Value Relevance of European High- and Low-Technology Companies’ Financial Statements

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Abstract

During the 1990s the increased importance of intangible assets caused concern among practitioners and academics that financial statements were losing their value relevance, i.e. the relation between a firms’ financial statement information and its market value, especially for high-technology firms which were deemed likely to be intangible-intensive. Research conducted on the US market largely show that financial statements were losing their relevance to investors during the build-up of the dot-com bubble in the 1990s but that this trend reversed to an increase for both high- and low-technology firms after the bursting of the bubble. This study extends the research on financial statements’ relevance for investors to the underexplored European markets to determine whether there is a difference in value relevance between high- and low-technology firms in the period from the bursting of the dot-com bubble through 2014 in Europe by performing a regression analysis on quantitative financial data. Our results show that high-technology firms have more value relevant financial statements than have low-technology firms, that the value relevance of low-technology firms’ financial statements has decreased over time and that this decrease is greater for low-technology firms than it is for high-technology firms for which the value relevance has not changed significantly over time.

Keywords: Value relevance, high-technology, low-technology, financial statement, intangible assets, dot-com bubble
Sammandrag

Under 1990-talet orsakade den ökande betydelsen av immateriella tillgångar oro bland yrkesutövare och akademiker över att årsredovisningar minskade i värderelvan, d.v.s. kopplingen mellan ett företags årsredovisningsinformation och dess marknadsvärde, i synnerhet för högtekologiska bolag vilka ansågs vara troliga att ha stor andel immateriella tillgångar. Forskning utförd på den amerikanska marknaden visar huvudsakligen att årsredovisningars värderelvan sjönk under tillväxtperioden av IT-bubblan men att denna trend vände till en ökning för både hög- och lågteknologiska företag efter IT-kraschen. Denna studie fokuserar på årsredovisningars relevans för investerare i de underutforskade europeiska marknaderna för att undersöka om det finns en skillnad i värderelvan mellan hög- och lågteknologiska företag i perioden från IT-kraschen till 2014 i Europa genom att genomföra en regressionsanalys på kvantitativ finansiell data. Våra resultat visar att högtekologiska bolag har mer värderelvanåta årsredovisningar än vad lågteknologiska bolag har, att värderelvansen för lågteknologiska företags årsredovisningar har minskat över tid samt att denna minskning är mer markant för lågteknologiska företag än för högtekologiska företag för vilka värderelvansen inte har förändrats signifikant över tid.

Nyckelord: Värderelvan, högtekologi, lågteknologi, årsredovisning, immateriella tillgångar, IT-bubblan
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1. Introduction

1.1 Background
As financial statements are one of the primary ways for companies to communicate financial and non-financial information to their stakeholders, the quality of them is an issue of constant interest to shareholders, potential investors and governments. Because the financial statement contains information about a company’s revenues, costs, assets and liabilities, the document is a valuable source of information for investors looking to assess the future potential of the company in order to make investment decisions. For a financial statement to be of value to an investor, the information it contains must accurately reflect both current performance and provide good indications of future performance, and the better a financial statement does this the more value relevant it is considered to be. Value relevance can change over time for several reasons, such as because of changes in accounting requirements, in the behavior of investors or in the company’s situation.

During the 1990s practitioners and academics expressed concern over financial statements losing their value to investors due to the economy changing, exemplified in companies seeing vast surges in their stock price while having no earnings at all or in stocks trading at record multiples of earnings (Morris & Alam, 2012). It was argued by many that earnings no longer mattered and that, especially during the 1990s, clicks and page views became more important in the valuation of a firm than concrete financial numbers were (Penman, 2003) and even Alan Greenspan, the chairman of the Federal Reserve Board at the time, warned against so-called irrational exuberance in a speech in 1996 about the dot-com bubble (Greenspan, 1996). In 2002, the consulting firm Stern Stewart claimed that “accounting has lost its anchor to value” (Stern Stewart, 2002, p. 1) and in 1994 the American Institute of Certified Public Accountants Special Committee on Financial Reporting reported that there were demands from practitioners for a change in accounting standards that would increase value relevance (AICPA, 1994).

The concern about decreasing value relevance has been addressed by many researchers, among them Amir & Lev, (1996), Brown et al. (1999), Collins et al. (1997), Francis & Schipper (1999), Morris & Alam (2012) and Ohlson (1995). Many researchers have found there to have been a
decrease in value relevance over time and have attributed this to the increasing importance of intangible assets in recent years (Collins et al., 1997) due in part to the accounting standards regarding the recognition of these assets being considered out of date (Francis & Schipper, 1999). As an example of this, Elliott (1995) mentions that “[a] large part of the immediate problem is the limited usefulness of today’s financial statements. They don’t, for example, reflect information-age assets, such as information, capacity for information, and human resources.” (Elliott, 1995, p. 118) while Collins et al. (1997) mention that “the shift from an industrialized economy to a high-tech, service-oriented economy has rendered traditional financial statements less relevant for assessing shareholder value.” (Collins et al., 1997, p. 40).

Amir and Lev (1996) argue that companies in technology-based industries invest heavily in intangible assets such as research and development and that, as a result of this, their financial variables such as earnings and book values are not related to market values (Amir & Lev, 1996). Similar thoughts have been presented in studies by Collins et al. (1997), Francis and Schipper (1999) and Lev and Zarowin (1999) who all argue that the increased importance of intangible assets has contributed to the decline in value relevance. This has led researchers such as Francis and Schipper (1999), Morris and Alam (2012) and Ciftci et al. (2014) to suggest that high-technology companies have less value relevant financial statements than have low-technology companies. Their results, along with those of other researchers studying a change in value relevance such as Brown et al. (1999) and Core et al. (2003), largely show that value relevance decreased in the period up to the late 1990s while those that extend their study into the 2000s have shown that value relevance started to increase after the bursting of the dot-com bubble in the early 2000s. Francis and Schipper (1999), in a direct comparison of the value relevance of financial statements of high- and low-technology firms, found marginal support for high-technology companies’ financial statements being less value relevant than their low-technology counterparts. The results of a similar but more recent study by Ciftci et al. (2014) pointed to financial statements of high-technology companies having significantly lower value relevance than those of low-technology companies.
1.2 Problem discussion
The link between intangible assets, value relevance and high-technology companies has been studied extensively in the US market, where researchers have found that there seems to be a difference in value relevance between high- and low-technology firms and that value relevance decreased up to the bursting of the dot-com bubble but started to increase after that time (Ciftci et al., 2014; Morris & Alam, 2012). Despite the large body of research on value relevance and high-technology firms, there is a lack of studies on this topic conducted by looking at European markets and, even though it is reasonable to assume that the increased importance of intangible assets in the US is mirrored in Europe, the impact of this on European markets has, to our knowledge, yet to be investigated.

As the decline in value relevance observed in the US has been mostly attributed to intangible assets such as research and development being accounted for in an insufficient way, similar results would be likely to be obtained in Europe if accounting standards regarding the recognition of intangible assets and other factors affecting value relevance were the same. However, as European and US corporations are obliged to report under different accounting standards, it is not reasonable to simply assume that the results of value relevance research in the US studying the time period after the bursting of the dot-com bubble would hold in a similar study in Europe studying the same time period.

