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Value Relevance Effects of R&D Capitalization in US Companies

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Abstract

During the last few decades, investments in intangible knowledge have grown in importance. Along with this development, there has been an ongoing discussion on how to best treat such investments in the financial reports. This paper specifically focuses on expenditures labelled research & development (R&D). To this day, there are still significant differences regarding the treatment of such expenditures between the two major accounting standard-setters, FASB and IASB, and despite much critique in research, US GAAP still largely prohibits companies to recognize R&D spending as an asset in the balance sheet. Through the usage of standardized amortization schedules developed by Lev & Sougiannis (1996) and presented by Lev (1999), this paper sets out to investigate the overall value relevance effect of this prohibition. Hypothetical earnings and book values are created with the sole difference being the treatment of its R&D expenditures, and have subsequently been compared with its original counterparts in terms of ability to explain market value. The paper finds clear evidence suggesting that allowing for R&D to be capitalized increases the value relevance, however, still recognizes that all relevant factors might not be accounted for in the investigation. Furthermore, the paper continues by examining how this value relevance effect has developed over the years, but the evidence provided is weak and inconsistent, thus not completely supporting the notion that R&D accounting is an issue that has grown in importance over time.

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Introduction

During the last decade, the accounting treatment of intangible assets has been a quite frequently discussed topic. There are researchers arguing that current accounting standards are limited in terms of communicating relevant information regarding intangible assets. Numerous studies have uncovered that the major issue is the complication to recognize the economic value that is assigned to intangible assets (Lev & Sougiannis, 1996; Lev & Zarowin, 1999). Given the current development of the economy, where companies are moving towards a more knowledge based paradigm, the intangible assets will grow in importance (Lev, 2001). Thus, as a corresponding effect, the considered struggle to adequately give an account for the increasing number of companies where intangible assets make out for a significant part of the balance sheet, will be more palpable and furthermore create a challenge for accounting standard-setters.

Following this development, a concern within the field of accounting in recent years has been a suggested loss of value relevance for investors in terms of the financial statements. To some extent, this common belief has been counted by research. Collins, Maydew & Weiss (1997) argues that if taking both earnings as well as balance sheet information into account, value relevance has actually increased slightly. Francis & Schipper (1999) observes a clear value relevance decrease of earnings during their sample period (1952-1994), but also a concurrent value relevance increase in terms of balance sheet and book value information for the same period, thus arguing that financial statements still consist of value relevant information for investors. Contradicting these studies, Chang (1999) examines the combined value relevance of earnings and book values and reaches the conclusion that value relevance has significantly decreased during the same four decades.

Ely & Waymire (1999) investigates the value relevance effects following significant changes of standard-setting organizations in the US. The conclusion drawn is that, in terms of earnings, value relevance has not increased following any of the three key changes investigated (the installment of CAP, APB and FASB, respectively). However, if adding book value information to the equation, a significant increase has been observed following the introduction of FASB in 1974. Though, Ely & Waymire (1999) argues that this might rather be a result of an unusually low level of relevance in the foregoing period than explicit evidence to the effectiveness of FASB.

While the development of the combined value relevance is still not entirely agreed upon, the value relevance decrease of earnings must be considered as widely recognized. This development was observed by Lev (1989), and thus further emphasized by Lev & Zarowin (1999) and Francis & Schipper (1999). Lev & Zarowin (1999) shows that the association between earnings and stock prices have decreased from R^2s of 6-12 % between 1977-1986 to R^2s of 4-8 % between 1987-1996. More recently, Lev & Gu (2016) suggests that reported earnings have gone from explaining 80-90 % of gains and losses in equity between 1950-1980, to about 40 % today.

Furthermore, Lev & Sougiannis (1996) points out the mandated expensing of R&D spending as a major point of concern. This is part of a long-running debate discussing the pros and cons of allowing companies to treat R&D spending as an asset, thus capitalizing it in the balance sheet. This paper sets out to participate in this discussion, with its main purpose being to investigate the value relevance effects of such mandated expensing, and how it might be affected by the hypothetical permission of R&D capitalization.

Today, the two major accounting regulatory frameworks differs quite significantly in their views on the matter. While US GAAP encourage full expensing for such expenditures, with only a few exceptions, IFRS are mandating capitalization of R&D expenditures if certain specific criteria are met. The opinions are divided regarding which one of the two approaches is preferable. A fair number of researchers suggest that the accounting numbers would be more useful and reflect the underlying economic situation better if capitalization of R&D expenditures were allowed, while some argue that the possibility to capitalize such expenditures might be abused by managers and create misleading numbers.

Lev & Sougiannis (1996) claims that the value relevance of the accounting is hampered if entities are forced to expense their R&D expenditures when incurred. Their study find evidence that the accounting numbers improve in terms of value relevance if earnings and book value are adjusted in line with hypothetical R&D amortization schedules based on industry belonging. Thus, suggesting that accounting as a phenomenon would improve if allowing companies to capitalize R&D spending. Following this, Lev (1999) presents a table over suggested amortization rates (on average) for specifically R&D-intensive industries, and advices analysts and investors to adjust for R&D expenditure accordingly, in order to increase the likelihood of making well-informed and correct decisions.

The overall effect forced expensing of R&D have on value relevance will be investigated with the usage of the industry-specific amortization rates provided by Lev (1999), which will create a hypothetical sample of companies with the sole difference in their treatment of R&D spending. In order to investigate the value relevance of such accounting numbers, this study will use a quite simple model for determining value relevance, following in the footsteps of earlier research (e.g. Shah, Liang & Akbar, 2013; Tsoligkas & Tsalavouvas, 2011). In the simplest of terms, the model used considers a company's market value to be a function of its book value and expected future residual income. With this definition, value relevance is a measure of how well the accounting numbers (earnings and book value) are able to explain a firm's true value (in this case assumed to be the same as the market value).

Onwards, this paper will further distinguish itself from earlier research by investigating the development of value relevance over time, and specifically explore what effect the prohibition of R&D capitalization have had on the overall value relevance. Previous research (Lev & Gu, 2016) have suggested that this prohibition to a significant extent is responsible for an alleged value relevance decrease over the last 20-30 years, a notion that this paper sets out to scrutinize. Earlier literature on the area is extensive, however, most research has investigated the value relevance effects of R&D accounting at one specific point in time, or at best, two points following a specific accounting regulation change. Thus, the value relevance development over time and its relation to R&D accounting is largely left unexplored. Furthermore, research on the area appears to have lessened in later years, why there seems to be a lack of research actually confirming the development suggested by research. In this instant, this paper aims to contribute to this research field by actually providing evidence to the time development of the R&D accounting issue.

