenced by general macro economic conditions and reputation influences.

5.4 Industry and regional effects

The first research objective in this study was to identify what firm level determinants influence the valuation behavior of sell-side equity research analysts. From the binary logit models above it is shown that indeed firm level predictor variables affect the implementation of equity valuation methods and most of these predictor variables are robust to the inclusion of economic indicator effects. Yet, it is interesting to compare the relative importance of firm level predictor variables with sector dummies or regional dummies in one logistic regression model.

The choice to analyze firm level determinants influencing the implementation of equity valuation techniques was deliberate, since most previous research (see Demirakos, Strong, and Walker (2004); Glaum and Friedrich (2006); Imam, Barker, and Clubb (2008)) focused on a cross sector comparison and found significant differences. Since both cross sector and cross firm level are significantly influencing the utilization of equity valuation techniques it becomes of interest to analyze the relative difference.

Unique to this data set is the geographic distribution of the firms under research. A geographical analysis on the employment of equity valuation methods has not been conducted previously and most studies focused on one country. Since most companies in this data set are headquartered in the USA or in Europe running simple kruskal-wallis tests would be unreliable. Nevertheless, including dummy variables per region, which are Europe (EUROPE), North America (NORTH AMERICA), Asia Pacific (ASIA), emerging Americas (E_AMERICAS), emerging Europe, Middle-East and Africa (E_EMEA) and emerging Asia Pacific (E_ASIA), and holding North America as the intercept variable gives empirical opportunities whether cross region effects influence equity research analysts in their decision process to apply a certain equity valuation techniques.

For both logit models eight and five dummies are included in the model. If all sector and regional dummies and the intercept would be included into the logit model the sum of the nine or six dummies would be equal to one which is equal to the variable this is represented by the intercept parameter. This problem causes perfect multicollinearity and no predictor variables can be estimated[2]. In the models below the omitted dummies are the material sector and North American bases companies which become the reference category to which the other dummies are compared to.

Sector effects

The sector dummies at the bottom of column 2 and 3 in table 5.6 show that, given all other predictor variables stay the same, classification into the technology and consumer sector negatively influences the employment of the DCF method compared to the base case of the materials sector. In contrast, research

[2]For further elaboration on the inclusion of the intercept parameter and the subsequent dummy variable trap, see Brooks (2008) page 456.

analysts focusing on firms in the telecom sector are more likely to apply the DCF model. From column 2 and 3 it is also reported the firm level determinants are robust to the inclusion of industry dummies. Sales growth (SGROW), dividend payout (DIV) and report size (LENGTH) remain significant. Firm maturity (AGE) is not statistically significant anymore and firm size (LnSIZE) declines the probability of employing the DCF method.

Firms classified in the technology sector are more likely and firms in the energy and telecom sector are less likely valued according to singleperiod equity based valuation models compared to firms in the materials sector. For singleperiod equity based valuation techniques only historical stock return volatility (SVOL) and firm size (LnSIZE) are robust to the inclusion of industry dummies. Profitability (PROF), earnings volatility (EVOL) and dividend payout (DIV) are not significantly influencing the choice of singleperiod equity based valuation models anymore. However, recommendation revisions for small firms (REVISION * $MCAP_{small}$) becomes statistically significant.

For singleperiod enterprise based valuation methods only the telecom sector dummy significantly influences the use of singleperiod enterprise based valuation models. Equity research analysts focusing on those firms are less likely to apply singleperiod enterprise based valuation models. The firm level determinants firm size (LnSIZE) and intangibles (INTANG) are robust to the inclusion of sector dummies. Since the lr-statistic becomes significant at the 10% level sector dummies do contribute to the explainability of employing singleperiod enterprise based valuation methods.

Regional influences

The second column in table 5.7 reports the results of the binary logit model with the DCF method as response variable. Equity research analysts analyzing firms based in Europe, emerging America, emerging EMEA and emerging Asia Pacific have a higher probability to apply the DCF method compared to research analysts following companies based in the North America. From the significant firm level determinants in model 1 only sales growth (SGROW) and firm maturity (AGE) are robust to the inclusion of regional dummy variables. Furthermore, leverage levels (LEVERAGE) positively influences the employment of the DCF method at the 5% significance level.

From the five regional dummies in the second model, with singleperiod equity based valuation methods as response variable, four out of five regional dummies are significantly different from the reference region North America. For firms based in Europe, Asia Pacific, emerging Americas and emerging EMEA the probability of applying singleperiod equity based valuation models is lower compared to firms based in North America. Firm level determinants affecting the employment of singleperiod equity based valuation models are robust to the inclusion of regional effects. Firm's profitability (PROFIT), earnings volatility (EVOL), stock return volatility (SVOL) and firm size (LnSIZE) remain significant and do not change sign. Only dividend payouts (DIV) is not robust to the inclusion of regional dummies.

Table 5.6: **Sector effects explaining the employment of valuation methods**

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable and firm level determinants as well as industry dummies as predictor variables. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	3.442	(2.742)[a]	-1.618	(-1.412)	-0.115	(-0.103)
PROF	0.313	(0.414)	-0.802	(-1.220)	0.186	(0.258)
EVOL	0.004	(0.116)	-0.049	(-1.472)	0.028	(0.853)
INTANG	0.732	(0.883)	-0.570	(-0.673)	1.520	(1.925)[c]
LEVERAGE	-0.456	(-0.791)	0.101	(0.179)	-0.439	(-0.786)
DIV	1.156	(2.154)[b]	-0.665	(-1.199)	0.033	(0.061)
AGE	-0.003	(-0.947)	0.003	(1.110)	-0.001	(-0.231)
SVOL	-4.786	(-0.489)	-20.583	(-1.830)[c]	-4.090	(-0.447)
LnSIZE	-0.331	(-2.075)[b]	-0.418	(-2.974)[a]	0.505	(3.695)[a]
REVISION * $MCAP_{small}$	-0.710	(-1.155)	-0.991	(-1.807)[c]	0.196	(0.381)
DELTA	-0.185	(-0.244)	0.477	(0.681)	0.451	(0.647)
LENGTH	0.026	(2.959)[a]	-0.002	(-0.246)	-0.007	(-0.835)
INDUSTRIALS	0.435	(0.923)	-0.114	(-0.246)	-0.225	(-0.475)
HEALTHCARE	-0.727	(-1.442)	0.620	(1.244)	-0.362	(-0.735)
TECHNOLOGY	-0.873	(-1.645)[c]	0.870	(1.693)[c]	-0.569	(-1.107)
CONSUMER	-1.117	(-2.398)[b]	0.621	(1.366)	-0.170	(-0.354)
ENERGY	-0.331	(-0.698)	-1.458	(-2.573)[b]	0.118	(0.245)
STAPLES	-0.787	(-1.635)	0.186	(0.405)	-0.124	(-0.270)
TELECOM	2.966	(4.628)[a]	-2.097	(-3.130)[a]	-1.627	(-2.745)[a]
UTILITIES	0.818	(1.563)	-0.177	(-0.351)	-0.300	(-0.614)
Intercept	1.215	(0.852)	4.366	(3.381)[a]	-4.459	(-3.613)[a]
McFadden R^2	0.190		0.176		0.060	
LR-statistic	107.413[a]		99.481[a]		30.390[c]	
Observations	412		412		412	

