Handelshøyskolen BI

GRA 19204 Masteroppgave i regnskap og revisjon

Thesis Master of Science 100% - W

Predefinert informasjon

Startdato:	10-01-2022 09:00 CET	**Termin:**	202210
Sluttdato:	01-09-2022 12:00 CEST	**Vurderingsform:**	Norsk 6-trinns skala (A-F)
Eksamensform:	T		
Flowkode:	202210||10933||IN17||W||T		
Intern sensor:	(Anonymisert)		

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Informasjon fra deltaker

Tittel *:	The Value Relevance of Accounting Information - Empirical Evidence from the Oslo Stock Exchange
Navn på veileder *:	Michael Kisser

Inneholder besvarelsen konfidensielt materiale?:	Nei	**Kan besvarelsen offentliggjøres?:**	Ja

Gruppe

Gruppenavn:	(Anonymisert)
Gruppenummer:	2
Andre medlemmer i gruppen:	

Master Thesis

The Value Relevance Accounting Information

Empirical Evidence from the Oslo Stock Exchange

Hand-in date:

27.05.2022

Campus:

BI Oslo

Examination code and name:

GRA 19204 Thesis Master of Science

Programme:

Master in Accounting and Auditing

Acknowledgements

We would like to express our deep gratitude to our supervisor Michael Kisser for his great support, guidance, and advice throughout our master thesis work. He has provided us with valuable feedback essential for quality of our research and analysis. We are also thankful to Sigrid Noer Gimse from the BI library who has kindly helped us with data collection from Eikon Datastream. Last but not least, all our thanks go to our families for their continuous support, inspiration and encouragement during our study at BI.

Abstract

The objective of the master thesis is to investigate value relevance of accounting information for the firms listed on the Oslo Stock Exchange. We employ 16 years of data (from 2005 until 2020) and explore three broad empirical questions. First, we investigate the value relevance of earnings, book value of equity and the combined value relevance of earnings and book value of equity. The second part of the study addresses the topic of value relevance of accounting information over time. The third part of the research focuses on the examination of the value relevance of operating cash flows in relation to earnings and the value relevance of intangible assets.

The empirical questions are answered by testing five hypotheses with the help of cross-sectional price level regressions derived from the Ohlson model (1995). In the course of the study, we examine both if particular pieces of accounting information are significantly related to the stock prices by reviewing the significance level of individual regression coefficients as well as how much variation in stock prices is explained by accounting information with the help of adjusted R^2 of regression models.

The assessment of the value relevance provides evidence that financial statement information produced by Norwegian firms is value relevant. We document that the book value of equity and net income jointly explain 27.9 percent of the variation in stock prices. Furthermore, we conclude that operating cash flow is more value relevant than net income when partitioning net income into an accrual and operating cash flow components. However, we find only partial evidence of value relevance of research and development expenditures and intangible assets for the firms listed on the Oslo Stock Exchange. With regard to value relevance over time, we document a slight increase in the value relevance of earnings as well as an increase in the combined value relevance of book value of equity and net income over time.

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1. Introduction

Value relevance of accounting information is one of the most prominent and widely discussed topics in accounting theory. Value relevance research examining the relations between capital markets and financial statements is generally considered a part of capital markets research (Kothari, 2001). Ball and Brown (1968) and Beaver (1968) published seminal papers on value relevance which provided evidence of a link between stock prices[1] and accounting information. Their results led to numerous studies examining the role of financial information in equity markets. Motivated by the information perspective, the value relevance research focuses primarily on the usefulness of financial information in equity valuation (e.g. Collins et al., 1997; Francis & Schipper, 1999; Francis et al., 2004).

Our paper, in line with previous research on value relevance, examines the value relevance of accounting information from an investors' point of view. Most research on value relevance is conducted using U.S. data. While interesting, U.S. data differs from European and Norwegian data due to different accounting regulations and economic conditions. Since the number of value relevance studies based on Norwegian data are relatively small, our research focuses on the value relevance of financial information for investors trading at the Oslo Stock Exchange.