The timespan of the investigation is 25 years, from 1991 - 2015, and the paper will focus on four specific industries, all known for its R&D-intensity. The included industries are pharmaceuticals, electrical equipment, machinery & computer hardware and transportation.

The study shows clear proof in favour of a value relevance increase if committing these R&D-based adjustments on numbers provided in the financial statements. As for the development over time, the results obtained are largely inconsistent, thus neither being able to confirm nor reject the alleged value relevance decrease.

The rest of the report will be structured as follows; The following chapter will disclose results and implications of previous literature on the area, which in turn will lead to a hypothesis development. The third chapter presents the paper's methodology. Following this, results of the conducted investigation are shown. Finally, the paper will end with a discussion and some conclusions.

Theoretical background and hypothesis development

Current treatment of R&D spending

Today, with few exceptions (software investments and acquired capitalized R&D), US companies are prohibited from capitalizing their R&D investments. Instead, US GAAP treats R&D spending as a regular expense, and as such, are instantly expensed in the financial statements. As an alternative to this approach, the European equivalent to US GAAP, IFRS, are more lenient in its R&D regulations. While both accounting regulators requires companies to expense research immediately, the possibility to capitalize internally generated development do exist for European companies. Firms are obligated to capitalize their development expenditures if six specific requirements regarding technical and economic feasibility of a specific project can be demonstrated (IAS 38, 2014). Among these requirements, the feasibility and intent to complete the asset, as well as the forthcoming ability to sell a product that has evolved from the development, can be found.

Motivation behind FASB's decision to forbid R&D capitalization is found in the following extract (Statement of Financial Accounting Standards No. 2, p. 41);

"A direct relationship between research and development costs and specific future revenue generally has not been demonstrated, even with the benefit of hindsight. For example, three empirical research studies, which focus on companies in industries intensively involved in research and development activities, generally failed to find a significant correlation between research and development expenditures and increased future benefits as measured by subsequent sales, earnings, or share of industry sales."

Thus, the key argument against a R&D capitalization possibility seems to be concerns of reliability and value relevance. These concerns have been significantly counted in later research. The following section will present a rich amount of research arguing in favor of the possibility to treat R&D spending as an investment.

Evidence supporting a capitalization possibility

US GAAP Research

One of the first paper to question the strict R&D regulations from FASB was the aforementioned paper by Lev & Sougiannis (1996). The paper constructs hypothetical earnings and book values to compare with the actual numbers using self-created amortization schedules specifically designed depending on industry belonging. The conducted investigation shows clear evidence of a correlation between capitalized R&D and stock prices, suggesting that allowing for capitalization of R&D would increase value relevance.

Healy, Myers & Howe (2001) elaborates on the issues with the current FASB standard's requirements of expensing all the R&D expenditures. The authors point out the potential risks of earnings management as a downside of allowing R&D spending to be capitalized (a risk that is supported by papers including Cazavan-Jeny & Jeanjean (2006) and Markarian, Pozza & Prencipe (2008)). However, the authors go on to argue that this downside is more than compensated for by an increasing value relevance. Thus, the paper argues in favor of allowing R&D expenditures to be capitalized.

Resembling research includes papers by Chambers, Jennings & Thompson (2002) and Eberhart, Maxwell & Siddique (2004). Chambers et al. (2002) examines R&D spending and its relation to future financial performance. The key argument is that the prohibition of capitalizing R&D is distorting the financial numbers, and all though not explicitly investigated, it is further implied that allowing for R&D spending to be capitalized might increase the utility of the financial statements. Eberhart et al. (2004) conducts a similar study, but with a longer time perspective. The paper explores the long-term consequences of R&D spending, and reaches the conclusion that firms with higher R&D expenditures in general experiences increasing future stock returns. Thus, the paper questions the US GAAP treatment of R&D spending, and adds to the body of evidence suggesting that capitalizing R&D improves the value relevance.

Additionally, Amir, Guan & Livne (2006) suggest that fully expensing the R&D expenditures in accordance with US GAAP is a conservative approach as they propose that R&D investments are not necessarily more unpredictable than classic capital expenditures, and suggest capitalization if certain criteria are met in accordance with IFRS.

Later on, the issue of R&D capitalization has been discussed by Ali, Ciftci & Cready (2012), as well as Park, Chung & Kim (2014). Ali et al. (2012) are questioning the requirements from US GAAP to expense all R&D expenditures when incurred, as it may make investors undervalue the possible benefits from R&D investments. Park et al. (2014) investigates how the capitalization of R&D spending influences earnings variability. By calculating the earnings as if companies would have capitalized their R&D expenditures, they compare the reported numbers in the financial statements when R&D was expensed. According to their findings, earnings are increasingly variable when companies' spending on R&D fluctuate more, the implication being that financial information might become more reliable if companies were allowed to capitalize their R&D expenditures.

Another recent study conducted by Goncharov, Mahlich & Yurtoglu (2014) have examined the issue of distorted profitability numbers in the pharmaceutical industry. The paper largely explains this phenomenon through current accounting regulations regarding R&D expenditures, and reaches the conclusion that if adjusting for this issue, profitability numbers within the pharmaceutical industry is far more comparable to corresponding numbers in other industries.

Furthermore, Sougiannis (2015) discusses the limitations of the R&D treatment in US GAAP. This article claims that investors generally price R&D expenditures positively, but since the accounting standard is treating the R&D expenditures as an expense when incurred, there is an increased risk of investor mispricing. Financial analysts tend to make up for this accounting limitation, but this is far from an optimal solution to the issue. Additionally, Sougiannis (2015) examines whether patents can be used to measure the successfulness of R&D investments, which in some instances have been shown to correlate positively with future earnings. However, the informational implications of the patents have turned out to be difficult to fully understand for both analysts and investors. Thus, the author suggests that improvements regarding the accounting policies of intangible assets are necessary to avoid information deficiencies. On the same subject, Hirschey, Richardson & Scholz (2001) examine whether the patent quality could be a useful indicator for investors and analysts to predict the market value of firms considered as innovative and "fast-changing". The relatively small portion of tangible assets in these companies makes the R&D capacity a decisive source of success in the longer run. The authors therefore suggest that the quality of the patents preferably should be disclosed separately in the financial statements since the US GAAP regulations do not meet the informational needs from investors.

IFRS Research

However, R&D accounting and the issue of value relevance has not only been a topic of concern within American research, and since the purpose of this paper is to investigate possible capitalization effects, the following section will further examine R&D accounting research in an IFRS context. In the UK, the issue has been widely debated, specifically following the transition to IFRS in 2005. Shah, Liang & Akbar (2013) have examined the value relevance of accounting for R&D expenditures, before and after the introduction of IFRS in UK. Their findings imply that capitalized R&D expenditures during the period were value relevant, while the expensed R&D were not. However, value relevance of capitalized R&D expenditures has decreased since the adoption of IFRS, while R&D related expenses were not affected. Since the introduction of IFRS have reduced the ability for managers to choose between capitalizing and expensing R&D, the authors suggest that strict regulations regarding R&D investments are worsening for the value relevance in general.