The last two columns in table 5.7 indicate that the employment of singleperiod enterprise based valuation models is identical in North America, Europe, emerging EMEA and emerging Asia Pacific. However, research analysts focusing on firms based in Asia are less likely to apply singleperiod enterprise based valuation methods and more likely when the firm is based emerging Americas. Firm size (LnSIZE) is robust to the inclusion of regional dummies and intangibles assets are dominated by regional dummies. Conclusions on the overall explainability of the logit model are identical to the model with industry dummies.

Table 5.7: **Regional effects explaining the employment of valuation methods**

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable and firm level determinants as well as regional dummies as predictor variables. E_AMERICAS means emerging Americas, E_EMEA means emerging EMEA and E_ASIA means emerging Asia Pacific. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	1.642	(1.745)[c]	-1.080	(-0.951)	0.260	(0.249)
PROF	0.986	(1.293)	-1.963	(-2.002)[b]	0.050	(0.079)
EVOL	0.042	(1.368)	-0.071	(-2.146)[b]	-0.008	(-0.250)
INTANG	-0.161	(-0.211)	0.774	(1.005)	0.438	(0.601)
LEVERAGE	1.084	(2.142)[b]	-0.751	(-1.442)	-0.592	(-1.077)
DIV	0.501	(1.044)	-0.137	(-0.284)	-0.059	(-0.116)
AGE	-0.005	(-1.852)[c]	0.004	(1.465)	0.000	(-0.042)
SVOL	-6.826	(-0.765)	-19.889	(-2.086)[b]	-7.394	(-0.775)
LnSIZE	-0.033	(-0.234)	-0.694	(-4.976)[a]	0.535	(3.995)[a]
REVISION * $MCAP_{small}$	-0.844	(-1.449)	-0.603	(-1.118)	0.220	(0.440)
DELTA	0.403	(0.566)	-0.282	(-0.387)	0.788	(1.042)
LENGTH	0.011	(1.370)	0.006	(0.763)	-0.003	(-0.403)
EUROPE	1.016	(3.204)[a]	-1.756	(-4.812)[a]	0.152	(0.471)
ASIA	0.106	(0.289)	-0.023	(-0.061)[a]	-0.810	(-1.981)[b]
E_AMERICAS	1.192	(2.618)[a]	-1.365	(-2.511)[a]	1.118	(2.508)[b]
E_EMEA	1.948	(4.494)[a]	-1.221	(-2.966)[c]	0.106	(0.255)
E_ASIA	0.971	(2.363)[b]	-0.743	(-1.686)	-0.703	(-1.465)
Intercept	-1.253	(-1.041)	6.787	(5.282)[a]	-4.701	(-4.146)[a]
McFadden R^2	0.112		0.162		0.067	
LR-statistic	63.361[a]		91.701[a]		34.198[a]	
Observations	412		412		412	

Implication of findings

The probability of applying the DCF method for firms classified in the telecom sector is higher and lower for firms in the technology and consumer sector. For the usage of singleperiod equity based valuation models an opposite relation is found, compared to DCF methods, for the technology and telecom sector and firms classified in the energy sector are less likely applied according to singleperiod equity based valuation models. The chance to apply singleperiod enterprise based valuation models decreases for firms in the telecom sector. The findings on industry levels are comparable to previous academic research. Glaum and Friedrich (2006) also showed a greater reliance on the DCF method in the telecom sector and the avoidance of the DCF method within the consumer sector is identically demonstrated by Imam, Barker, and Clubb (2008). Nevertheless, the focus on singleperiod valuation models in the technology sector is contradictory

to the findings of Imam, Barker, and Clubb (2008).

Firm level determinants are robust to the incorporation of industry dummies for the DCF method and singleperiod enterprise based methods. Yet, similarly to the inclusion of economic indicator effects, the firm level determinants sales growth and dividend payouts are not robust for singleperiod equity based valuation regression.

The regional effects imply strong opposing usage of the DCF method and the singleperiod equity based method. The probability of applying the DCF (singleperiod equity based) method is higher (lower) in Europe, emerging Americas and emerging EMEA compared to North America. The strong relation between usage of singleperiod equity based valuation models and reputable stock exchanges probably explains the finding on regional effects. Since most firms headquartered in North America are expected to be listed on the NASDAQ or NYSE.

Firm level determinants are robust to the incorporation of industry dummies for the singleperiod equity based methods. However, the firm level determinants of the DCF method only two predictor variables are significant and for singleperiod enterprise based valuation only firm size remains significant. The lr-statistic is for all models twice as high so regional dummies contribute to the overall explainability what determines equity research analysts in applying valuation methods.

To conclude, the sector and regional dummies show that their inclusion increases the overall explainability and goodness-of-fit of the binary logistic regression. Equity research analysts are influenced by the country of the company's headquarter and sector classification. Nevertheless, firm level determinants for the DCF and singleperiod enterprise method are more robust to the inclusion of industry dummies than regional dummies. In contrast, firm level determinants for singleperiod equity based models loose their strength when sector dummies are incorporated.

5.5 Sensitivity analysis

In the first section of the sensitivity analysis robustness checks are conducted to test the quality of the empirical models. Robustness checks on binary logit models are deviating to some extent compared to robustness tests on ordinary least square regression models. The second section focuses on further data set analysis. This analysis comprises of including and adjusting predictor variables and cutting the data set for brokerage house and further regional analysis.

5.5.1 Robustness checks

Diagnostic tests for logistic regression models require a different approach compared to ordinary least square regression models. Heteroskedasticity is controlled for since all the applied binary logit models have robust covariances. The Huber/White specification is incorporated into the model which makes

the estimation more conservative and controls for heteroskedasticity. Moreover, by transforming the size measurement variable into the natural logarithm (Ln-SIZE), the model is further protected against any threat of heteroskedasticity.

Other robustness tests discussed in this section are non-normality tests, multicollinearity analysis, the expectation-prediction evaluation and sample size considerations. These four checks are further discussed in this section.