As intangible assets are assumed by researchers to have increased in importance over time and to be more important to high-technology firms than to low-technology firms, researchers studying value relevance primarily focus both on whether value relevance has declined over time and on whether financial statements of high- and low-technology firms differ in their value relevance. For accounting practitioners, standard setters and other groups for which these issues are important, it becomes relevant both to determine whether there is a difference in value relevance of financial statements between the two groups of companies in order to assess whether a potential difference is cause for changing accounting standards and practices, and to determine how a change in value relevance has evolved in recent times in order to assess how pressing the need is for changes in standards and practices.
1.2.1 Research questions
Because both the questions of whether there is an absolute difference in value relevance between high- and low-technology firms’ financial statements and whether a change in value relevance for the two groups has evolved over time are relevant, and because these questions have, to our knowledge, yet to be answered for the European markets, we will in this paper perform a study in order to answer these questions by taking a European perspective on value relevance. Our research questions are therefore as follows:

*Are financial statements of high-technology companies less value relevant than financial statements of low-technology companies are in Europe in the period from the bursting of the dot-com bubble to 2014?*

*Is there a difference in changes over time in value relevance between financial statements of high-technology companies and financial statements of low-technology companies in Europe in the period from the bursting of the dot-com bubble to 2014?*

1.3 Purpose of the study
The purpose of this study is to address the concern that an increased importance of intangible assets has led to high-technology firms having less value relevant financial statements than have low-technology firms in the European markets. Since the field is, to our knowledge, underexplored, the results of our study of value relevance in high and low-technology companies in Europe will be of interest to a number of groups. For investors in the European stock markets, the results in this study will provide indicators as to whether fundamental analyses of financial statements are worthwhile or if other sources of information should be relied upon more when making investment decisions. For accounting regulators, this study will provide information on whether accounting standards should be rewritten to better suit today’s economy, and for accounting professionals, the results will contribute information on whether financial statement preparation and information for investor relations need to be reassessed. Finally, for academics, the results in this study will extend the value relevance research to a hitherto underexplored European market and create a foundation upon which further research can be built upon.
2. Theory

2.1 Value relevance
Investors can be expected to look for information that will allow them to maximize their returns, that is, information providing them with indicators of future asset values. Assuming investors are rational, they will tend to place greater emphasis on the highest quality sources of these indicators. In other words, the sources of information most effective at explaining future asset values will be the ones most important to investors in their investment decision making. Sources of information effective at explaining future asset values can be said to be value relevant.

Value relevance is defined by Karğın (2013) as “the ability of financial statements to capture and summarize firm value.” (Karğın, 2013, p. 71). He further explains that value relevance is measured “through the statistical relations between information presented by financial statements and stock market values or returns.” (Ibid.). Thus, researchers studying the value relevance of, for instance, earnings might look at if there is a relation between an increase in earnings of one company year over year and an increase in the market price of that company’s shares in the corresponding year, as do Easton & Harris (1991). At this point, it is important to point out that the value relevance of a financial statement does not have one single measure or one single formula for calculation. Instead, researchers studying value relevance use different measures with different assumptions and look at different items in a financial statement to study these items’ relations with market share prices or the market value of equity¹. This is consistent with the behavior of investors, who do not simply look at one single line item in a financial statement when making investment decisions but instead tend to look at multiple items and relations.

2.2 Book value of equity
The book value of equity is the total value of a company’s equity as it is stated in the company’s financial statement (Lee & Lee, 2006). In other words, it is the book value of the company’s assets less the book value of its liabilities. This value can be considered to be the lower bound of a company’s value since the book value of equity is what would theoretically remain after all assets

¹Market value of equity, or market capitalization of a company, is the market price of the company’s shares on a per share basis multiplied by the number of the company’s shares outstanding (Lee & Lee, 2006)
were sold and all liabilities were paid. Only items that appear in a company’s statement of financial position contribute to the book value of equity of the company, meaning that unrecognized assets, which are excluded from recognition in the financial statement, are not included in the calculation of book value of equity and thus do not affect it.

The book value of equity is expected to be related with stock price, according to Easton and Harris (1991). A study by Collins et al. (1997) shows that the value relevance of book values has increased over time up to the point of the study’s event period, a result attributed by the authors to two factors, one being that “book values serve as a better proxy for future earnings when current earnings contain large transitory components”, the other being that “book values serve as a proxy for the firm’s abandonment option.” (Collins et al., 1997, p. 40-41). In fact, the study shows that when earnings decrease in value relevance due to being negative or containing nonrecurring items, book values increase in value relevance, indicating that they have become increasingly beneficial to investors as a predictor of future stock returns, at least during the time prior to the bursting of the dot-com bubble. The shift in value relevance over time from earnings to book values that Collins et al. (1997) observe is explained by the increase in the frequency of intangible-intensive firms, or high-technology firms as they are described by Francis & Schipper (1999). However, Lev and Zarowin (1999) find that the value relevance of earnings and book values combined has decreased, the results conflicting with those of Collins et al. (1997). In addition, Brown et al. (1999), who criticize the method used by Collins et al. (1997) for not considering so-called scale effects\(^2\) in their regression model and who replicate the study by Collins et al. (1997) but adjust for scale effects, find that the value relevance of book values has in fact decreased over time.

\subsection{2.3 Earnings}
Earnings, or net income, is a factor included in many value relevance studies and is an important influencer of firm value (Ohlson, 1995). However, the value relevance of the line item is shown in multiple studies to have declined over time, at least up to the 1990s (Collins et al., 1997; Lev & Zarowin, 1999). In addition, Hayn (1995) reports that “losses represent only a specific case of a more general situation where the earnings signal indicates future earnings that are sufficiently low (albeit positive) as to make the liquidation option attractive. In these situations, investors do

\footnotesize{\(^2\)Scale effects are discussed in section 2.6 of this paper}
not evaluate firms strictly on the basis of their reported earnings, thus leading to a weak observed return-earnings association.” (Hayn, 1995, p. 127), suggesting that firms with losses may have less value relevant earnings numbers than have firms with positive earnings.

The studies of Francis and Schipper (1999) and Collins et al. (1997) had results indicating that value relevance of earnings has decreased over time. Their studies did not however take scale effects into consideration. When Brown et al. (1999) replicated the study by Collins et al. (1997) but corrected for scale effects, they found that the value relevance of earnings had in fact decreased, confirming the conclusion reached by Francis and Schipper (1999) and Collins et al. (1997).

Alford et al. (1993), in their study of value relevance of accounting information in different countries, observe a difference in value relevance of earnings between European nations, with earnings being more value relevant in the United Kingdom, France and the Netherlands than in Germany, Italy, Denmark and Sweden. However, Bartov et al. (2002) do not find a significant difference in value relevance between US GAAP-based earnings and IFRS-based earnings3.

2.4 Research and development expenditures
Research is an original and planned investigation undertaken for the purpose of gaining new knowledge and understanding of a technical nature, while development is the application and implementation of knowledge or findings obtained through research or from other sources done for the purpose of producing products or similar items before commercial production begins (IASB, 2014). Intangible assets resulting from research are not recognized under International Accounting Standards (IAS), meaning that all research expenditures are always expensed immediately and are thus not capitalized4. In regards to development expenditure, there are multiple criteria that must be satisfied before it can be capitalized and an intangible asset resulting from it recognized under IAS. Among other things, the technical feasibility of making the asset available for sale must be demonstrated and the company must prove its ability to reliably measure

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3US GAAP are the accounting standards that companies in the United States use and IFRS, before 2001 known as IAS, are the accounting standards that companies in many countries, among them the majority of European nations, use (KPMG, 2014; ICAEW, 2016)
4To capitalize is to “carry forward (defer) some expenditure as an asset” (Deegan & Ward, 2013, p. 94)
the expenses attributable to the asset’s development. If all criteria are not satisfied the expenditures relating to development are expensed in full (IASB, 2014).