A similar study was conducted by Tsoligkas & Tsalavoutas (2011). This paper investigates how the introduction of IFRS in the UK has affected the value relevance of the accounting numbers regarding R&D. The conclusion from this paper is somewhat contradicting the results of Shah et al. (2013), suggesting that IFRS better reflects the underlying economics of the studied firms than earlier accounting standards. The study does, however, still emphasize the value relevance of R&D capitalization, thus not arguing for a complete prohibition.

A final paper focusing on UK companies was written by Oswald (2008). He argues that managers have the capability to decide if the entity should capitalize or expense their R&D expenditures and preferably communicate the information that they hold, thus agreeing with the conclusion of Shah et

al. (2013), that the leniency of earlier accounting standards is preferable to the stricter IFRS regulations.

Furthermore, the subject of R&D capitalization has been a frequent area of concern in Canada as well as Australia. The focal point of Smith, Percy & Richardson is R&D accounting in Canada and Australia compared with the US, where Canadian and Australian regulators represents a more lenient approach to capitalizing R&D. Smith et al. (2001) investigate the value relevance effect of discretionary capitalization in Canada & Australia in comparison with theoretical accounting numbers created if complying with US GAAP. The conclusion reached is that the discretionary capitalization does provide useful information, thus possibly being a useful signal for investors.

Ang, Church & Feng (2008) investigates the Australian transition in 2005, moving from a somewhat lenient R&D accounting approach to the stricter IFRS regulations. The paper provides partial support to the hypothesis that this change has decreased the value relevance, thus suggesting that the information content lost from this change exceeded the possible decrease in earnings management. The authors especially emphasize that the value relevance of the expensed R&D has decreased, and further suggest that this is a result of the inability to recognize research as an asset, following the new regulations.

Chan, Faff, Gharghori & Ho (2007) focuses on the Australian R&D accounting as well. This study, however, only includes results between the years of 1991-2002, thus not including any evidence from the period after the transition of 2005. The study suggests that allowing for companies to choose between expensing and capitalizing R&D is preferable to the alternative. They further point out the downside of imposing an accounting standard forcing a single method approach, emphasizing the information loss for investors.

Continuously, Australian companies was also the center of attention in a paper by Ke, Pham & Fargher (2004). The study investigated R&D intensive companies and came to the conclusion that there is a correlation between capitalized R&D expenditures and the firm's market value. Finally, Han & Manry (2004) conducted a study with a sample consisting of Korean companies. In agreement with Ke et al. (2004), the paper reports a positive association between capitalized R&D expenditures and the market value of the studied firms.

Hypothesis development

The aim of the paper is to investigate what effect allowing for R&D to be capitalized would have on the overall value relevance. Given this aim, the rich amount of research presented above and the purpose of the amortization rates provided by Lev (1999), the first hypothesis of this paper is;

H_1: Adjusting earnings and book value for R&D capitalization will increase the value relevance.

Moreover, this paper will also investigate if this value relevance increase, if existent, differs over time. Research (Lev & Gu, 2016) have suggested that the issue of R&D accounting have grown in importance over time, due to the paradigm shift in of terms vital assets and knowledge dependence. Therefore, logic would suggest that the difference in value relevance between the actual accounting numbers and the hypothetical equivalents should increase over time. Thus, the second hypothesis of this paper is;

H_2: The difference between the actual and hypothetical value relevance will increase over time.

Contradicting evidence

As indicated, however, research on the field is not entirely consistent, and several papers are arguing against a capitalization possibility. In an attempt to provide a fair view of the existing opinions, this section will give an account for some of this research as well. Examples of such papers are the already mentioned Cazavan-Jeny & Jeanjean (2006) and Markarian et al. (2008), two papers who both focuses on the risk of increasing earnings manipulation when allowing firms to capitalize R&D spending. Cazavan-Jeny & Jeanjean (2006), investigate whether managers' decision to capitalize R&D spending reflect estimated future performance or not. The paper makes the realization that many times capitalizing R&D is a consequence of incentives to meet or beat thresholds, rather than to accurately reflect underlying economic performance.

Similar conclusions are drawn by Markarian, Pozza & Prencipe (2008), who also investigate the existence of earnings management related to R&D capitalization. In their paper, two specific hypotheses related to earnings manipulation are investigated. While no significant support for R&D manipulation relating to the level of a firm's debt financing were found, the paper provides evidence suggesting that R&D capitalization do correlate with changes of profitability within a firm, thus suggesting that the capitalization possibility is used as a tool to smoothen earnings.

Further on, Godfrey & Koh (2001) investigates R&D capitalization in Australia. But in contradiction to much other research (Chan et al., 2007; Ke et al., 2004), this paper finds no evidence of a positive correlation between R&D capitalization and value relevance. Xu, Magnan & Andre (2007) claims that R&D expenditures are too uncertain in terms of providing future benefits to the firm and should therefore not be capitalized. Similarly, Kothari, Laguerre and Leone (2002) argue that capitalization of R&D investments to its nature is much more uncertain than capitalization of other "traditional" investments, such as PP&E. This statement is strengthened by their investigation, and it is therefore suggested that standard-setters should not allow for capitalization of R&D.

A final paper worthy of be given an account for is Zhao (2002). In an attempt to examine the issue on an international level, the paper sets out to make a relative comparison of value relevance of R&D between countries with different regulations regarding R&D accounting. Zhao draws the conclusion that, if adjusting for reporting environment, specifically code-law versus common-law, complete expensing of R&D does increase the association between stock prices and reported earnings in countries forbidding capitalization, while the deviation between capitalization and expensing increases the value relevance in countries allowing capitalization.

Methodology

Value relevance

As many previous studies (e.g. Shah et al., 2013; Zhang, 2002; Beisland & Hamberg, 2013 etc.) within the research field of accounting value relevance, this study will be taking a quite simple methodological point of departure for its value relevance determination. This model considers a firm's market value as a function of its current book value and its expected future residual income. This method is beneficial since the adjustments made when creating hypothetical amortization schedules ultimately

will affect the earnings as well as the book value. Thus, the model will very clearly be able to show what effects such adjustments will have on the value relevance. The initial model will therefore be;

$$(1)\ MV_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 E_{it} + \varepsilon_{it}$$

Where MV_{it} is the market value of firm i at year t, calculated as the closing price multiplied by the number of outstanding shares. BV_{it} is the same firm's book value while E_{it} is the earnings. The ability of explaining a firm's market value with its actual accounting numbers will thus be compared with the ability of explaining the same market value with hypothetical earnings and book values, following the created amortization schedules, as is shown in the model below;

$$(2) MV_{it} = \alpha_0 + \alpha_1 AdjBV_{it} + \alpha_2 AdjE_{it} + \varepsilon_{it}$$

Where $AdjBV_{it}$ is the adjusted book value and $AdjE_{it}$ the adjusted earnings.