Non-normality

In order to conduct a just logit model specification it is essential that the normality assumption ($u_t \sim N\left(0, \sigma^2\right)$) holds. One commonly applied approach to measure the level of normality is the Bera-Jarque test. This test analyzes the third and fourth moments of a standardized normal distribution specified as skewness and kurtosis. Skewness analyzes whether the distribution of variables is symmetric around its mean and is expected to be zero, while kurtosis measures the peakedness of a distribution and describes the fatness of the tails. A normal distribution is should have a kurtosis coefficient of 3. If the predictor variables are normally distributed the Bera-Jarque test should not be significant.

Table 5.8 reports that for all the continuous variables the Bera-Jarque test is significant at the 1% level and are all not normal. Yet, there are two reasons why the non-normality does not violate the empirical findings. First, following Brooks (2008) standard normal distributed predictor variables are implausible for financial or economic data analysis. Leptokurtic distributions[3] are better characterizing financial data analysis. Second, dummy variables are incorporated and outliers have been detected. The dummy variables remove seasonality and are theoretically justified to incorporate into the model, and consequently are not artificially improving the goodness of fit of the model. Since the data set is relatively small, deleting observations would further decrease the sample size. To avoid this problem large outliers have been replaced by the mean value. This procedure is only conducted for sales growth (SGROW) and earnings volatility (EVOL).

Multicollinearity

One important assumption within multiple regressions is that there exists no interaction or correlation between the independent variables. Since the logistic regressions consist of a large variety of independent variables this threat is present. The three threats of multicollinearity, as described by Brooks (2008), consists of causing a high R^2 while the standard deviations of the predictor variables are large and therefore insignificant. Causing the individual contribution of each predictor variable to the overall fit to be unobservable. Second, the high sensitivity of the model gives large changes to predictor variables when adding or removing explanatory variables. Third, confidence intervals are very wide and as a results significance tests can give unreliable conclusions.

[3]Leptokurtic distribution are more peaked at the mean and have fatter tails.

Table 5.8: **Skewness & kurtosis test**

Table shows skewness and kurtosis level to test for non-normality on continuous variables applied in logistic regression. [a] significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level.

		Descriptive statistics		
Predictor variable	N	Skewness	Kurtosis	Bera-Jarque
SGROW	412	1.274	6.670	342.733[a]
PROF	412	-0.025	13.442	1871.733[a]
EVOL	412	4.380	24.958	9594.472[a]
INTANG	412	1.117	3.177	86.168[a]
LEVERAGE	412	0.664	3.242	31.242[a]
DIV	412	1.068	3.784	88.829[a]
AGE	412	0.672	2.061	46.152[a]
SVOL	412	1.686	6.639	422.544[a]
DELTA	412	1.253	6.079	270.554[a]
LENGTH	412	1.502	5.816	290.940[a]
MRET	412	-0.120	5.017	70.803[a]
MVOL	412	1.789	6.608	443.269[a]
LnSIZE	412	3.485	20.095	5850.390[a]

Perfect multicollinearity is hardly present in multiple regression analysis and therefore near multicollinearity is more likely to occur. Because no formal benchmark is present to test for multicollinearity the most applicable way to detect multicollinearity is through a correlation matrix of the predictor variables. From the correlation matrix (shown in appendix C) it is reported that the only threat to multicollinearity is the high correlation (0.706) between the market index return volatility (MVOL) and stock return volatility (SVOL). The correlation of other predictor is not higher than 0.5 and causes no threat to the binary logit models.

Since enlarging the sample size, pooling data or just ignoring the likely presence of multicollinearity is not satisfactory, it is chosen to re-estimate model 1 [2,3] and omit the firm level determinant of stock return volatility. The new binary logit models (see appendix D) show that in general the parameters remain the same. From this it is concluded that multicollinearity is not a major threat to the this data set.

Expectation-Prediction evaluation

Another measure to analyze the goodness-of-fit test is the expectation-prediction evaluation or classification table. Although this test is an in sample analysis, the table demonstrates the proportion of cases which are correctly classified and therefore evaluates the predictive accuracy of the logistic regression model. The cut-off value (C) is the benchmark which classifies predicted observations as being a success when the probability is above the cut-off value. In this analysis

Table 5.9: **Expectation-prediction evaluation**

Table shows expected-prediction evaluation for the binary logit regression of models 1, 2, 3, 4, 5 and 6. [a] refers to the absolute percentage difference between the estimated model and the default (constant) model, [b] refers to the percentage of incorrect predictions by the default model corrected by the estimated model and C is the installed cut-off point.

Model	Actual	Predicted		Correct		Gain[a]	Percent gain %[b]	C
		0	1	%	total %			
DCF	0	141	90	61.04	61.89	17.96	32.03	0.439
	1	67	114	62.98				
S-EQ	0	151	78	65.94	66.50	10.92	24.59	0.444
	1	60	123	67.21				
S-EN	0	161	123	56.69	57.52	-11.41	-36.72	0.311
	1	52	76	59.38				

the cut-off value is equal to the number of successful observations in the default model.

Column five and six in table 5.9 report the percentage of correct classifications for each equity valuation technique. Important to note is that the expectation-prediction evaluation is conducted on logit models 1, 2 and 3 which include firm level determinants as predictor variables. In order to draw any meaningful conclusions, the estimated models are compared to the default model which only incorporates an intercept term. Column seven and eight report the increased gain of the estimated model over the default specification and shows that for the DCF and singleperiod equity based models the estimated regression model is preferred over the default model. In contrast, a negative gain is observed for singleperiod enterprise based models. The goodness-of-fit for singleperiod enterprise based valuation models has been low and the lr-statistic insignificant so this observation was expected before hand.

The expectation-prediction evaluation is only conducted on the estimated model with firm level determinants as predictor variables. However, the goodness of fit statistics and lr-statistic of the economic indicator variables and industrial and regional dummies are superior to firm level predictor variables independently. As a result, it is expected that the conclusion based on those expectation-prediction evaluations will be better (although not tabulated).

Sample size

As already mentioned the sample size in this thesis consists of 412 observations. Regression analysis on financial data normally consists of larger sample sizes and at first instance it is arguable that the size of the data set is insufficient. Nevertheless as argued by Peduzzi, Concato, Kemper, Holford, and Feinstein (1996), a minimum number of predictor variables incorporated in the logistic

regression model depends on the proportion of success rates. Formula 5.5.1 shows that the minimum number of observations (N) is equal to ten times the amount of predictor variables (k), divided by the probability of success of the response variable (p).

$$N = \frac{10 * k}{p} \tag{5.5.1}$$

In this thesis the only violation to this assumption are the singleperiod enterprise based logistic regressions in model 5 which only have a probability of 31.1%. The optimal amount of observations should be above 580, as a result conclusions drawn on these models could be ambiguous.