The capitalization of research and development expenditures has been described as providing a better match between the future revenue it generates and its eventual expensing (Zhao, 2002). However, problems can arise with the capitalized asset potentially being overstated in the statement of financial position. The full expensing of research and development can also create problems such as costs being overstated and profits and assets being understated in any given year. Whether a company capitalizes or expenses the expenditures related to research and development can thus affect the value relevance and the reliability of both its earnings and its book values. (Zhao, 2002)

Amir and Lev (1996) give research and development as an example of an investment in intangibles by high-technology companies. They describe the expensing or arbitrary amortization of such investments as excessively depressing earnings and book values, even causing them to be negative, despite these companies creating significant market value through their production and investment activities. They find that when financial information is combined with nonfinancial information and adjustments are made for excessive expensing of intangibles, the value relevance of the financial information is increased, suggesting that reported information about research and development is itself value relevant, at least when combined with other information. This is consistent with multiple findings, among them those of Zhao (2002), Xu et al. (2007), Lev and Sougiannis (1996) and Kotabe et al. (2002). It is important to note however that studies of value relevance of research and development under the standards of IFRS and US GAAP are not directly comparable due to US GAAP generally mandating the full expensing of research and development (FASB, 1974) and IFRS providing some measure of discretion.

2.5 Capital expenditures and sales growth
Capital expenditures are “expenditure[s] by an organization of an appreciable sum for the purchase or improvement of a fixed asset.” according to A Dictionary of Accounting (2010). Capital expenditures are not expensed in the year that they occur but are instead capitalized, matching expenses with the increased revenues resulting from an improvement of a fixed asset.
Capital expenditures are used in regression models in studies of value relevance by Core et al. (2003) and Morris and Alam (2012) as a proxy for growth in earnings in order to “capture expected growth in earnings due to new investments in tangible assets.” (Core et al., 2003, p. 48). These researchers also include sales growth over the previous year as another proxy for expected future growth in earnings. For the valuation of intangible-intensive firms, these proxies for growth in earnings are considered especially important since “the valuation of High-technology firms is influenced by factors such as the prevalence of intangible assets and the importance of future growth that affect other firms to a lesser extent.” (Core et al., 2003, p. 50)

2.6 Scale effects
Value relevance is often studied by using regression models that have financial statement information as the independent variables and market value or share price of a company as the dependent variables. However, many studies in the 1990s used regression models that failed to take scale effects into consideration, pointed out by Brown et al. (1999) as a problem with some of the leading value relevance research conducted up to the point of their study. Brown et al. (1999) describe scale effects as unintended influences on the $R^2$ of a regression analysis caused by differences in the independent or the dependent variables. An example by Brown et al. (1999) of a situation in which a scale effect may occur is when a company that is being studied undertakes a stock split. This would cause a change in the company’s nominal share price that is not linked to a change in the fundamental value of the company. Such a change in one variable occurring without a corresponding change in its determinant would be a scale effect. If the analysis includes market value or share price of a company as a variable and scale effects are not controlled for, the empirical results of the analysis could unintentionally be affected by the stock split, something that could result in incorrect conclusions being drawn.

Easton and Sommers (2003) describe another type of scale effect that can manifest itself when conducting cross-sectional studies of financial statement data and market capitalizations, and larger and smaller companies are included in the same sample. Companies with large market capitalizations can be expected to have financial variables such as earnings and book values of

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5 The $R^2$ in a regression analysis is the measure of the degree to which the variability in the independent variables in the regression model explain the variability in the dependent variable.
equity that are larger than those of companies with smaller market capitalizations, leading to the results of such an analysis being dominated by the larger companies in the sample unless this scale effect is controlled for (Easton & Sommers, 2003). Brown et al. (1999) conclude that in the absence of controls for scale effects, R²'s of samples drawn from different times, different stock exchanges or different countries are unreliable measures of value relevance.

2.7 Hypotheses

2.7.1 Difference in value relevance between high and low-technology companies

Francis and Schipper (1999) investigate whether financial statements of high-technology companies are less value relevant than are those of other companies. They assume that high-technology companies have more intangible assets and more research and development spending than have low-technology companies and group companies into high- and low-technology subsets according to the likely extent to which they would have unrecorded intangible assets. This method is also used in multiple other studies such as those of Core et al. (2003) and Morris and Alam (2012). The results of these studies show mixed results.

Morris and Alam (2012) perform a study on high and low-technology companies by looking at the period 1989-2006 and, although they perform no analysis on the statistical significance of the differences between the two groups of companies, their results seem to indicate that, in the period after the bursting of the dot-com bubble, high-technology companies have financial statements with higher value relevance than have low-technology companies. In a similar study, Francis and Schipper (1999) use eight different measures of value relevance on a sample of high and low-technology companies looking at the period 1952-1994. All but one of the measures show that high-technology companies have less value relevant financial statements than have low-technology companies. In a similar study, Francis and Schipper (1999) use eight different measures of value relevance on a sample of high and low-technology companies looking at the period 1952-1994. All but one of the measures show that high-technology companies have less value relevant financial statements than have low-technology companies, of which three of the measures show that financial statements of high-technology companies are significantly less value relevant than are those of low-technology companies. Ciftci et al. (2014), studying the period 1975-2006, found that companies in intangible-

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6 The one measure that does not show that high-technology companies have less value relevant financial statements than low-technology companies is the so-called earnings relation which has empirical results suggesting that there is no difference in value relevance in any direction between the two groups of companies
intensive industries have accounting information that is lower in value relevance than the accounting information of companies in industries that are not intangible-intensive. Lev and Zarowin (1999) find that there has been “*a systematic decline in the usefulness of financial information to investors*” (Lev & Zarowin, 1999, p. 383) in a study of the usefulness of financial information compared to the usefulness of total information available to investors and attribute this change in part to how intangible assets are accounted for. This link between intangible assets, high-technology companies and low value relevance was also demonstrated in Amir’s and Lev’s (1996) study in which financial information and nonfinancial information from cellular companies were examined in regards to their value relevance.

Although some contradictory results exist, the body of research taken together seems to indicate that financial statements of companies that generate more intangible assets have lower value relevance than do companies that generate less intangible assets. On the basis of the existing research we form our first hypothesis:

**H1: Financial statements of high-technology companies are less value relevant than are financial statements of low-technology companies**

### 2.7.2 Difference in change in value relevance between high and low-technology companies

A large part of the value relevance debate in recent times is linked to a perception among academics and practitioners that the economy is changing in regards to the increased importance of intangible assets and that this change will have decreased the value relevance of financial statements over time. To address these growing concerns, researchers have largely focused on determining whether there has been a decline in the value relevance of financial statements.

Studies in the US market have shown mixed results regarding whether there is a difference in the change over time in value relevance between high and low-technology firms. Francis and Schipper (1999) have marginal evidence of high-technology firms experiencing a greater decrease in value relevance than do low-technology firms in the period leading up to 1994. However, Ciftci et al. (2014) observe a decline in the value relevance for high-technology companies’ financial statements in the period leading up to the bursting of the dot-com bubble while the value relevance
of low-technology companies’ financial statements remained stable in the same period. They also find that these trends were followed by an increase in value relevance for both groups of companies from the bursting of the dot-com bubble up to 2007, the end of their sample period. Similar results were also found by Morris and Alam (2012) who, in addition, found that high-technology firms experienced a greater increase in value relevance than did low-technology firms from the bursting of the dot-com bubble to 2006. Both of these studies were conducted by looking at the US market in which companies have less discretion regarding the capitalization of research and development spending than do companies in Europe that use IFRS.

Amir and Lev (1996) describe how the full expensing of research and development excessively depresses earnings and book values while Zhao (2002) makes a similar claim. Based on these findings, capitalizing research and development expenditures should lead to higher value relevance compared to expensing them, a conclusion supported by Ciftci et al. (2014) who find that capitalization of research and development increases value relevance of financial statements. These findings are supported by Gjerde et al. (2008) who find that the shift to IFRS in Norway led to increased value relevance of balance sheet items and net income, stemming from new rules regarding the reporting of intangible assets. Aharony et al. (2010) find that the implementation of IFRS in the European Union led to increased value relevance of research and development expenditures while Tsoligkas and Tsalavoutas (2011) find that capitalized research and development expenditures are positively related to market values in the United Kingdom after the implementation of IFRS. Because high-technology firms are more intangible-intensive than low-technology firms, these results taken together suggest that the mandatory implementation of IFRS in the European Union during our study period should have a greater impact on the value relevance of financial statements of high-technology firms than on the value relevance of financial statements of low-technology firms.