Creation of amortization schedules

This paper will be using the amortization rates in accordance with the table presented by Lev (1999), which is heavily based on a paper by Lev & Sougiannis (1996). The amortization periods and rates are shown in the table below;

Table 1: Amortization rates

Industry	Amortization rate	Amortization period
Pharmaceutical companies	8-10 %	10-12 years
Chemicals	12-15 %	6-8 years
Computer hardware, electronic equipment and transportation vehicles	17-20 %	5-6 years
Scientific instruments and software	25 %	4 years

Table 1. Amortization rates and periods provided by the research of Lev & Sougiannis (1996) and Lev (1999), for the industries included in the study.

Thus, amortization schedules can be created, and with the help of these, earnings and book values can be adjusted. In order to maintain some degree of conservatism, the shortest amortization period has been used consequently during the study. The likelihood of this decision to have any significant effect on the results is deemed to be very low. The adjusted book value is defined as;

$$(3) AdjBV_{it} = BV_{it} + RDC_{it}$$

Where RDC_{it} is the research & development capital. This variable is further defined as;

$$(4)\ RDC_{it} = \beta_0 RDE_{it} + \beta_1 RDE_{it-1} + \ldots + \beta_n RDE_{it-n}$$

Where RDE_{it} is the research & development expenses and β is a specific percentage representing the portion of R&D spending that has not yet been amortized. Thus, this percentage is decided by the industry where the company in question exists. For instance, for a company within the pharmaceutical

industry (using 10 % as amortization rates), β_0 will be 0.9, β_1 will be 0.8, β_2 will be 0.7, and thus continue to β_8 which will be 0.1. Continuously, the adjusted earnings are defined as;

$$(5)\ AdjE_{it} = E_{it} + RDE_{it} - ARD_{it}$$

Where ARD is the amortized research & development. This variable is further defined as;

$$(6)\ ARD_{it} = \beta_{iar}RDE_{it} + \beta_{iar}RDE_{it-1} + \ldots + \beta_{iar}RDE_{it-n}$$

Where β_{iar} is the industry-specific amortization rate percentage. Thus, in the same pharmaceutical company as is used in the example above, β_{iar} will be 0.1. Given these definitions, equation (2) can be further developed as;

$$(2b)\ MV_{it} = \alpha_0 + \alpha_1(BV_{it} + \beta_0 RDE_{it} + \beta_1 RDE_{it-1} + \ldots + \beta_n RDE_{it-n}) + \alpha_2(E_{it} + RDE_{it} - (\beta_{iar}RDE_{it} + \beta_{iar}RDE_{it-1} + \ldots + \beta_{iar}RDE_{it-n})) + \varepsilon_{it}$$

Furthermore, an additional regression has been conducted in order to investigate the significance of the actual changes made when adjusting earnings and book values. In this regression, a new variable is created, DiffRD. This variable is defined below;

$$(7) DiffRD = ARD_{it} - RDE_{it}$$

Data sample

The data sample for this study incorporates American listed companies with reported R&D expenditures during a time period of 25 years (1991-2015). The data was retrieved and extracted from Compustat. When extracting the data, four different samples were created for investigation. The samples were formed after the two or three digit SIC-codes for four specific R&D intensive industries in which the companies are operating, namely pharmaceuticals (283), electrical equipment (36), machinery & computer hardware (35), and transportation (37). This deviation is primarily conducted to enable the subsequent creation of hypothetical earnings and book values, since the amortization period differs depending on industry. The paper makes no effort to distinguish results depending in industry belonging, as it lies outside the scope of this paper's purpose.

All companies included in the samples are listed on an American stock exchange, primarily on the New York Stock Exchange and Nasdaq. A total number of 42 179 observations were extracted. Additional observations from 1981 to 1990 for pharmaceutical companies and observations from 1986 to 1990 for the other industries were collected as well to be able to construct amortization schedules for all entities in the sample. Secondly, to create relevant samples for the study, observations lacking data regarding R&D expenditures, earnings, share price, common shares outstanding and book value were removed. Furthermore, firm observations with R&D expenditures equivalent to 0 over the entire amortization period were excluded from the sample as these were deemed not relevant for the scope of this paper. Following these exclusions, 26 313 observations remained in the dataset, distributed on 2 765 entities.

The next step in the process was to create an alternative dataset consisting of the hypothetical earnings and book values, all in line with the models presented in the previous segment.

The created samples involve multiple observations measured over time and should therefore be considered as panel data. Furthermore, the regressions are conducted with a fixed effects model. The fixed effects model is used to remove time-invariant effects for each company that may correlate with the regressors. To mitigate heteroscedasticity issues related to company size, the data has been deflated. Barth & Clinch (2009) discuss this issue and perform a deflation with both book value of equity and the total number of shares outstanding to scrutinize the effects caused by scale differences. However, the results from the paper show that, in general, number of shares is a more adequate deflator to control for the firm scale effects. Thus, in line with Barth & Clinch (2009), the common shares outstanding has been used as a deflator in this paper, which will generate variable numbers on a per-share level.

Continuously, the dataset has been further adjusted to deal with the likely issue of outliers. Specifically, the data have been trimmed (the top and bottom percentile for each dependent and independent variable) in order to ensure that questionable data as well as data stemming from very clear anomalies are not allowed to diminish the results. For instance, three specific observations disclosed that the number of outstanding shares was equal to a mere 1000 shares. When deflated, these three observations showed earnings and book values significantly different from the rest of the dataset, thus suffocating the results significantly. As an example of data stemming from anomalies, the trimming allowed us to exclude data rendering from a very clear-cut example of Big bath-accounting from General Motors between the years of 2007-2009, where the second and third largest losses for the entire dataset were noted for 2007 and 2008, and the largest earnings by far for the dataset was accounted for in 2009.

All in all, these adjustments took us to a total of 24 949 observations distributed over four industries and 25 years, where the lowest number of observations for one year was 764 (1991) and the highest number was 1 248 (1998). As for the industries, three out of the four business fields were somewhat similar in terms of number of observations, namely pharmaceuticals, computer hardware and electronic equipment (8 311, 8 576 and 6 352 observations, respectively). The fourth industry, transportation, consisted of significantly fewer observations (1 710). However, since the purpose of the paper does not include any analysis between the industries, transportation companies were included in the study despite the shortage in number of observations.