5.5.2 Further data set analysis

Before further elaborating on other data set reconsiderations two remarks must be made. First, theoretical literature argues that equity research should focus on leading multiples (see Goedhart, Koller, and Wessels (2010)). Within the applied logistic regression models no distinction is made between leading and trailing multiples, since only 5.4% of all applied equity valuation models consist of trailing multiples. This observations leads to the conclusion that equity research analysts are aware of the shortcoming of trailing multiples and no further reconsideration is required.

The second remark refers to multiple equity valuation methods applied in the research reports. Within the data set only 94 equity research reports applied several equity valuation techniques. From these 94 reports, 81 reports assigned an equal weight to the final target price estimation. This indicates that dominant and alternative valuation models are seldom identified, and the methodology to classify each equity valuation model is just. Equity research analysts obviously do not use alternative valuation techniques to support the dominant valuation technique.

Firms reporting losses

An interesting feature during the sample period is the economic downturn and subsequent possible losses experienced by firms in the data set. The presence of losses may make the implementation of singleperiod equity valuation models impossible. In the data set in total 37 firms experienced a negative net income in the period before the estimation period commenced in the research report.

By running model 1 [2, 3] with the inclusion of a dummy for firms reporting losses it is tested whether negative income explains the decision of equity research analysts to apply certain equity valuation techniques. The results of the logistic regressions (see appendix E) show that the dummy variable is insignificant for all three response variables and the firm level determinants significant in model 1 [2, 3] are all robust to the inclusion of a dummy for firms reporting losses. This finding implies that firm reporting losses does not affect equity research analysts valuation behavior.

Adjusting predictor variables

Some variables in the empirical model could be unjustly estimated possibly causing specification errors. The first parameter which is defined in a different manner is total intangibles. Total intangibles are ought to reflect future growth opportunities of a company. As stated in the hypotheses, R&D expenditure as part of total sales is a better reflection of firm level investment in future growth opportunities.

By replacing the relative amount of intangibles by the relative investments in R&D for model 1 [2,3] the sample size decreases significantly to 202 observations. By rerunning the logistic regressions for firm level determinants (see appendix F) it is reported that R&D levels do not affect equity research analysts to apply either the DCF method, singleperiod equity based or singleperiod enterprise based method. In addition, due to this smaller sample size most firm level determinants are not significant anymore.

The second adjustment deals with the historical 90-day trading horizon to define market index return and market index return volatility. The definition of the 90-day trading interval is copied from Roosenboom (2007) who analyzed the valuation of IPO underwriting. Normally, IPO processes take a couple of months before the firm is finally publicly traded, moreover IPOs tend to succeed under favorite market conditions. The process of writing an equity research report is shorter than an IPO process and therefore it sounds plausible that equity research analysts do not consider historical market conditions on a 90-day trading interval.

The logistic regression model 4 [5,6] is reestimated and the market index return and market return volatility on a 90-day trading interval are replaced by 30 days trading interval (see appendix F). The regressions report that, identically to the 90-day trading interval, equity research analysts are not influenced by market index return and market index return volatility on shorter time frames. Firm level determinants and economic indicators significant in model 4 and 6 are not affected, however the dummy for negative GDP growth and peaks in M&A in relation to top investment banks do not change sign, but become insignificant.

Brokerage house effects

The next check on the data set concerns whether the reputation of the financial institution releasing the equity research reports effects the choice of equity valuation models. Since the data set is too small to include dummy variables for all institutions releasing equity research reports, only a subsample for top investment banks is analyzed.The adapted selection criteria for top investment banks is similar to the definition given in table 4.3. The larger exposure to equity investors, the focus on larger firms and the likely effect of higher experienced research analysts in top investment banks may specifically affect the valuation behavior.

Model 1 [2,3] are reestimated for the sample consisting of top investment banks. The results of the logistic regressions (see appendix G) report that equity

research analysts employed by top investment banks concentrate mainly on sales growth, profitability and leverage levels. The chance of using the DCF method increases by higher sales growth, higher profitability and higher leverage levels, while these three predictor variables are negatively related to the probability of applying singleperiod equity based valuation models. In addition, firm size is negatively related to the use of singleperiod equity based valuation models, while the use of the DCF is independent of firm size. The results of singleperiod enterprise based valuation models remain largely intact.

The findings gives three conclusions. First equity research analysts employed by top investment banks strongly focus on the operating performance of firms and on leverage levels. Second, while assessing which equity valuation technique to apply the choice is either between the DCF method or singleperiod equity based models. Third, outside circumstances like focusing on larger corporations and larger exposure to equity investors makes a company analysis more straightforward and robust.

Further regional analysis

The last two tests on the data set concentrates on regional effects. Table 5.7 reported that regional dummies explain the probability of applying the DCF method and singleperiod equity based methods. However, by constructing sub sample on specific regions further interesting insights in regional influences could be obtained.

Model 1 [2,3] is reestimated to analyze firm level determinants for equity research analysts focusing on firms based in North America. From this a subsample of 152 equity research reports emerges. The binary logit models (see appendix H) report that the employment of the DCF method is only affected by historical stock return volatility. Next, from the significant firm level determinants for the full sample in model 2 only profitability, earnings volatility and firm size are robust. In addition sales growth and intangible assets also negatively affect the usage of singleperiod equity based valuation methods. For singleperiod enterprise based valuation methods firm size and sales growth affect the employment of this valuation technique.

The findings imply that equity research analysts focusing on companies located in North America randomly apply the DCF method, unless high historical stock return volatility is present. Furthermore, singleperiod equity based models are applied to translate future growth opportunities due to high level of intangible assets. The findings show that research analysts refrain from using singleperiod equity based models as soon as any irregularities arise in terms of operating performance.

The second test on regional influences is conducted by cutting the data set into firms which are based in emerging areas. This comprises of emerging Americas, emerging EMEA and emerging Asia Pacific. Companies operating in emerging areas are normally more volatile than their larger counterparts in terms of operating performance and tend to be smaller. Using singleperiod

equity valuations seems to be difficult since the growth stage of the peer group may be different causing biased multiples.

Through the reestimation of model 1 [2,3], for companies based in emerging regions, it is shown that firm size positively affects the DCF method. Moreover, the DCF method is avoided after small firms experienced a recommendation revision. The results for singleperiod equity based valuation models is opposing the results of model 2. Equity research refrain from the usage of singleperiod equity based methods when sales growth, leverage levels, firm size and delta is high. For the full sample the negative effect was observed for high profitability, dividend payout, stock return volatility and firm size. The results for singleperiod enterprise based model remain largely intact.