Because the results of Ciftci et al. (2014) and Morris and Alam (2012) show that value relevance has increased for both groups of firms in the United States with the latter also finding that high-technology firms’ value relevance increased more rapidly than did low-technology firms’ value relevance, and because the implementation of IFRS in the EU during our study period should impact high-technology firms more, we formulate the following hypotheses:


**H2a:** The value relevance of high-technology firms’ and low-technology firms’ financial statements have both increased since the bursting of the dot-com bubble

**H2b:** The value relevance of high-technology firms’ financial statements has increased more rapidly than the value relevance of low-technology firms’ financial statements has increased

### 3. Method and research design

#### 3.1 Introduction to method and research design

In accordance with prior studies on value relevance such as those of Collins et al. (1997), Francis and Schipper (1999), Brown et al. (1999), Core et al. (2003), Morris and Alam (2012) and Ciftci et al. (2014), we perform a quantitative study in order to assess the veracity of our three hypotheses, ensuring that our study maintains a high level of reliability, meaning that it can be replicated by other researchers and that these researchers will achieve the same results (Saunders, Lewis & Thornhill, 2016, p. 202). By using a quantitative approach in favor of a qualitative method, we reduce the possibility of researcher bias affecting our results, thus increasing the study’s reliability. Since our approach follows that of other researchers studying value relevance we ensure that our study measures what it is supposed to measure, thus making sure that it has a high level of validity and is comparable to their studies (Saunders et al., 2016, p. 202).

We use two regression models, one in order to assess how value relevant financial statements of high- and low-technology companies are since the bursting of the dot-com-bubble which looks at how relevant book value of equity, earnings and relevant proxies for growth in earnings are for determining market value of equity, and one in order to assess the difference in change over time in value relevance for the two subsets of companies which looks at the coefficients of the change in value relevance over time for the two subsets of companies. The financial statement variables used in the models are gathered from Thomson Reuters Datastream. Tests of significance are performed on the results of both models in order to determine the statistical significance of the results and thus assess the veracity of hypotheses H1, H2a and H2b.
The study is performed on high- and low-technology companies in fifteen European countries, selected on the basis of their representativeness of companies in the entire continent. The industries included in each subsample are based on classifications made by Francis and Schipper (1999) and further used by Morris and Alam (2012). We perform a test of significance to test the validity of the classifications. Because our study looks at value relevance after the bursting of the dot-com bubble, occurring in the year 2000, we use 2001 as the first year of our sample period. In order to make our study relevant for practitioners and academics we select 2014 as the last year of our sample period since it is the year closest to present day for which all data needed for our regression models is available.

While we have attempted to increase the study’s comparability by selecting our models and the first year of our sample period to be consistent with studies of other researchers, it is important to point out that the comparability of our results with those of researchers studying the US market is somewhat limited by the fact that accounting standards differ between European and US markets which may have different effects on the value relevance of financial statements.

3.2 Constructing a model for testing hypothesis H1

In order to assess the veracity of our first hypothesis, H1, a model is needed that can be used to measure the value relevance of a company's financial statement based on information from the financial statement and the company's stock returns or market capitalization. A number of such models have been used in prior research, such as regression models used by Easton and Harris (1991), Collins et al. (1997) and Francis and Schipper (1999). These regression models, along with regression models in other studies, have stock returns or market capitalization of a company as the dependent variable and financial statement variables such as book values, earnings or research and development expenditures as independent variables in order to test the value relevance of financial statement information on market share prices. The researchers look at adjusted $R^2$ in order to assess the degree to which the independent financial statement variables explain the variation in share prices or market values to thus determine the statements’ value relevance.

Early simple models of value relevance that test the value relevance of earnings and book values on market share prices were developed by Ohlson (1995) and have since been further developed
by other researchers to take more variables from financial statements into account. Core et al. (2003) developed a model that we use in our study and that was also used by Morris and Alam (2012) who argue that the model is superior to other value relevance models because it “includes more detailed accounting data points than other models.” (Morris & Alam, 2012, p. 246). They further explain that the accounting variables used in the model have been selected because they “theoretically and empirically explain cross-sectional variation in stock prices, and are expected to be robust over time.” (Ibid.). Because Morris and Alam (2012) divide their sample into high- and low-technology subsets and look at the value relevance of financial statements of the two subsets, as do we, this further validates the use of the model for answering our research questions.

The model regresses the market value of equity on the book value of equity (BVE), earnings and proxies for future growth in earnings, factors that have all have been shown in prior studies to affect value relevance. The model includes two variables for earnings: one for current earnings (NI) and one for loss years (NEG_NI), since research indicates that firms with losses may have less value relevant earnings numbers than have firms with positive earnings (Hayn, 1995). The proxies for future growth in earnings are research and development expenditures (RND), since adjustments for research and development expensing increases value relevance of financial statements (Amir & Lev, 1996; Zhao, 2002; Xu et al., 2007; Lev and Sougiannis, 1996; Kotabe et al., 2002), as well as capital expenditures (CAP_EX) and growth in sales over the previous year (SALES_GR), since “the valuation of High-technology firms is influenced by factors such as the prevalence of intangible assets and the importance of future growth that affect other firms to a lesser extent.” (Core et al., 2003, p. 50). The model used in this study differs from the one used by Core et al. (2003) in our exclusion of the independent variable for advertising expenditures (ADVERT), another proxy for future growth in earnings. This exclusion has been made because information about advertising expenditures is not available in the database used, Thomson Reuters Datastream, something that could affect the comparability of our results with those of researchers using the model developed by Core et al. (2003).
3.2.1 Scale effects
In order to avoid the results of this study being affected by scale effects, the model used needs to control for these effects. Brown et al. (1999) describe two methods of doing this: one is using an additional variable in the regression model to serve as a proxy for scale, the other is deflating the variables in the model by a proxy for scale. The first approach is described by Brown et al. (1999) as non-implementable when comparing R²s from different companies, something that we are doing in this study, leaving deflation as the only viable method of controlling for scale effects in our situation. The model used in this study, developed by Core et al. (2003) and used by them and by Morris and Alam (2012), is consistent with the recommendations of Brown et al. (1999) in that it controls for scale effects by deflating each variable, both dependent and independent, by book value of equity.