Results

Table 2: Descriptive statistics

	Number of observations	Mean	Median	Std. Dev.	Min	Max
E	24949	.089648	(.0404189)	1.330423	(5.18975)	5.745075
BV	24949	10.0509	4.806241	14.34833	.002981	114.6338
AdjE	24949	.289817	(.0006582)	1.353224	(4.86607)	6.428879
AdjBV	24949	11.61619	6.32326	15.17378	.011682	120.7779
RD	24949	.695472	.4379455	.8371364	(.02067)	13.23496
MV	24949	13.29896	7.16	15.93822	.0295	90.64

Table 2. Descriptive statistics for the complete dataset. E is earnings, BV is book value, AdjE is the adjusted earnings according to model 5, AdjBV is the adjusted book value according to model 3, RD is R&D expenditures and MV is market value of equity. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis.

The table above depicts the descriptive statistics of the entire dataset, after the adjustments for heteroscedasticity and possible outliers described in the previous section are committed. As mentioned, a total number of 24 949 observations are included in the study, and the table furthermore discloses the mean, median, standard deviation as well as minimum and maximum values for each variable in the models. Because of the heteroscedasticity mitigation, all numbers are presented per share. Noticeable is the difference between initial and adjusted earnings, where the latter indicates a slightly higher mean, thus suggesting that in general, the hypothetical R&D amortization expense is lower than the actual R&D expense. In other words, forced expensing of R&D affects earnings negatively. In all likelihood, this is mainly because of startups/IPOs where past R&D expenses do not exist and thus cannot be included in the creation process of the hypothetical amortization expenses. It is also apparent that the medians for each variable is significantly smaller than the mean, suggesting that a number of large entities are having an increasing effect on the means.

Table 3: Descriptive statistics, five-year basis

Mean					
Time period	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015
E	.22034	.174231	(.1314609)	.043217	.182743
BV	11.6641	10.19216	9.19191	9.013933	10.57378
AdjE	.440909	.463932	.0288986	.21616	.324354
AdjBV	13.19439	11.69502	10.65306	10.6254	12.33678
RD	.765763	.742105	.6242671	.651212	.705578
MV	12.73692	14.89689	12.43882	11.96395	14.35688
Number of observations	4268	5826	5506	5042	4307
Median					
Time period	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015
E	.1138978	.0503291	(.1160637)	(.0768124)	(.0658199)
BV	6.337301	5.327989	4.293194	3.961478	4.242445
AdjE	.1972324	.1917478	(.0840048)	(.0461321)	(.0404192)
AdjBV	7.541658	6.690419	5.796246	5.666262	6.198157
RD	.4543064	.4819364	.4057994	.4021825	.4402258
MV	8	9.1875	6.5	5.56505	6.4
Number of observations	4268	5826	5506	5042	4307

Table 3. Descriptive statistics for the complete dataset. Data is pooled into five periods of five years, respectively. E is earnings, BV is book value, AdjE is the adjusted earnings according to model 5, AdjBV is the adjusted book value according to model 3, RD is R&D expenditures and MV is market value of equity. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis.

This table showcases the means, medians and number of observations for the same variables, over the time period of the study. The data have been pooled into five groups, with each group containing data over five years. This decision was made in order to avoid yearly anomalies, as well as increasing the reliability of the statistics, since the number of observations for some years were all too few. Moreover, pooling the data is making it easier to identify any trends over time. As seen above, the number of observations are highest between 1996-2000 (5 826), and lowest between 1991-1995 (4 268). The notion above regarding the difference between earnings and adjusted earnings are visible here as well, where adjusted earnings, in general, are higher for each time period observed. It is also evident that the means are consequently higher than the medians, as was the case above. The average R&D spending per share, and its development over time, is also noteworthy. The mean reaches its highest point 1996-2000, only to decrease significantly during the following period and reach its low point. In the following two time periods, R&D spending is gradually increasing yet again. Furthermore, the negative earnings mean of 2001-2005 should be pointed out, as well as a general decrease for all variables from 1996-2000 to 2001-2005.

Table 4: Descriptive statistics, industry based

Mean				
Industry	Pharmaceuticals	Electrical Equipment	M&C	Transports
E	(.36952)	.148949	.38111111	.941255
BV	4.59432	9.410493	13.82629	25.76006
AdjE	(.02616)	.282946	.5094721	1.044054
AdjBV	6.776924	10.59174	15.1403	27.18326
RD	.709733	.648815	.7220736	.761343
MV	11.32138	12.34263	15.25971	20.42329
Number of observations	8311	8576	6352	1710
Median				
Industry	Pharmaceuticals	Electrical Equipment	M&C	Transports
E	(.3308772)	.0576677	.2053037	.7892676
BV	2.027467	5.845311	7.89667	17.2309
AdjE	(.17390769)	.1022923	.2826356	.8867366
AdjBV	3.955076	6.891932	9.160112	18.25539
RD	.4285092	.4369997	.463723	.35411317
MV	5.24	7	9.375	15
Number of observations	8311	8576	6352	1710

Table 4. Descriptive statistics for the complete dataset. Data is allocated on industry basis. E is earnings, BV is book value, AdjE is the adjusted earnings according to model 5, AdjBV is the adjusted book value according to model 3, RD is R&D expenditures and MV is market value of equity. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis.

Just as the table before, this table discloses means, medians and number of observations for the variables in question. In this table, however, the observations are distinguished by industry rather than time. First and foremost, which is mentioned earlier, the number of observations are considerably fewer in the transport industry than the other three. Additionally, the means for the different variables are significantly higher in this industry in comparison with other industries. The table suggests that transportation companies are spending more in terms of R&D per share than any other industry. However, if taken the general size (book value) of the company into account, other industries are far more R&D intensive. With the same reasoning in mind, pharmaceutical companies seem to be the most R&D intensive business field, with average R&D expenses per share valued to about 15 % of the average book value per share. It is also noticeable that book values for pharmaceutical companies increases by almost 50 % in general when capitalizing R&D expenditures. Moreover, pharmaceutical companies disclose negative earnings in general, while all other industries disclose profits.

Table 5: Pearson correlations

Correlation	MV	E	BV	AdjE	AdjBV
MV	1				
E	.5464	1			
BV	.6075	.4906	1		
AdjE	.6286	.9388	.5088	1	
AdjBV	.6274	.4690	.9926	.5042	1

Table 5. Pearson correlation matrix on the complete dataset. MV is market value of equity, E is earnings, BV is book value, AdjE is the adjusted earnings according to model 5 and AdjBV is the adjusted book value according to model 3. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis.