The regional analysis on firm level determinants indicate that equity research analysts focus on other firm level characteristics in different geographical regions when applying singleperiod equity based valuation techniques. This effect is less strong for the employment of the DCF method and singleperiod enterprise valuation methods.

Chapter 6

Conclusions

In the last chapter of this thesis the main findings and importance of the findings are described through answering of the main research questions. In section 6.2 the findings are related to other studies and further alternative explanations for the results are presented. The second paragraph in section 6.2 presents the main limitations of the thesis and the chapter is completed with some recommendations for further research in section 6.3.

6.1 Summary of findings

From the descriptive analysis it is shown that the DCF, P/E and EV/EBITDA are mostly utilized by equity research analysts. Multiperiod accrual based valuation models are, against theoretical recommendations, rarely applied and the usage dividend discount models is limited and is invaluable for equity research analysts. Nevertheless, the use of singleperiod valuation models is in line with theoretical recommendations. The divergence between theoretical recommendation on applying multiperiod accrual based methods and the focus in practice on multiperiod cash flow based methods can have two explanations. Either equity research analysts are convinced of the strengths of cash flow based multiperiod valuation models and disagree with arguments in favor of accrual based models, or equity research analysts are willing to acknowledge the theoretical advantages of accrual based multiperiod valuation techniques but the computational difficulties or and unfamiliarity is causes the avoidance of accrual earnings based valuation models.

Through the empirical analysis the main research question can be answered. The first research question stated; *'how do sell-side equity research analysts select the valuation methods to estimate firm's market value of equity?'*. The results imply that operating performance variables, stock return volatility and firm size explain the employment of the DCF and singleperiod equity based valuation methods. Firm level determinants only negatively affect the chance of applying singleperiod valuation methods indicating that irregularities in firm

level characteristics causes equity research analysts to avoid singleperiod equity based valuation models. Yet the firm level determinants are robust to the inclusion of control variables. Furthermore, firm level determinants do not explain the usage of singleperiod enterprise based valuation methods implying that those valuation methods are randomly applied by equity research analysts.

The second research question stated; *'to what extent did the global credit crunch and reputation influences affect the employment of equity valuation techniques?'*. The empirical analysis shows that negative GDP growth and the reputation of the stock exchange directly affect equity research analysts in applying certain valuation methods. In addition, peaks in M&A and equity issuing declines the chance of applying singleperiod equity based valuation techniques by top investment banks indicating that sell-side equity research analysts do not want their valuation to be negatively influenced by less optimistic multiples valuation. Moreover, the usage of the DCF method is robust to the inclusion of economic indicators.

Regional and sector classification also influence equity research analysts in their valuation procedure. For the DCF method sector classification are less important than regional effects, while singleperiod equity based methods are stronger affected by industry classifications. However, further regional effects on North American and emerging countries based firms show that firm level determinants are quite sensitive to regional influences.

Finally, analysts employed by top investment banks merely concentrate on operating performance characteristics and leverage levels in their choice to use either the DCF method or singleperiod equity based models.

6.2 Discussion

Contributions

This paragraph discusses the importance and meaning of the findings through the following three arguments. First, from section 5.1 and section 5.2 it is reported that the employment of equity valuation techniques is not completely in line with theoretical recommendations. To illustrate, empirical evidence and theoretical literature (for instance Penman and Sougianis (1998) and Palepu, Healy, and Peek (2010)) show that accrual earnings based multiperiod valuation models are superior to cash flow based multiperiod models, yet this thesis shows that sell-side equity research analysts only apply the DCF as multiperiod valuation method. In contrast, when equity research analysts employ singleperiod equity valuation models they do follow the theoretical guidance (for instance Schreiner (2007); Goedhart, Koller, and Wessels (2010)). Recommendation on leverage adjustment, income statement figures and leading multiples are adopted by research analysts. This thesis has demonstrated that equity research analysts and academic literature are unaligned in applying equity valuation techniques.

Second, the focus of Demirakos, Strong, and Walker (2004); Glaum and Friedrich (2006) and Imam, Barker, and Clubb (2008) on cross industry differ-

ences is plausible since significant differences between sectors are present. However, by analyzing firm level determinants a more complete view on the applied valuation methodology of equity research analysts is provided. A firm level analysis on applied equity valuation methods was also conducted by Roosenboom (2007) for IPO processes. Although his results are corresponding to this thesis, IPO underwriters usually have an incentive to inflate equity estimations to satisfy the expectations of their client. So the firm level analysis on equity research reports is not affected by biased IPO processes or transaction circumstances. An alternative explanation for the significant firm level determinants is relative small unique firm year observations. Although the data set consists 412 equity research reports only 108 companies are analyzed. Nevertheless, the firm level empirical analysis on the valuation behavior of equity research analysts increased the understanding why equity research analysts apply certain valuation methods under different circumstances. These findings possibly diminish the ambiguous reputation of sell-side equity research analysts.

Third, Glaum and Friedrich (2006) observed a changing valuation behavior after the dot.com bubble in the beginning of the 2000s. The findings in this thesis show that the economic indicators and industry and regional classifications affect valuation methodologies. It can therefore be argued that equity research analysts are sensitive to outside circumstances and are not in using utilizing equity valuation methods.

Limitations

Since it is impossible to perfectly explain the valuation behavior of equity research analysts, this thesis is prone to a couple of limitations. Firstly, the novel aim of this research was to remove the ambiguity faced by sell-side equity research analysts. Empirical testing after the structured content analysis has broaden the understanding and valuation behavior of sell-side equity research analysts. However, a structured content analysis in combination with semi-structured interviews could further complete the analysis on equity valuation behavior by sell-side equity research analysts. As a consequence, the ambiguity surrounding equity analysts could be further declined.

The second limitation concerns the data set. Although the amount of equity research reports is much larger then in previous academic papers, logistic regression on a relatively small sample size causes the McFadden R^2 to be low. Furthermore, the small sample size makes it impossible to divide the sample over years and constructing panel data regressions. Although the data set is dividend into subsample to observe regional and brokerage house effects, the remaining sample size is in fact too small to draw reliable conclusions. The sample size is too broad to do run proper logistic regressions on a smaller sample size. Therefore one of the advantages of the data set, covering lots of industries, geographic regions and years, is simultaneously also its pitfall.

The third limitation concerns the usage of binary logit models instead of multinomial logit models. Equity research analysts are not assessing whether to employ the DCF or not, but have to decide whether to use a DCF, P/E

or EV/EBITDA method. This multiple selection procedure is equal to the decision to do an IPO on either the NASDAQ, NYSE or LSE. Since equity valuation models are not exposed to a natural ordering a multinomial logit method should be utilized. In addition, multinomial logit model can expose the relative importance of firm level determinants on different equity valuation techniques.