The purpose of our research is to study the value relevance of accounting information for the firms listed on the Oslo Stock Exchange. Our study uses 16 years of data, and we explore three broad empirical questions. First, we investigate the value relevance of earnings, book value of equity and the combined value relevance of earnings and book value of equity.

The value relevance of accounting information is not constant. Studies based on the U.S. data present different opinions on the development of value relevance over time: while most researchers agree that value relevance of earnings has declined whereas value relevance of book value of equity has increased, the

[1] Stock price, share price and security price are used interchangeably.

development of the combined value relevance of earnings and book value of equity is disputed (Brown et al., 1999; Collins et al., 1997; Francis & Schipper, 1999; Lev, 2018 among others). Motivated by the limited previous research on development of value relevance over time for the firms listed on the Norwegian stock exchange, we will address this topic in the second part of the empirical part of the study.

The third part of the research will focus on other accounting information. Previous studies show conflicting evidence on the importance of various data components (for instance, intangible assets and special items), value relevance of cash flows and the significance of the appearance of new industries (Barth et al., 2021; Lev & Gu, 2016; Lev & Zarowin, 1999; Sloan, 1996 among others). The same concerns about value relevance of accounting information to investors can be raised in Norway. Even though accounting information is useful for valuation, it is not obvious which accounting information is most value relevant to investors. Therefore, the objective of the third part of the research is to study the value relevance of operating cash flows in relation to earnings as well as the value relevance of intangible assets for the firms listed on the Oslo Stock Exchange.

The thesis proceeds as follows. Chapter 2 presents an overview of existing literature on value relevance. There is an extensive amount of prior value relevance studies, and, hence, we focus on those studies that are relevant for our research question: the different interpretations of the value relevance concept, value relevance of earnings, book value of equity, and other accounting information, the acknowledged models to study value relevance as well as some issues complicating value relevance research. We begin Chapter 3 by introducing the research question followed by five hypotheses which are tested in the practical part of the study, and then elaborate on research design and sampling of the data collected from Refinitiv Datastream. Chapter 4 presents research models, empirical findings as well as several robustness tests to validate the results of our main tests. Finally, we make an overall conclusion where we summarize our empirical findings.

2. Value Relevance

Chapter 2 presents an overview of the existing literature on value relevance that is relevant for our research question. Our paper will discuss value relevance from an investor's rather than standard setter's or manager's standpoint. The focus is on the security prices' response to accounting information as a test of value relevance.

The chapter on value relevance is organized as follows. We first discuss the theoretical background to value relevance studies in Section 2.1. We further move to the definitions of value relevance which represent different approaches in capital market research in Section 2.2. Section 2.3 elaborates on the concept of market efficiency in value relevance studies. Sections 2.4 - 2.6 present value relevance analysis of different components of accounting information as well as value relevance over time. Furthermore, the most acknowledged models to study value relevance are reviewed in Section 2.7. While discussing value relevance models, we touch upon some of the issues complicating value relevance research, i.e. different firm-specific characteristics and economic factors which should be controlled for when applying value relevance models. We conclude by reviewing the value relevance literature based on the Norwegian data samples in Section 2.8.

2.1 Theoretical Background

Accounting research is often conducted from the perspective of stock market participants since investors are considered the most frequent users of financial statement information (Ball & Kothari, 1991). However, as prescribed in the agency theory, investors have an information disadvantage relative to the management as they don't run the firm (Scott, 2015). Due to the information asymmetry between investors and management, the primary objective of financial reporting is to provide its users with useful information about firms' performance, i.e. information capable of making a difference in economic decisions (Scott, 2015).

Accounting information is subject to a tradeoff between relevant and reliable information (Scott, 2015). Barth et al. (2001) point out that value relevance tests are joint tests of relevance and reliability of accounting information, and if a financial statement user finds the financial information relevant, their decisions can be directly influenced by the information. While investors regard forward-looking information as useful, the reliability principle is one of the key reasons why financial statements lack forward-looking information that influence market values (Kothari, 2001). However, since accounting standard setters view investors as key stakeholders we can hypothesize that accounting information is value relevant (International Accounting Standards Board [IASB], 2020, BC1.9). The next section will discuss several interpretations of value relevance in detail.