As shown in the table 5 there is a positive correlation between all the independent variables and the dependent variable, market value. Noteworthy, however, is the remarkably stronger correlation for the adjusted earnings in comparison to the original earnings. If making these R&D-related adjustments, the correlation increases with around 0.08. There is also an increased correlation effect for the adjusted book value compared to the original book value, even though it is not as apparent as for earnings, about 0.02. This statistic would suggest that it is mainly earnings that stands to gain from these adjustments, speaking from a value relevance perspective. This is very much in line with earlier research claiming that earnings relevance specifically has decreased over the last decades (Collins et al., 1997; Francis & Schipper, 1999).

Table 6: Regression, model 1

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
24 949	2 720	1	9.2	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.2148	.4328	.4489				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.4709247***	.0278072	16.94	0	.4163993	.52545
E	3.02618***	.1262579	23.97	0	2.778609	3.273751
_cons	8.294415***	.2782726	29.81	0	7.748768	8.840063

Table 6. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

The table above is the first of a number of linear regressions conducted. The data used in the study is considered panel data, and because of possible covariation between the different independent variables, a fixed effect regression model is preferred. Robust standard errors are used in all regressions, in order to increase reliability in the results. This first regression is executed on the entire

dataset (with adjustments for heteroscedasticity and outliers already made), all 25 years, and is based on model 1. Thus, the dependent variable is market value per share, and the two independent variables are book value and earnings per share. A total number of 2 720 companies are included in the dataset, with the average number of observations per company being 9.2. Both variables show positive coefficients, indicating, quite naturally, a positive relationship between the dependent and independent variables, and the high t-values suggests that these relationships are statistically significant. Finally, an r-square of 21.48 % can be observed. This would suggest that the model used only is equipped to explain 21.48 % of all market value changes. In other words, almost 80 % of market values cannot be explained by earnings or book values. To some extent, a low r-square is expected seeing that the industries included in the study are greatly dependent on assets not included on the traditional balance sheet.

Table 7: Regression, model 2

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
24 949	2 720	1	9.2	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.2464	.5401	.5219				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.3915929***	.00872	44.91	0	.3745011	.4086848
AdjE	3.471742***	.0575055	60.37	0	3.359027	3.584456
_cons	7.743976***	.1126774	68.73	0	7.523121	7.964832

Table 7: The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

The second regression relies on the same premises as the first in terms of panel data, fixed effects, heteroscedasticity and outlier adjustments, and is also conducted on the complete dataset. This time, however, the regression uses model 2a (which is equivalent to model 2b). The dependent variable is still market value, but book values and earnings are now adjusted in line with models and amortization schedules as described above. Not surprisingly, the adjusted numbers are also indicating positive relationships with the dependent variable. The coefficients themselves are rather similar to its original counterparts, all though with slight variations, and t-values are still high. An increasing R-square is also observed. When adjusting earnings and book values as done in this study, the explanatory ability for these variables in terms of market value increases by a little more than 3 percentage points, from 21.48 % to 24.64 %. As a final note, these regressions have also been conducted on the initial dataset, before adjustments for heteroscedasticity and outliers. While each r-square respectively increases slightly (33

% for original numbers and 36 % when adjusting the R&D spending), the increase is still very much comparable. These regression statistics are available in the appendix (table 20-21).

Table 8: Additional regression

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
24 949	2 720	1	9.2	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.255	.5658	.5297				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.3989257***	.0279446	14.28	0	.3441308	.4537205
E	3.368998***	.1227517	27.45	0	3.128302	3.609694
RDC	.0923436	.1523523	.61	.544	(.2063944)	.3910815
DiffRD	(5.622514)***	.3781121	(14.87)	0	(6.36393)	(4.881098)
_cons	7.755238***	.2777019	27.93	0	7.21071	8.299766

Table 8. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, BV is book value, E is earnings, RDC is R&D capital according to model 4 and DiffRD is the difference between created amortization expenses and actual R&D expenses according to model 7. Market value is the dependent variable. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

This regression contains two new independent variables, RDC and DiffRD. These variables are meant to capture the differences between the original and adjusted book values and the original and adjusted earnings respectively. Thus, RDC consists of the accumulated R&D expenditures that is not yet expensed. This variable is specifically defined in model 4. The second independent variable, DiffRD, is the difference between the hypothetical amortized R&D expenditure and the actual R&D expense accounted for in the income statement, and is specified in model 7. In addition to this, original book values and earnings are also included as independent variables. Market value is still used as the dependent variable. The purpose of this regression is to investigate whether the adjustments conducted actually have a significant effect for the ability of the model to explain market values. As can be seen in the table, BV, E and DiffRD all show statistically significant coefficients. That book value and earnings are related to market value are expected, and needs no further analysis. The DiffRD-coefficient, however, is more noteworthy. It suggests a significant negative association between the market value and amortized R&D. Thus, if the variable were to increase, the market value would decrease. This is quite natural, since an increase in DiffRD means a decrease in the hypothetical earnings, as this variable is deducted from the actual earnings to create the adjusted earnings. Furthermore, the regression indicates a positive relationship between RDC and market value, indicating that market value increases when RDC increases. This coefficient, however, is not significant.

Thus, while the model confirms the relevance of adjusting earnings in line with what is done in this study, it does not completely support the book value adjustments.

Table 9: R^2 development

R-squares			
Time period	Original numbers	Adjusted numbers	Difference
1991-1995	.1367	.1377	.001
1996-2000	.1092	.1121	.0029
2001-2005	.1244	.1362	.0118
2006-2010	.1263	.1413	.015
2011-2015	.214	.2352	.0212

Table 9. Coefficients of determination for each time period. Original numbers come from model 1 and adjusted numbers come from model 2. The difference is in percentage points. All the data is adjusted for heteroscedasticity.

This table discloses the determination coefficient for the original and adjusted book values and earnings, for each of the five pooled time periods respectively. Thus, the aim of this table is to shine a light on how the value relevance effects of R&D accounting have developed over time. As can be seen in the table, r-squares are quite similar over the first four periods. For the last time period, however, a slight increase is observed. As for the differences between the determination coefficients, a somewhat vague pattern is identifiable, where the adjusted numbers seem to outperform the original numbers slightly clearer for each time period. As is shown, the difference is barely existent between 1991-1995, while the difference between 2011-2015 is far more apparent. It should, however, be pointed out that, because of the overall very low r-squares, it might be dangerous to draw too big conclusions from these statistics. The complete regression data for each of the time periods can be found in the appendix (table 10-19).

Apart from these regressions, time trend regressions were also conducted in order to examine possible time effects during the time period of the sample. Results showed that there were significant differences between the years. However, since coefficients for the variables included in the different models were largely left unaltered, this would indicate that in terms of value relevance of the financial statements, little actual change can be proven. These time trend regressions are found in the appendix (table 22-23).