6.3 Further research

The last section of this chapter is completed by some recommendations for further research. Within the global financial markets equity valuation is conducted for valuing IPO underwritings, equity research reports and M&A transactions. This research completes the understanding of valuation processes within equity research reports and Roosenboom (2007) already conducted equity valuation analysis for IPO underwritings. Further insights could emerge on equity valuation methodologies when deal prospectus are gathered or experienced M&A bankers are interviewed.

The second recommendation for further research is a focus on either a smaller amount of industries or one specific region. By cutting the sample size to only North American based companies in the sensitivity analysis interesting findings were observed. By extending the focus on one sector or region further insights can be obtained on the valuation procedure of sell-side equity research analysts.

The third suggestion for further research would be to mirror firm level determinants explaining equity valuation practices during semi-structured interviews. Imam, Barker, and Clubb (2008) first conducted interviews and later analyzed the content of equity research reports. However, by first running an empirical data analysis and after semi-structured interviews, equity research analysts could be questioned how to explain differences with theoretical literature, the importance of sector or geographical classifications or to what extent external circumstances influence their valuation procedure.

This thesis has provided insights into the valuation behavior of sell-side equity research analysts who's objectives remain unclear. Strong conflicts of interest has risen doubts on the credibility of equity research reports and the subsequent valuation methods. By analyzing firm level determinants influencing equity research analysts it is tried to decrease this ambiguity surrounding research analysts. If further research on firm level determinants in collaboration with regional or sector classification does not further diminish the vagueness around the objectives of sell-side equity research analysts, maybe the recommendations by Mr. Jackson in his article in the Financial Times should be followed. His suggestion implies that authorities impose standard measures and valuation requirements, similar to the credit industry, and those seeking capital are obliged to pay for the research.

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Appendices

Appendix A: Regression parameter interpretation

Log odds	Odds	Probabilities
-6.9067	.001	.001
-4.5951	.010	.01
-1.7346	.177	.15
-1.3863	.250	.2
-1.0986	.333	.25
-.8473	.429	.3
-.6190	.539	.35
-.4055	.667	.4
-.2007	.818	.45
.0000	1.000	.5
.2007	1.222	.55
.4055	1.500	.6
.6190	1.857	.65
.8473	2.333	.7
1.0986	3.000	.75
1.3863	4.000	.8
1.7346	5.667	.85
2.1972	9.000	.9
6.9068	999.000	.999
9.2102	9999.000	.9999

Appendix B: Overview reputable investment banks and stock exchanges

Table shows most active global stock exchanges and top investment banks over the sample period. LSE stands for London Stock Exchange, TSE stands for Tokyo Stock Exchange, SSE stands for Shanghai Stock Exchange.

	2006	2007	2008	2009	2010
Stock exchange					
1	NYSE	NYSE	NASDAQ	NASDAQ	NASDAQ
2	NASDAQ	NASDAQ	NYSE	NYSE	NYSE
3	LSE	LSE	LSE	SSE	SSE
4	TSE	TSE			
Investment banks					
1	Goldman Sachs	Goldman Sachs	Goldman Sachs	Morgan Stanley	Morgan Stanley
2	Morgan Stanley	Morgan Stanley	JP Morgan	Goldman Sachs	Goldman Sachs
3	JP Morgan	JP Morgan	Citi	JP Morgan	JP Morgan
4	Citi	Merrill Lynch	Merrill Lynch	Citi	Credit Suisse
5	Merrill Lynch	Citi	Morgan Stanley	Merrill Lynch	Deutsche Bank
6	UBS	UBS	UBS	UBS	Merrill Lynch
7	Credit Suisse	Credit Suisse	Deutsche Bank	Deutsche Bank	UBS
8	Deutsche Bank	Deutsche Bank	Credit Suisse	Credit Suisse	Citi
9	Lazard	Barclays Capital	Barclays Capital	Barclays Capital	Barclays Capital
10	Barclays Capital	Nomura	Lazard	Lazard	Lazard
11			Lehman Brothers	Nomura	Nomura
12			Wachovia	RBS	

Appendix C: Correlation matrix predictor variables

	SGROW	PROF	EVOL	INTANG	LEVERAGE	DIV	AGE	SVOL	DELTA	LENGTH	MRET	MVOL	LEHMAN	CRISIS	LnSIZE	EXCHANGE	REVISION	$MCAP_{small}$	BANK	PEAK
SGROW	1.000																			
PROF	0.121	1.000																		
EVOL	-0.099	-0.044	1.000																	
INTANG	-0.149	-0.047	0.020	1.000																
LEV.	-0.101	-0.032	0.026	0.147	1.000															
DIV	0.030	0.043	-0.069	-0.296	-0.008	1.000														
AGE	-0.198	-0.009	0.065	-0.064	0.027	0.188	1.000													
SVOL	0.141	-0.039	-0.062	-0.092	-0.038	-0.003	-0.088	1.000												
DELTA	-0.086	-0.131	0.004	-0.043	-0.100	0.106	-0.083	-0.079	1.000											
LENGTH	0.013	0.059	-0.022	0.067	0.147	-0.083	-0.010	-0.014	-0.123	1.000										
MRET	-0.050	-0.041	-0.006	-0.034	0.004	0.032	-0.025	-0.279	0.105	-0.080	1.000									
MVOL	0.087	0.069	-0.054	-0.014	-0.068	0.063	-0.030	0.706	-0.034	0.018	-0.461	1.000								
LEHMAN	-0.086	-0.025	-0.040	0.064	0.060	0.119	0.006	0.296	-0.012	0.015	0.065	0.376	1.000							
CRISIS	-0.038	-0.079	-0.008	0.105	0.003	-0.014	0.031	0.459	0.023	0.009	-0.150	0.491	0.271	1.000						
LnSIZE	-0.042	-0.034	0.017	-0.075	0.361	0.007	0.076	0.047	-0.110	0.116	-0.102	0.040	0.139	0.082	1.000					
EXCH.	-0.121	-0.054	0.082	0.221	0.030	-0.356	-0.022	-0.096	0.009	-0.118	-0.066	-0.125	-0.196	-0.015	-0.025	1.000				
REVISION	-0.027	-0.008	0.002	-0.085	0.007	0.061	0.054	-0.069	-0.008	-0.059	0.048	-0.063	-0.018	-0.134	-0.009	-0.164	1.000			
$MCAP_{sm}$	-0.165	-0.193	0.025	0.095	-0.117	0.031	-0.156	0.107	0.105	-0.147	-0.015	0.034	0.038	0.089	-0.313	0.041	0.035	1.000		
BANK	-0.012	0.032	0.069	0.006	0.074	0.147	0.068	-0.018	-0.009	-0.004	-0.088	0.024	0.018	0.041	0.122	0.022	0.120	-0.045	1.000	
PEAK	0.067	-0.019	0.055	-0.003	0.026	-0.077	0.031	-0.169	-0.035	-0.005	0.111	-0.234	-0.546	-0.055	-0.138	0.108	0.088	-0.044	-0.029	1.000