3.2.2 Regression model for testing hypothesis H1
The regression model of Core et al. (2003), used by Morris and Alam (2012) and in our study, is:

\[
(MVE_{i,t+4m}/BVE_{i,t}) = \alpha_0 + \alpha_1(1/BVE)_{i,t} + \alpha_2(NI/BVE)_{i,t} + \alpha_3(NEG\_NI/BVE)_{i,t}
+ \alpha_4(RND/BVE)_{i,t} + \alpha_5(CAP\_EX/BVE)_{i,t} + \alpha_6(SALES\_GR/BVE)_{i,t} + \epsilon \tag{1}
\]

where \(MVE_{i,t+4m}\) = market value of equity for firm \(i\) measured four months following the end of fiscal year \(t\) to allow the market to incorporate financial statement information into share prices, consistent with the approach used by researchers such as Core et al. (2003), Morris and Alam (2012) and Francis and Schipper (1999)\(^7\) (Datastream MV); \(BVE_{i,t}\) = book value of equity for firm \(i\) at the end of fiscal year \(t\) (Datastream WC03501); \(NI_{i,t}\) = net income before extraordinary items for firm \(i\) for fiscal year \(t\) (Datastream WC01551); \(NEG\_NI_{i,t}\) = net income before extraordinary items for firm \(i\) for fiscal year \(t\) if net income is negative or zero (Datastream WC01551), otherwise = 0; \(RND_{i,t}\) = research and development expenditures for firm \(i\) for fiscal year \(t\) (Datastream WC01201); \(CAP\_EX_{i,t}\) = capital expenditures for firm \(i\) for fiscal year \(t\) (Datastream WC04601); and \(SALES\_GR_{i,t}\) = change in sales revenue (Datastream WC01001) for firm \(i\) from fiscal year \(t-1\) to fiscal year \(t\). (Core et al., 2003)

\(^7\)Core et al. (2003) and Morris and Alam (2012) use a four-month lag while Francis and Schipper (1999) use a three-month lag.
3.2.3 Analyzing the results of model for hypothesis H1

In order to prepare the data for statistical analyses, the variables in model (1) are sorted by fiscal year and all independent variable values are winsorized in the 1 percent and 99 percent in each sample year in order to limit to risk of outliers severely affecting our results, in line with the method used by Morris and Alam (2012). A regression analysis using model (1) will be performed for each subsample of companies for each sample year to assess the value relevance, measured with the adjusted $R^2$, of financial statements of each sample year for high- and low-technology companies, respectively. Thereafter, an arithmetic average of the adjusted $R^2$s for each subsample will be calculated, in line with the method used by Morris and Alam (2012), in order to assess the average value relevance in our sample period for high- and low-technology companies, respectively, and a one-sided t-test will subsequently be performed in order to test whether the subsets’ average adjusted $R^2$s differ significantly from each other using a p-value of .05 as the significance level, thus assessing the veracity of hypothesis H1\(^8\).

3.3 Constructing a model for testing hypotheses H2a and H2b

In order to assess the veracity of hypotheses H2a and H2b a model is needed to test whether the average change in value relevance over time of financial statements of high-technology companies differs from the average change in value relevance over time of financial statements of low-technology companies. For this purpose, we will use a regression model developed by Francis and Schipper (1999) which has adjusted $R^2$ as the dependent variable and variables $\kappa_1$ and $\kappa_2$ as independent variables:

$$ADJ \_ R^2_{s,y} = \kappa_0 + \kappa_1(HIGH_{s,y} \times y) + \kappa_2(LOW_{s,y} \times y) + \xi_{s,y} \quad (2)$$

where $ADJ \_ R^2_{s,y}$ = adjusted $R^2$ from model (1) for subsample $s$ in year $y$; $HIGH_{s,y}$ = dummy variable equal to 1 if subsample $s$ is a high-technology subsample, otherwise = 0; $LOW_{s,y}$ = dummy variable equal to 1 if subsample $s$ is a low-technology subsample, otherwise = 0; and $y = 1…14$ corresponding to our sample fiscal years 2001…2014.

---

\(^8\)A t-test is used in this case because the test compares the means between two populations (Moore, McCabe & Craig, 2012)
3.3.1 Analyzing the results of model for hypothesis H2a and H2b
A regression analysis will be performed on our entire sample using model (2) to get the coefficients of $\kappa_1$ and $\kappa_2$, respectively, telling us the average change over time in the value relevance of financial statements for high- and low-technology companies, respectively. To determine whether each coefficient is significantly positive, we look at each coefficient’s p-value using a p-value of .05 as the significance level, thus assessing the veracity of hypothesis H2a. Thereafter, an F-test will be performed, in line with the method used by Francis and Schipper (1999), in order to test whether the coefficients of $\kappa_1$ and $\kappa_2$ equal each other using a p-value of .05 as the significance level, thus assessing the veracity of hypothesis H2b.

3.4 Sample time period
This study is concerned with financial statements from the period following the bursting of the dot-com bubble. Because of this, establishing which year should be used as the beginning of the post-dot-com period is of paramount interest. The NASDAQ Composite, a technology-heavy stock market index, reached its bubble-period peak on March 10, 2000 before dropping significantly in the following period (Pástor & Veronesi, 2006). Because this was the turning point between the technology market rising and falling, this date can be seen as the earliest point in time of the beginning of the post-bubble period. A review of literature studying the dot-com bubble and the time that followed shows that Ciftci et al. (2014) use the year 2000 as the first year of the post-NEP, with NEP being described by Core et al. (2003) as a New Economy Period related to the rise of Internet-related firms in the 1990s. Morris and Alam (2012) define the bubble as lasting from 1995 to 2000 and use 2001 as the first year of the post-bubble period. Arnold and Dagher (2015) use 2001 in a similar manner as the beginning of a post-crisis period in a study of growth opportunities during and after the dot-com bubble. With these prior studies in mind, we use 2001 as the first year of our studied time period to minimize the risk of lingering effects of the bubble-period affecting our results, something which might have occurred had the year 2000 been used. It is worth mentioning that some technology companies saw a decrease in their share prices well into the year 2002 both in Europe and in the United States. However, considering that researchers studying the post-dot-com bubble period in the US market (Morris & Alam, 2012; Ciftci et al., 2014; Arnold & Dagher, 2015) have not postponed the start of their sample period to adjust for the subsequent share price decline, we also elect to not make this adjustment in order to increase the
comparability of our results with those of other researchers, thus increasing the validity of our study.

The last year of our sample period is 2014 due to this being the most recent year for which the needed financial statement information is available at the time the study is conducted, thus extending the sample period closer to present time. This proximity to present day is preferable in order to increase the study’s relevance for investors and other practitioners, accounting regulators, accounting professionals and academics.

3.5 Sample including markets
In order to study companies in Europe, we create our sample by first selecting the largest stock exchanges in Europe measured by the total market capitalization of companies listed on them and thereafter selecting high- and low-technology companies from the countries represented on those exchanges. The market capitalizations of the five largest stock exchanges in Europe (Deutsche Börse, Euronext, London SE Group, NASDAQ OMX Nordic Exchange and SIX Swiss Exchange) represent 85.7% of the total market capitalizations of all European stock exchanges that are members of the World Federation of Exchanges, and are considered representative of companies in the entire continent. It is however important to note that even though our sample may be representative of the continent by size, the selection of stock exchanges is skewed towards Western European countries, potentially limiting the ability to make inferences about companies in the entire continent. The fifteen countries whose stock exchanges are included in the sample of the five largest stock exchanges in Europe are Germany, France, the United Kingdom, the Netherlands, Belgium, Portugal, Italy, Sweden, Denmark, Finland, Lithuania, Latvia, Estonia, Iceland and Switzerland. The inclusion of Switzerland, it being the only country in our sample that does not mandate the use of IFRS for all companies (IASB, 2015), could be a potential source of error. However, the inclusion is not believed to negatively affect our results for two reasons, one being that 63% of all companies listed on the SIX Swiss Exchange follow IFRS, the other being that the differences between the Swiss GAAP FER accounting standards and IFRS are marginal.

See Appendix for a full list of all European stock exchanges that are members of the World Federation of Exchanges and their respective market capitalizations.
in most regards, among them in the recognition of research and development expenditures (IASB, 2015; PwC, 2011).

By using secondary data gathered from Thomson Reuters Datastream we allow the study to be more easily replicated by other researchers, thus increasing its reliability. In order to select high- and low-technology industries we use the list of industries from Francis and Schipper (1999), based on US industry classifications with so-called SIC codes, and find appropriate equivalent classifications in Datastream, presented in table 1.