Discussion

After running various statistical tests of the dataset, some noteworthy findings have been made. The findings will be compared with the findings from previous studies discussed in the report, as well as the hypotheses earlier presented in the paper to either further strengthen these or reject them. The first hypothesis to be scrutinized was;

H_1: Adjusting earnings and book value for R&D capitalization will increase the value relevance.

With the presented data in mind, there seems to be a rather strong case in favour of this hypothesis. Model two is showing consistently higher coefficients of determination than model one, for each of the five time periods as well as the entire dataset put together, as is visible in table 6. Furthermore, the adjusted earnings and book values disclose higher correlations with the market value than the original numbers, respectively. This is depicted in table 5. Additionally, the specific earnings

adjustments conducted are significantly correlated with market value, showcased by regression 3. With all these statistics combined, this paper makes a strong argument suggesting that allowing for the capitalization of R&D expenditures does increase the value relevance. These findings are very much in line with papers such as Lev & Sougiannis (1996), Healy et al. (2001) and Oswald (2008), all of whom arguing in favour of a capitalization possibility.

There is, however, a few additional arguments to be made on this topic, which are left unconsidered by the investigation conducted in this paper. A key argument against a capitalization possibility is that such a regulation change might enable for various kinds of earnings management. This has been argued as well as empirically demonstrated by Cazavan-Jeny et al. (2006) and Markarian et al. (2008), among others. This possibility is disregarded in the statistics above, and needs to be considered when debating whether capitalization should be accepted or not. There is, naturally, a risk that these statistical improvements experienced from such R&D adjustments as are committed above, in practice might be overshadowed by a value relevance decrease stemming from increased earnings manipulations.

On the other hand, it should also be kept in mind that this apparent value relevance increase is based on standardized, general adjustments. The used amortization rates are far from perfect, and it must be assumed that if allowing companies to make these estimations themselves, it would further the accounting numbers even more, under the assumption that it would be faithfully conducted by the companies.

As is stated above, however, none of these results are unique for this paper. Several research has found evidence in favour of an R&D capitalization possibility. It would be fair to assume that this debate has not been flying under FASB's radar. Yet, the US standard-setters have made no adjustments to its regulations, still prohibiting American entities from recognizing R&D expenditures on their balance sheets. On many levels, this could be interpreted as a conservative approach, keeping both earnings and book values to a minimum. It has been further implied that this issue might gain in importance, because of the changing company climate and vitality of intangible investments. This is where the second hypothesis comes into play;

H_2: The difference between the actual and hypothetical value relevance will increase over time.

Considering hypothesis 2, there is not the same convincing evidence found from the statistical results. There is a weak increasing pattern existent in terms of r-square differences, as is depicted in table 6. The differences are, however, rather fractional and the r-squares overall is considerably low. Thus, the obtained results do speak in favour of the second hypothesis, but cannot be considered strong enough to be recognized as undisputed evidence to the belief of an increasing value relevance difference over time dependent on R&D accounting treatment. In addition to this, time trend regressions were conducted, and failed to identify any significant changes in value relevance over the sample period.

It should be further pointed out, however, that simply comparing r-squares may not be an ideal approach, and that either confirming or rejecting this hypothesis merely on such grounds might be a bit premature. The investigation does, however, provide somewhat limited evidence suggesting that value relevance issues stemming from the inability to capitalize R&D expenditures may have increased over time. Due to the weakness of it, however, debaters using this alleged development as an argument to why current accounting standards need adjustment might therefore find themselves lacking empirical evidence strengthening this claim. Because of the inconsistency of the results, we would suggest that future research should further investigate this area. The aforementioned lack of research on this issue is far from satisfied, and this paper would encourage researchers to continue to

explore this topic. For instance, this paper does not include any statistical tests specifically examining the significance of the differences between the estimated R-squares. Hopefully, such further research could, together with this paper, provide an answer to whether FASB needs to reexamine their view on R&D capitalization.

Conclusively, this paper contributes to body of research by finding additional evidence suggesting that value relevance will increase if allowing for R&D expenditures to be capitalized. It does, however, only find very limited and inconsistent evidence supporting that this value relevance discrepancy depending on R&D treatment have increased over time.

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Appendix

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
4 268	1 180	1	3.6	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1367	.4989	.4474				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.318693***	.05639	5.65	0	.2080512	.4293349
E	2.055379***	.1782233	11.53	0	1.705709	2.40505
_cons	8.56677***	.6607113	12.97	0	7.270469	9.863071

Table 10. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 1991-1995. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
4 268	1 180	1	3.6	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1377	.5903	.5261				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.2635367***	.0241854	10.9	0	.2161156	.3109578
AdjE	2.126417***	.1180622	18.01	0	1.894929	2.357906
_cons	8.322157***	.3310256	25.14	0	7.673105	8.97121

Table 11. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 1991-1995. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 826	1 532	1	3.8	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1092	.3515	.3593				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.3824337***	.0498131	7.68	0	.2847245	.4801428
E	2.488695***	.1839735	13.53	0	2.127828	2.849562
_cons	10.56545***	.5046635	20.94	0	9.575549	11.55536

Table 12. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 1996-2000. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 826	1 532	1	3.8	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1121	.4123	.4134				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.3465226***	.0273022	12.69	0	.2929962	.400049
AdjE	2.431644***	.1377126	17.66	0	2.161656	2.701632
_cons	9.716181***	.3340809	29.08	0	9.061209	10.37115

Table 13. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 1996-2000. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 506	1 424	1	3.9	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1244	.4213	.3786				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.4964285***	.066225	7.5	0	.3665195	.6263376
E	2.36284***	.1989361	11.88	0	1.972601	2.75308
_cons	8.186311***	.608687	13.45	0	6.992291	9.380331

Table 14. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2001-2006. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 506	1 424	1	3.9	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1362	.5196	.4604				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.3708576***	.0322611	11.5	0	.3076081	.434107
AdjE	2.809783***	.1372896	20.47	0	2.54062	3.078945
_cons	8.406851***	.3580672	23.48	0	7.704844	9.108859

Table 15. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2001-2005. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 042	1 317	1	3.8	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1263	.6149	.5588				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.3167304***	.0673035	4.71	0	.1846966	.4487642
E	2.121109***	.2269146	9.35	0	1.675955	2.566262
_cons	9.017291***	.6044122	14.92	0	7.831575	10.20301

Table 16. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2006-2010. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
5 042	1 317	1	3.8	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.1413	.7227	.6378				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.224858***	.0264717	8.49	0	.1729576	.2767583
AdjE	2.49137***	.1205265	20.367	0	2.255066	2.727675
_cons	9.036208***	.289371	31.23	0	8.468866	9.603549