Appendix D: Binary logit models excluding stock return volatility predictor variable

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level determinants and economic indicators are included as predictor variables. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	2.052	(2.011)[b]	-1.656	(-1.487)	0.428	(0.423)
PROF	1.298	(1.549)	-1.935	(-1.751)[c]	-0.098	(-0.152)
EVOL	0.035	(1.154)	-0.066	(-1.965)[b]	0.020	(0.703)
INTANG	0.081	(0.123)	0.419	(0.587)	1.541	(2.255)[b]
LEVERAGE	0.670	(1.371)	-0.714	(-1.357)	-0.657	(-1.254)
DIV	0.992	(2.107)[b]	-0.314	(-0.629)	-0.239	(-0.474)
AGE	-0.005	(-1.940)[c]	0.004	(1.374)	0.001	(0.494)
LnSIZE	-0.031	(-0.228)	-0.640	(-4.516)[a]	0.584	(4.203)[a]
REVISION * $MCAP_{small}$	-0.716	(-1.293)	-0.784	(-1.379)	-0.025	(-0.053)
DELTA	0.389	(0.552)	0.048	(0.063)	0.388	(0.561)
LENGTH	0.013	(1.638)	0.005	(0.684)	-0.006	(-0.681)
CRISIS	0.250	(0.754)	-0.661	(-2.001)[b]	-0.579	(-1.751)[c]
MRET	-0.550	(-0.617)	0.926	(1.015)	0.344	(0.373)
MVOL	-22.234	(-1.071)	6.831	(0.325)	18.685	(0.915)
EXCHANGE	-0.467	(-1.969)[b]	0.753	(3.020)[a]	-0.384	(-1.513)
BANK * PEAK	0.340	(1.059)	-0.523	(-1.529)	0.202	(0.559)
LEHMAN	-0.226	(-0.858)	0.021	(0.073)	-0.282	(-1.041)
Intercept	-0.454	(-0.376)	5.172	(3.966)[a]	-5.423	(-4.340)[a]
McFadden R^2	0.069		0.120		0.047	
LR-statistic	39.126[a]		67.876[a]		24.027	
Observations	412		412		412	

Appendix E: Binary logit models including dummy loss making firms

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics and a dummy for loss making firms are included as predictor variables. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	2.264	(2.198)[b]	-1.908	(-1.686)[c]	0.761	(0.756)
PROF	1.205	(1.616)	-2.031	(-2.340)[b]	0.029	(0.045)
EVOL	0.034	(1.081)	-0.060	(-1.885)[c]	0.017	(0.601)
INTANG	-0.061	(-0.095)	0.249	(0.366)	1.155	(1.745)[c]
LEVERAGE	0.662	(1.379)	-0.532	(-1.062)	-0.610	(-1.206)
DIV	1.183	(2.600)[a]	-0.911	(-1.912)[c]	-0.048	(-0.097)
AGE	-0.004	(-1.809)[c]	0.003	(1.040)	0.001	(0.358)
SVOL	-2.858	(-0.305)	-21.421	(-2.118)[b]	-4.242	(-0.458)
LnSIZE	-0.056	(-0.423)	-0.619	(-4.629)[a]	0.515	(3.854)[a]
REVISION * $MCAP_{small}$	-0.661	(-1.272)	-0.709	(-1.256)	0.095	(0.198)
DELTA	0.371	(0.524)	-0.133	(-0.182)	0.274	(0.387)
LENGTH	0.015	(2.011)[b]	0.001	(0.088)	-0.003	(-0.416)
LOSS	0.117	(0.296)	-0.612	(-1.447)	0.069	(0.162)
Intercept	-0.906	(-0.802)	6.248	(5.386)[a]	-5.021	(-4.374)[a]
McFadden R^2	0.055		0.100		0.034	
LR-statistic	31.308[a]		56.712[a]		17.127	
Observations	412		412		412	

Appendix F: Binary logit models on R&D and 30-day market return and volatility

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics are included as predictor variables. R&D stands for total R&D expenditures divided by total sales. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	3.407	(2.489)[b]	-2.523	(-1.857)[c]	-0.247	(-0.168)
PROF	0.165	(0.132)	-0.703	(-0.576)	0.153	(0.121)
EVOL	0.027	(0.678)	-0.055	(-1.434)	-0.010	(-0.259)
R&D	1.787	(0.791)	1.487	(0.638)	-1.974	(-0.844)
LEVERAGE	-0.189	(-0.277)	-0.673	(-0.976)	-0.098	(-0.139)
DIV	1.797	(2.811)[a]	-0.950	(-1.393)	0.078	(0.117)
AGE	0.001	(0.226)	-0.001	(-0.309)	0.001	(0.259)
SVOL	-12.188	(-0.767)	-9.178	(-0.564)	1.279	(0.086)
LnSIZE	-0.010	(-0.045)	-0.426	(-1.877)[c]	0.301	(1.354)
REVISION * $MCAP_{small}$	-0.486	(-0.574)	-0.486	(-0.664)	-0.324	(-0.456)
DELTA	0.308	(0.292)	0.198	(0.184)	-0.035	(-0.031)
LENGTH	0.023	(1.994)[b]	0.002	(0.150)	-0.011	(-0.921)
Intercept	-1.808	(-0.952)	4.730	(2.442)[b]	-2.912	(-1.520)
McFadden R^2	0.075		0.072		0.022	
LR-statistic	20.159[c]		19.930[c]		5.465	
Observations	202		202		202	