Table 1

<table>
<thead>
<tr>
<th>Industries Included in High- and Low-Technology Samples</th>
<th>Number of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-Technology Industries</strong></td>
<td></td>
</tr>
<tr>
<td>Electronic &amp; Electrical Equipment</td>
<td>204</td>
</tr>
<tr>
<td>Mobile Telecommunications</td>
<td>34</td>
</tr>
<tr>
<td>Pharmaceuticals &amp; Biotechnology</td>
<td>269</td>
</tr>
<tr>
<td>Software &amp; Computer Services</td>
<td>488</td>
</tr>
<tr>
<td>Technology Hardware &amp; Equipment</td>
<td>151</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,146</strong></td>
</tr>
<tr>
<td><strong>Low-Technology Industries</strong></td>
<td></td>
</tr>
<tr>
<td>Construction &amp; Materials</td>
<td>179</td>
</tr>
<tr>
<td>Food &amp; Drug Retailers</td>
<td>45</td>
</tr>
<tr>
<td>Food Producers</td>
<td>148</td>
</tr>
<tr>
<td>Forestry &amp; Paper</td>
<td>34</td>
</tr>
<tr>
<td>Gas, Water &amp; Multiutilities</td>
<td>35</td>
</tr>
<tr>
<td>Industrial Metals &amp; Mining</td>
<td>52</td>
</tr>
<tr>
<td>Industrial Transportation</td>
<td>107</td>
</tr>
<tr>
<td>Leisure Goods</td>
<td>69</td>
</tr>
<tr>
<td>Mining</td>
<td>186</td>
</tr>
<tr>
<td>Personal Goods</td>
<td>133</td>
</tr>
<tr>
<td>Travel &amp; Leisure</td>
<td>229</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,217</strong></td>
</tr>
</tbody>
</table>
The list of industries used by Francis and Schipper (1999) is based on the likelihood of companies in an industry generating unrecorded intangible assets with high-technology (low-technology) companies being regarded as likely (unlikely) to do so. In order to take into consideration possible changes since the time of Francis’s and Schipper’s (1999) study in the likelihood of an industry generating unrecorded intangible assets we have selected our industry category equivalents based on our estimation of this likelihood for each industry category equivalent in today’s economy. Because of this, and because the industry classifications differ between those used by Francis and Schipper (1999) and those used by Datastream, our equivalent industry categories are not identical to those of Francis and Schipper (1999). To limit the risk of this affecting our results we verify the validity of our industry classification equivalents by testing whether the two subsamples differ significantly from each other in their relative research and development spending, in line with the approach used by Francis and Schipper (1999), using a p-value of .05 as the significance level. This is done by first compiling research and development spending as a percentage of total assets for each company in each sample year, thereafter calculating the average percentages for each subsample and finally performing a test of significance.

As with the low-technology industry selections of Francis and Schipper (1999), our sample of low-technology industries does not include all industries which are considered to be unlikely to generate unrecorded intangible assets. Instead the two samples of companies have been selected to include approximately equal-size portfolios of high- and low-technology equities, defined by Francis and Schipper (1999) as the portfolios not differing by more than 100 equities. Each variable for model (1) is first gathered from Datastream for each fiscal year in our sample period for all 2,363 companies. Thereafter, all firm-year observations in which at least one variable is missing are deleted, leaving us with a final sample of 5,788 firm-year observations on which statistical analyses are performed.
4. Results and analysis

4.1 Test of industry categories
Francis and Schipper (1999) define high-technology firms as firms that are likely to generate unrecorded intangible assets and select industries for their high- and low-technology subsets in accordance with this criterion. Our industry selections have been chosen to correspond with this criterion, and in order to test the veracity of the claim that high-technology firms have more unrecognized assets than have low-technology firms, we compare the average research and development expenditures for each firm in each year of the two subsets, in accordance with the method used by Francis and Schipper (1999). This test shows that high-technology firms invest on average 15.3% of total assets in research and development compared to 2.8% for low-technology firms (difference significant with p-value < .0001 < .05), confirming that our industry selections are congruent with the criterion of Francis and Schipper (1999) and thus are valid for answering our research questions.

4.2 Results of model (1)
After regressing the independent variables from financial statements in model (1) on the dependent variable, the market value of equity, for each fiscal year, we get the adjusted R² as the measure of value relevance for each fiscal year and for each subset of companies. These adjusted R² values are presented below in table 2 along with the mean adjusted R² value for each subset. A graphical representation of this information is presented below in figure 1.
Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>High-Tech</th>
<th>Low-Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.398</td>
<td>0.465</td>
</tr>
<tr>
<td>2002</td>
<td>0.245</td>
<td>0.535</td>
</tr>
<tr>
<td>2003</td>
<td>0.379</td>
<td>0.423</td>
</tr>
<tr>
<td>2004</td>
<td>0.561</td>
<td>0.291</td>
</tr>
<tr>
<td>2005</td>
<td>0.628</td>
<td>0.232</td>
</tr>
<tr>
<td>2006</td>
<td>0.612</td>
<td>0.122</td>
</tr>
<tr>
<td>2007</td>
<td>0.543</td>
<td>0.109</td>
</tr>
<tr>
<td>2008</td>
<td>0.159</td>
<td>0.140</td>
</tr>
<tr>
<td>2009</td>
<td>0.165</td>
<td>0.292</td>
</tr>
<tr>
<td>2010</td>
<td>0.456</td>
<td>0.227</td>
</tr>
<tr>
<td>2011</td>
<td>0.229</td>
<td>0.065</td>
</tr>
<tr>
<td>2012</td>
<td>0.487</td>
<td>0.146</td>
</tr>
<tr>
<td>2013</td>
<td>0.361</td>
<td>0.399</td>
</tr>
<tr>
<td>2014</td>
<td>0.151</td>
<td>0.180</td>
</tr>
</tbody>
</table>

Mean values

<table>
<thead>
<tr>
<th>High-Tech</th>
<th>Low-Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.384</td>
<td>0.248</td>
</tr>
</tbody>
</table>

Adjusted $R^2$ results are from the following regression model:

$$(MVE_{i,t+4}/BVE_{i,t}) = \alpha_0 + \alpha_1(1/BVE_{i,t}) + \alpha_2(NI/BVE_{i,t}) + \alpha_3(NEG_{NI}/BVE_{i,t}) + \alpha_4(RND/BVE_{i,t}) + \alpha_5(CAP\_EX/BVE_{i,t}) + \alpha_6(SALES\_GR/BVE_{i,t}) + \epsilon$$

where $MVE_{i,t+4}/BVE_{i,t}$ = market value of equity for firm $i$ measured four months following the end of fiscal year $t$ (Datastream MV); $BVE_{i,t}$ = book value of equity for firm $i$ at the end of fiscal year $t$ (Datastream WC03501); $NI_{i,t}$ = net income before extraordinary items for firm $i$ for fiscal year $t$ (Datastream WC01551); $NEG_{NI_{i,t}}$ = net income before extraordinary items for firm $i$ for fiscal year $t$ if net income is negative or zero (Datastream WC01551), otherwise = 0; $RND_{i,t}$ = research and development expenditures for firm $i$ for fiscal year $t$ (Datastream WC01201); $CAP\_EX_{i,t}$ = capital expenditures for firm $i$ for fiscal $t$ (Datastream WC04601); and $SALES\_GR_{i,t}$ = change in sales revenue (Datastream WC01001) for firm $i$ from fiscal year $t-1$ to fiscal year $t$. 
4.2 Assessing hypothesis \( H1 \)

In order to assess the veracity of our first hypothesis, \( H1 \), we need to establish whether high-technology companies’ financial statements are less value relevant than are low-technology companies’ financial statements in Europe after the bursting of the dot-com bubble. During our sample period 2001 through 2014, the mean adjusted \( R^2 \) for high-technology companies’ financial statements was 0.384 and for low-technology companies’ financial statements the corresponding value was 0.248, indicating that high-technology companies’ financial statements were more value relevant than were those of low-technology companies in the observed time period. This is confirmed statistically as the value relevance of high-technology companies’ financial statements...
in Europe is significantly (p-value = .025 < .05) higher than the value relevance of low-technology companies’ financial statements\textsuperscript{10}.