Table 17. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2006-2010. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
4 307	1 222	1	3.5	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.214	.549	.5249				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.7977736***	.0889896	8.96	0	.6231841	.9723632
E	1.369797***	.2637969	5.19	0	.8522515	1.887342
_cons	5.671079***	.9325015	6.08	0	3.841596	7.500562

Table 18. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2011-2015. MV is market value of equity, BV is book value and E is earnings. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
4 307	1 222	1	3.5	5		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.2352	.6031	.5713				
Regression statistics						
MV	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.753999***	.0285454	26.41	0	.6980291	.8099689
AdjE	1.714416***	.1456303	11.77	0	1.428873	1.999958
_cons	4.498886***	.3626157	12.41	0	3.787893	5.209879

Table 19. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable, only for data between 2011-2015. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
26 313	2 765	1	9.5	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.3322	.4339	.388				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.6210385**	.2119576	2.93	.003	.2054272	1.03665
E	2.667442	1.543372	1.73	.084	(.3588369)	5.693722
_cons	986.4376	510.8801	1.93	.054	(15.30774)	1988.183

Table 20. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, BV is book value and E is earnings. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
26 313	2 765	1	9.5	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.3586	.52	.4485				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.5602812***	.1539038	3.64	0	.2585032	.8620592
AdjE	2.868811	1.643086	1.75	.081	(.3529885)	6.09061
_cons	881.379	472.4103	1.87	.062	(44.93383)	1807.692

Table 21. The regression is conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
24 949	2 720	1	9.2	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.2253	.4591	.4632				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
BV	.468117***	.0279283	16.76	0	.4133542	.5228799
E	2.95227***	.1247959	23.66	0	2.707566	3.196974
Year						
1992	3.347512***	.2924921	11.44	0	2.773983	3.921041
1993	3.505511***	.3294415	10.64	0	2.85953	4.151492
1994	4.581121***	.3704333	12.37	0	3.854762	5.307481
1995	3.28565***	.3636885	9.03	0	2.572516	3.998784
1996	5.888719***	.3875785	15.19	0	5.128741	6.648697
1997	5.17478***	.3908007	13.24	0	4.408484	5.941076
1998	5.991444***	.425295	14.09	0	5.15751	6.825378
1999	4.402472***	.4509062	9.76	0	3.518318	5.286625
2000	8.270361***	.5796125	14.27	0	7.133835	.9406886
2001	6.458154***	.5480983	11.78	0	5.383423	7.532886
2002	5.11284***	.462961	11.04	0	4.205049	6.020631
2003	1.294141**	.4364379	2.97	.003	.4383575	2.149925
2004	4.659365***	.4847955	9.61	0	3.70876	5.60997
2005	4.324023***	.4918257	8.79	0	3.359633	5.288413
2006	4.257428***	.4958665	8.59	0	3.285114	5.229741
2007	4.720314***	.5116897	9.22	0	3.716974	5.723654
2008	4.409751***	.5365051	8.22	0	3.357752	5.46175
2009	(.0347029)	.523069	(.07)	.947	(1.060356)	.9909502
2010	2.103554***	.5257095	4	0	1.072723	3.134384
2011	3.20382***	.5723816	5.6	0	2.081473	4.326167
2012	1.587653**	.5661423	2.8	.005	.4775407	2.697766
2013	2.548889***	.6029514	4.23	0	1.3666	3.731179
2014	6.273998***	.6666379	9.41	0	4.96683	7.581166
2015	7.028494***	.6819632	10.31	0	5.691276	8.365713
_cons	4.09725***	.4428213	9.25	0	3.22895	4.965551

Table 22. Time trend regression, conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, BV is book value and E is earnings. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).

Regression						
Observation statistics						
Number of observations	**Number of groups**	**Obs per group - Min**	**Obs per group - Avg**	**Obs per group - Max**		
24 949	2 720	1	9.2	25		
R-squares						
R^2 - Within	**R^2 - Between**	**R^2 - Overall**				
.2856	.5681	.5358				
Regression statistics						
MV	**Coef.**	**Robust Std. Err.**	**t**	**P>|t|**	**[95% conf.**	**Interval]**
AdjBV	.3880662***	.0232092	16.72	0	.3425567	.4335758
AdjeE	3.410281***	.1187824	28.71	0	3.177368	3.643194
Year						
1992	3.561061***	.2953608	12.06	0	2.981907	4.140216
1993	3.625057***	.3273228	11.07	0	2.983231	4.266884
1994	4.654755***	.3662647	12.71	0	3.93657	5.37294
1995	3.23714***	.3604991	8.98	0	2.53026	3.944019
1996	5.791651***	.3809203	15.2	0	5.044728	6.538573
1997	4.625784***	.3889421	11.89	0	3.863132	5.388436
1998	5.917602***	.4087326	14.48	0	5.116144	6.71906
1999	4.426622***	.4398077	10.06	0	3.564231	5.289014
2000	8.522626***	.572698	14.88	0	7.399659	9.645593
2001	6.730434***	.5358802	12.56	0	5.679661	7.781208
2002	5.616981***	.4505291	12.47	0	4.733567	6.500395
2003	1.919292***	.4248947	4.52	0	1.086143	2.752441
2004	5.327041***	.4656139	11.44	0	4.414048	6.240034
2005	4.941254***	.4742709	10.42	0	4.011286	5.871222
2006	4.749719***	.4754679	9.99	0	3.817404	5.682034
2007	5.046611***	.4911199	10.28	0	4.083605	6.009617
2008	4.80096***	.5202139	9.23	0	3.780906	5.821015
2009	.3667695	.5026231	.73	0.466	-.6187925	1.352331
2010	2.893991***	.5151743	5.62	0	1.883818	3.904164
2011	3.922001***	.5570651	7.04	0	2.829687	5.014315
2012	2.205872***	.5459364	4.04	0	1.135379	3.276364
2013	3.211742***	.5797293	5.54	0	2.074988	4.348497
2014	7.027041***	.6444386	10.9	0	5.763402	8.29068
2015	7.700587***	.6572862	11.72	0	6.411756	8.989418
_cons	3.249576***	.4401272	7.38	0	2.386559	4.112594

Table 23. Time trend regression, conducted with panel data, fixed effects and robust standard errors, where company is used as the group variable and year as the time variable. MV is market value of equity, AdjBV is adjusted book value according to model 3 and AdjE is adjusted earnings according to model 5. All the data is adjusted for heteroscedasticity, and is thus presented on a per-share basis. * Coefficient is significant at a 0.05 level (2-tailed). ** Coefficient is significant at a 0.01 level (2-tailed). *** Coefficient is significant at a 0.001 level (2-tailed).