Appendix F: continued

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics and economic indicator variables are included as predictor variables. The predictor variables market index return (MRET30) and market index volatility (MVOL30) are on a 30-day historical trading interval. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	1.965	(1.961)[b]	-1.412	(-1.267)	0.427	(0.419)
PROF	1.191	(1.437)	-1.876	(-1.676)[c]	-0.107	(-0.164)
EVOL	0.036	(1.220)	-0.068	(-2.066)[b]	0.021	(0.729)
INTANG	0.144	(0.216)	0.213	(0.293)	1.591	(2.300)[b]
LEVERAGE	0.705	(1.449)	-0.724	(-1.389)	-0.660	(-1.267)
DIV	0.992	(2.087)[b]	-0.352	(-0.707)	-0.227	(-0.447)
AGE	-0.005	(-1.859)[c]	0.003	(1.239)	0.001	(0.518)
SVOL	-1.822	(-0.155)	-10.210	(-0.818)	3.138	(0.248)
LnSIZE	-0.020	(-0.150)	-0.668	(-4.720)[a]	0.585	(4.237)[a]
REVISION * $MCAP_{small}$	-0.712	(-1.274)	-0.767	(-1.298)	-0.053	(-0.114)
DELTA	0.364	(0.520)	0.091	(0.122)	0.383	(0.544)
LENGTH	0.013	(1.659)[c]	0.005	(0.610)	-0.006	(-0.741)
CRISIS	0.103	(0.319)	-0.411	(-1.236)	-0.589	(-1.692)[c]
MRET30	0.368	(0.218)	-1.898	(-1.130)	1.589	(0.900)
MVOL30	4.603	(0.232)	-20.520	(-1.168)	14.890	(0.780)
EXCHANGE	-0.439	(-1.868)[c]	0.704	(2.865)[a]	-0.375	(-1.465)
BANK * PEAK	0.324	(1.006)	-0.505	(-1.471)	0.204	(0.562)
LEHMAN	-0.344	(-1.358)	0.213	(0.793)	-0.280	(-1.070)
Intercept	-0.827	(-0.694)	5.987	(4.624)[a]	-5.459	(-4.439)[a]
McFadden R^2	0.067		0.124		0.048	
LR-statistic	38.043[a]		70.093[a]		24.552	
Observations	412		412		412	

Appendix G: Binary logit models on top investment banks

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics are included as predictor variables and the data set consists of research reports released by top investment banks. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	4.097	(3.024)[a]	-2.393	(-1.729)[c]	1.419	(1.042)
PROF	3.193	(2.296)[b]	-3.834	(-3.174)[a]	-0.045	(-0.043)
EVOL	0.061	(1.350)	-0.039	(-1.071)	-0.008	(-0.240)
INTANG	0.135	(0.157)	0.023	(0.024)	0.447	(0.508)
LEVERAGE	1.650	(2.419)[b]	-1.682	(-2.361)[b]	-0.979	(-1.441)
DIV	0.304	(0.464)	-0.350	(-0.554)	-0.559	(-0.854)
AGE	-0.006	(-1.605)	0.004	(1.087)	-0.003	(-0.794)
SVOL	-13.416	(-1.107)	-17.920	(-1.109)	-6.830	(-0.530)
LnSIZE	-0.248	(-1.119)	-0.636	(-3.046)[a]	0.500	(2.369)[b]
REVISION * $MCAP_{small}$	-0.654	(-1.039)	-0.210	(-0.340)	-0.555	(-0.832)
DELTA	-0.517	(-0.502)	0.509	(0.444)	1.427	(1.452)
LENGTH	0.023	(1.996)[b]	0.002	(0.199)	-0.006	(-0.613)
Intercept	0.115	(0.059)	6.674	(3.564)[a]	-3.870	(-2.059)[b]
McFadden R^2	0.120		0.131		0.050	
LR-statistic	35.049[a]		37.845[a]		13.869	
Observations	212		212		212	

Appendix H: Binary logit models on North America and Emerging countries

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics are included as predictor variables and the data set consists of companies based in North America. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	1.827	(1.088)	-5.697	(-2.760)[a]	-3.957	(-2.006)[b]
PROF	0.921	(0.793)	-8.332	(-4.415)[a]	1.291	(1.024)
EVOL	-0.008	(-0.163)	-0.108	(-2.309)[b]	-0.021	(-0.516)
INTANG	-0.028	(-0.025)	3.640	(2.486)[b]	-1.175	(-0.880)
LEVERAGE	0.583	(0.636)	-1.550	(-1.496)	-0.254	(-0.272)
DIV	-2.551	(-1.575)	-1.143	(-0.935)	-0.115	(-0.112)
AGE	-0.008	(-1.236)	0.017	(2.822)[a]	0.000	(-0.044)
SVOL	-43.080	(-2.243)[b]	-9.479	(-0.684)	21.290	(1.513)
LnSIZE	0.107	(0.518)	-1.159	(-4.080)[a]	0.827	(3.753)[a]
REVISION * $MCAP_{small}$	-0.415	(-0.356)	-1.408	(-1.254)	-0.362	(-0.315)
DELTA	-2.102	(-1.198)	-0.820	(-0.451)	6.421	(3.457)[a]
LENGTH	0.016	(1.184)	0.020	(1.210)	0.004	(0.255)
Intercept	-1.281	(-0.805)	10.495	(4.080)[a]	-6.771	(-3.628)[a]
McFadden R^2	0.110		0.296		0.164	
LR-statistic	20.456[c]		60.873[a]		31.381[a]	
Observations	152		152		152	

Appendix H: continued

Table shows three binary logit regressions with the DCF, singleperiod equity based and singleperiod enterprise based valuation methods as response variable. Firm level characteristics are included as predictor variables and the data set consists of companies based in emerging regions. Numbers in parentheses are z-statistics based on robust Huber/White standard errors. [a] significant at the 1% level, [b] significant at the 5% level, [c] significant at the 10% level. Variable definitions are given in table 4.3.

Predictor variables	**Response variables**					
	DCF		S-EQ		S-EN	
SGROW	3.022	(1.456)[b]	-3.790	(-1.676)[c]	5.147	(2.178)
PROF	0.097	(0.092)	0.673	(0.742)	-0.258	(-0.288)
EVOL	0.149	(1.722)[c]	-0.034	(-0.479)	0.044	(0.551)
INTANG	-0.896	(-0.500)	-0.100	(-0.050)	0.397	(0.263)
LEVERAGE	2.119	(1.148)	-5.948	(-2.807)[a]	1.420	(0.964)
DIV	2.445	(2.695)[a]	0.251	(0.224)	-0.923	(-0.976)
AGE	-0.003	(-0.514)	-0.015	(-1.951)[b]	0.007	(1.086)
SVOL	22.168	(1.001)	-43.222	(-1.284)	-17.672	(-1.000)
LnSIZE	0.626	(1.935)[c]	-1.753	(-3.904)[a]	0.811	(2.072)[b]
REVISION * $MCAP_{small}$	-2.465	(-2.017)[b]	1.441	(1.777)[c]	-0.637	(-0.668)
DELTA	1.248	(0.650)	-3.119	(-1.775)[c]	1.020	(0.524)
LENGTH	0.002	(0.127)	0.025	(1.498)	0.014	(0.851)
Intercept	-6.706	(-2.243)	15.504	(3.926)[a]	-8.403	(-2.420)[b]
McFadden R^2	0.148		0.323		0.127	
LR-statistic	22.863[b]		47.197[a]		18.924[c]	
Observations	117		117		117	