With these results we reject hypothesis $H1$ and establish that financial statements of high-technology companies in Europe are not less value relevant than are financial statements of low-technology companies in Europe since the bursting of the dot-com bubble. In fact, our results show that high-technology companies have significantly more value relevant financial statements than have low-technology companies in the European post-dot-com bubble period.

**4.3 Results of model (2)**

In order to assess the veracity of hypotheses $H2a$ and $H2b$ we need to establish whether the value relevance of financial statements for both high- and low-technology companies increased on average following the bursting of the dot-com bubble and whether the value relevance of financial statements from high-technology companies increased more rapidly on average than did the value relevance of financial statements from low-technology companies. For this purpose, a regression analysis using model (2) was performed with the annual adjusted $R^2$s for each subset of companies obtained from model (1) as the dependent variable. The results from this regression analysis are shown in table 3.

**Table 3**

*Changes Over Time in Value Relevance, 2001-2014*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>$\kappa_0$</th>
<th>$\kappa_1$</th>
<th>$\kappa_2$</th>
<th>$F: \kappa_1 = \kappa_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted $R^2$</td>
<td>0.442 (.000)</td>
<td>-0.009 (.258)</td>
<td>-0.023 (.006)</td>
<td>3.81 (.001)</td>
</tr>
</tbody>
</table>

We report the coefficient estimates (significance levels) for regression with the following model:

$$ADJ_R^2_{s,y} = \kappa_0 + \kappa_1(HIGH_{s,y} \times y) + \kappa_2(LOW_{s,y} \times y) + \zeta_{s,y}$$

where $ADJ_R^2_{s,y}$ = adjusted $R^2$ from model (1) for subsample $s$ in year $y$; $HIGH_{s,y}$ = dummy variable equal to 1 if subsample $s$ is a high-technology subsample, otherwise = 0; $LOW_{s,y}$ = dummy variable equal to 1 if subsample $s$ is a low-technology subsample, otherwise = 0; and $y = 1...14$ corresponding to our sample fiscal years 2001...2014.

\textsuperscript{10}The t-value of this one-sided t-test is 1.771
Following Francis and Schipper (1999), the coefficients $\kappa_1$ and $\kappa_2$ from the regression model are used as indicators of the average changes over time in the value relevance of financial statements for high- and low-technology companies, respectively. Both $\kappa_1$, the coefficient for high-technology companies, and $\kappa_2$, the coefficient for low-technology companies, are negative, indicating that value relevance has decreased on average for both groups of companies in Europe following the bursting of the dot-com bubble. It must however be noted that the p-value of the coefficient for $\kappa_1$ is .258, meaning that the observed coefficient cannot be said to differ significantly from zero. However, the coefficient for $\kappa_2$ is significantly negative (p-value = .006 < .05).

4.3.1 Assessing hypothesis H2a

Based on the fact that the coefficients for the high-technology company variable and the low-technology company variable are both negative, albeit with a coefficient for the high-technology variable that does not differ significantly from zero, we reject hypothesis H2a which states that the value relevance of financial statements increased for both subsamples in Europe over the sample time period. In fact, our results show that the value relevance of financial statements from low-technology companies decreased significantly on average in Europe following the bursting of the dot-com bubble and that the value relevance of financial statements from high-technology companies did not change significantly in Europe over the same time period.

4.3.2 Assessing hypothesis H2b

The coefficient for the low-technology subsample variable, $\kappa_2$, is more negative than is the coefficient for the high-technology subsample variable, $\kappa_1$, suggesting that the ability of financial statement information to explain movements in market values has decreased on average more rapidly for low-technology companies over the sample time period than it has for high-technology companies. This is supported statistically as an F-test on whether the coefficients for the two subsamples equal each other shows that the coefficients differ significantly (p-value = .001 < .05), indicating that the difference between the two coefficients, and thus the difference in the average change over time in the value relevance of financial statements of the two groups in Europe, is statistically significant.
Due to the fact that neither the coefficient for the high-technology subsample variable nor the coefficient for the low-technology subsample variable has a significantly positive value, together with the fact that the coefficient for low-technology companies is observed to be significantly more negative than is the coefficient for high-technology companies, we reject hypothesis $H2b$ which states that the value relevance of financial statements of high-technology companies increased more after the bursting of the dot-com bubble than did the value relevance of financial statements of low-technology companies in Europe. In fact, our results show that the value relevance of financial statements of low-technology companies decreased on average at a significantly more rapid pace than did the value relevance of financial statements of high-technology companies in Europe in the period following the bursting of the dot-com bubble.

4.4 Analysis of results
For the high-technology sample, value relevance dropped for high-technology companies from 2001 to 2002 before it increased successively from year to year until the peak year of 2005. This increase in value relevance for high-technology companies from the bursting of the dot-com bubble until around 2005-2006 is consistent with the results of Morris and Alam (2012) and Ciftci et al. (2014). The drop in value relevance for the high-technology subsample from 2001 to 2002 could possibly be the result of a spillover effect from the bursting of the dot-com bubble in the year 2000, an explanation supported by the fact that many high-technology firms saw steady decreases in their share prices well into the year 2002. The mandatory implementation of IFRS in the European Union in 2005 does not seem to have had the hypothesized positive effect on the value relevance of European high-technology firms’ financial statements as their value relevance from 2005 to 2007 did not increase but in fact decreased slightly. However, a possible explanation for the increase in value relevance for European high-technology firms from 2002 to 2005 is that it was caused by adjustments undertaken by companies in the years prior to the mandatory implementation of IFRS in expectance of the new rules in order to smooth the transition to the new accounting standards. The U-shaped pattern in value relevance for European high-technology companies from 2007 to 2010 is similar to the untabulated results of Morris and Alam (2012), possibly an effect of the market collapse during the financial crisis in 2008 and 2009. The causes for the volatile movement from year to year of the value relevance for the high-technology subsample observed from 2010 and onward is, to our knowledge, unexplained by prior research.
For the low-technology sample, the pattern in the change in value relevance is similar to the results of Morris and Alam (2012) from the year 2001 to 2006 in which an increase in value relevance from 2001 to 2002 was followed by a general decrease until the year 2006. Our results for the market collapse period 2007-2010, however, differ from the untabulated results of Morris and Alam (2012) for the same period in which they observed a U-shaped pattern in the value relevance while we observed a slight inverted U-shaped pattern. The causes for such an increase in value relevance during a generally turbulent financial period is, to our knowledge, unexplained by prior research, as are the causes for the slight jump in value relevance observed for low-technology companies after the year 2011.

The observed higher value relevance for high-technology firms’ financial statements compared to low-technology firms’ financial statements differs from much of the research on value relevance conducted in the US in which the general tendency is for results to show that value relevance is lower for high-technology firms than it is for low-technology firms. This discrepancy between our results and those of researchers studying US companies indicates that the value relevance of European companies differs from the value relevance of companies in the US market, the reasons for which are unexplained and should be a subject of further study. However, the higher value relevance for high-technology firms compared to low-technology firms in the post-dot-com bubble period was also observed by Morris and Alam (2012) for the US market, although they conducted no tests of significance on those specific results. Their results indicate that the build-up of the dot-com bubble may have heavily distorted the value relevance for high-technology firms, disproportionally lowering it during the 1990s. This explanation is supported by researchers such as Penman (2003) who suggests that investors increasingly valued Internet-related firms based on nonfinancial information such as clicks and page views in the period leading up to the bursting of the dot-com bubble. It could therefore be argued that the value relevance for high-technology firms returned to what can perhaps be called ‘real’ levels after the bursting of the bubble and that investors in the post-bubble period increasingly based their company valuations on concrete financial information rather than on speculation, possibly explaining the higher value relevance for high-technology firms’ financial statements compared to those of low-technology firms.
The significant decline on average over time for the value relevance of low-technology companies’ financial statements and the nonsignificant decline on average over time for the value relevance of high-technology companies’ financial statements can be contrasted with the results of Morris and Alam (2012) and Ciftci et al. (2014), both of whose results suggest that value relevance increased for high- and low-technology companies during the post-dot-com bubble period. This discrepancy indicates that the value relevance of financial statements from companies operating in the European markets differ from the value relevance of their American counterparts. Another possible reason for our results differing from the results of research in the US market is the extension of our sample time period to 2014, with the time period studied by Morris and Alam (2012) extending to 2006 and the time period studied by Ciftci et al. (2014) extending to 2007. The changes in value relevance from 2007 to 2014 can thus have led to the average movement during the period 2001 to 2014 being lowered compared to the results of Morris and Alam (2012) and Ciftci et al. (2014).

5. Conclusion and suggestions for further research

5.1 Summary and conclusions

The purpose of this paper has been to address the concern that an increased importance of intangible assets has led to high-technology firms having less value relevant financial statements than have low-technology firms in the European markets. The perception that intangible assets have become increasingly more important for firms in today’s economy has prompted both practitioners and academics to conclude that financial statements have become less important for firm valuations, leading researchers to study whether financial statements have decreased in value relevance over time as intangibles have become more important. The majority of this value relevance research has been undertaken by looking at the US market in which the general results indicate that high-technology firms have less value relevant financial statements than have low-technology firms and that value relevance has changed differently over time for the two groups of companies. However, whether or not this trend is similar for European companies has not yet, to our knowledge, been investigated.
We have in this study addressed this issue by formulating the following two research questions:

_Are financial statements of high-technology companies less value relevant than financial statements of low-technology companies are in Europe in the period from the bursting of the dot-com bubble to 2014?_

_Is there a difference in changes over time in value relevance between financial statements of high-technology companies and financial statements of low-technology companies in Europe in the period from the bursting of the dot-com bubble to 2014?_

In order to answer these questions, we have used two regression models from prior research conducted on the same topic, one in order to assess the value relevance for each year in our sample time period for high- and low-technology companies, respectively, and one in order to assess the average change in value relevance over time for each group of companies. We have conducted our study by looking at high- and low-technology companies from fifteen European countries over the period 2001 through 2014 with a sample size of 5,788 firm-year observations. The results show that movements in value relevance partly mirror those in studies on the US market and, contrary to our hypotheses, that high-technology firms’ financial statements are significantly more value relevant than are financial statements of low-technology firms and that low-technology firms’ financial statements have declined in value relevance, on average, faster than have financial statements of high-technology firms.

**5.2 Implications**

The results of this study may have implications for several groups concerned with the value relevance of financial statements. The fact that financial statements published by companies in Europe were observed to be largely comparable in value relevance to those published by US companies means that investors can find the information in European financial statements equally useful for making investment decisions as American financial statement information is. This usefulness is not permanent however, with the more rapid average decline over time in value relevance of financial statements published by low-technology companies compared to those of high-technology companies possibly leading to investors having to adapt their investment
strategies in the future. The notable fall in value relevance of low-technology companies' financial statements may give accounting professionals reason to review the content of the statements, and may further motivate accounting standard setters in their work to improve the rules and standards governing the preparation and publishing of financial statements. The results observed in this study shed light on the differences in value relevance between European high- and low-technology firms’ financial statements and their changes over time, a previously underexplored area, and may thus prove useful to academics and give cause for further research.

5.3 Credibility
In order to answer our research questions we have used a quantitative method in line with the method of other researchers studying value relevance. A quantitative approach using secondary data minimizes the risk of researcher bias affecting our results, thus increasing the reliability of the study, strengthened by the fact that the database used for data collection, Thomson Reuters Datastream, contains historic data, allowing researchers to replicate our study and achieve similar results. We have used regression models to study the value relevance of financial statements of our two groups of companies, in line with the method used by many value relevance researchers, and our two models have been selected because they are well established and because the variables in our value relevance model “theoretically and empirically explain cross-sectional variation in stock prices, and are expected to be robust over time.” (Morris & Alam, 2012, p. 246). The fact that our models have been used in established value relevance studies ensures that our study measures what it is supposed to measure. It is however important to point out that value relevance does not have one single model for calculation and that different models used by researchers use different pieces of financial statement information as independent variables in regression models. While we in this study have sought to choose a proven and accepted model to study value relevance, different results might have been observed had a different model been used.

We have selected the starting year of our sample time period to conform to choices made by prior researchers and selected the final year used in order to bring the sample closer to present day and thus increase the study’s relevance for professionals and academics. The industries included in our high- and low-technology samples correspond to industry classifications made by Francis and Schipper (1999), further used in subsequent studies, with the sizes of our industry portfolios having
been selected to fulfill the criteria established by these researchers. These industry classifications have been tested in order to control their validity for performing our study.

5.4 Suggestions for further research
Due to the fact that a link between value relevance, intangible assets and high-technology firms in Europe is a previously underexamined topic further research on value relevance of high- and low-technology firms in Europe is appropriate in order to confirm our results. Since there seems to be a difference between some of our results and results of value relevance research conducted in the US, studies should also focus on the eventual causes for the observed differences in value relevance between Europe and the US such as the causes for the volatile changes in value relevance of financial statements of high-technology companies after the year 2010 observed in this study. Another potential topic of investigation is to see whether the results of this study hold when including Eastern European companies in the sample, none of which were included in the sample of this study.
References


Stern Stewart & Co. 2002. “Accounting is Broken Here’s How to Fix It A Radical Manifesto”, *EVALuation*, vol. 5, no. 1, pp. 1-29


## Appendix

<table>
<thead>
<tr>
<th>STOCK EXCHANGES</th>
<th>MARKET CAPITALIZATIONS</th>
<th>Europe</th>
<th>March</th>
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<tbody>
<tr>
<td>Athens Stock Exchange</td>
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<td>36 611.4</td>
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<td>BME Spanish Exchanges</td>
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<td>Budapest Stock Exchange</td>
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<td>20 346.4</td>
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<td>1 655 367.4</td>
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<tr>
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<td>3 353 619.2</td>
<td></td>
</tr>
<tr>
<td>Irish Stock Exchange</td>
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<tr>
<td>Ljubljana Stock Exchange</td>
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<td>6 242.8</td>
<td></td>
</tr>
<tr>
<td>London SE Group(^b)</td>
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<tr>
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<td></td>
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<td>Malta Stock Exchange</td>
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<tr>
<td>Moscow Exchange</td>
<td></td>
<td>459 400.8</td>
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<tr>
<td>NASDAQ OMX Nordic Exchange(^c)</td>
<td></td>
<td>1 257 622.1</td>
<td></td>
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<td><strong>Total region</strong></td>
<td></td>
<td><strong>13 216 120.8</strong></td>
<td></td>
</tr>
</tbody>
</table>


The five largest stock exchanges in Europe by market capitalization are written in *italics*

\(^a\)European countries whose stock exchanges are in the Euronext stock exchange are France, the United Kingdom, the Netherlands, Belgium and Portugal

\(^b\)European countries whose stock exchanges are in the London SE Group are the United Kingdom and Italy

\(^c\)European countries whose stock exchanges are in the NASDAQ OMX Nordic Exchange are Sweden, Denmark, Finland, Lithuania, Latvia, Estonia and Iceland