2.2 The Concept of Value Relevance

Francis and Schipper (1999, pp. 325-27) summarize four definitions of the value relevance concept as presented in Figure 1.

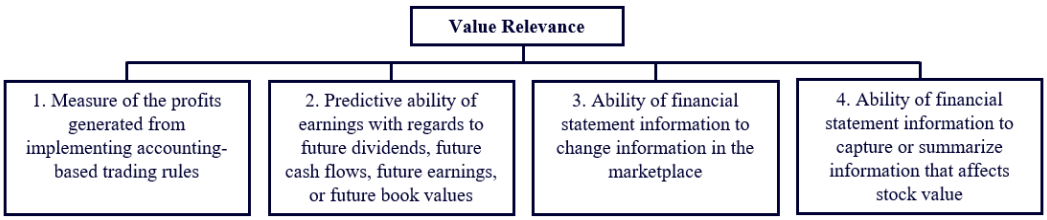

Figure 1. Definitions of the Value Relevance Concept.

The first definition refers to value relevance as a measure of the profits generated from implementing accounting-based trading rules (Francis & Schipper, 1999; Ou & Penman, 1989). This interpretation is regarded by Francis and Schipper (1999) as the most difficult to implement since researchers often fail to make the required risk adjustments, i.e. adjustments for risk in implementing trading rules.

According to the second definition, financial information is regarded as value relevant if it assists in predicting underlying value attributes derived from valuation theory. Thus, value relevant financial information helps to forecast future dividends, future cash flows, future earnings, or future book values (Francis & Schipper, 1999). Most of the studies based on the second definition of value relevance investigates earnings or cash flows predictions (Sloan, 1996).

The third and the fourth interpretations operationalize value relevance as a statistical association between financial information and prices or returns. Since the main aim of accounting information is to provide investors with relevant information for their investment decisions, most studies focus on the associations between accounting information and stock prices consistent with the third and fourth definitions.

Under the third approach, value relevance is operationalized by the ability of financial statement information to change information in the marketplace. Thus, financial information about the amount, timing and uncertainty of a firm's future cash flow is considered value relevant if its appearance changes stock price due to investors' revising their expectations (Francis & Schipper, 1999). Studies adopting this approach are often referred to as event studies where security price changes are measured over short time intervals, e.g. days or weeks after the announcement day (Collins & Kothari, 1989; Kothari, 2001; Kothari & Warner, 2007). The seminal works by Ball and Brown (1968) and Beaver (1968) are examples of event studies that provide compelling evidence about the presence of information content in accounting earnings announcements.

The fourth approach determines value relevance as a statistical association between financial information and market values or returns, and is prevalent in the value relevance literature (Barth et al., 2001; Barth et al., 2021; Beaver, 1998; Francis & Schipper, 1999; Lev & Zarowin, 1999 among others). When a significant association exists, the accounting information is assumed to be value relevant to investors and reliable enough to be reflected in share prices (Song et al., 2010). Under this approach, value relevance of accounting information is measured by its ability to capture or summarize information that affects stock value (Francis & Schipper, 1999). Value relevance is then "*based on the explanatory power of accounting information for measures of market value: the ability of earnings to explain annual market-adjusted returns, and the ability of earnings and book values of assets and liabilities to explain market values of equity*" (Francis & Schipper, 1999, p. 320).

The association approach of value relevance does not presuppose any causation between accounting information and stock price development. On the contrary, this type of study assumes the existence of numerous sources of information about a firm's cash flows available to market participants (Kothari, 2001). Therefore, it is possible that the accounting information is value relevant but not decision relevant if it is superseded by more timely information (Barth et al., 2001).

The main aim of association studies is to analyze "*whether and how quickly accounting measures capture changes in the information set that is reflected in security returns over a given period*" (Kothari, 2001, p. 116). Thus, association studies are most often conducted as long window studies measuring accounting performance over relatively long contemporaneous time periods (Easton et al., 1992).

To summarize, the objective of general purpose financial reporting is consistent with the value relevance research adopting information or valuation interpretations of value relevance which focus on financial statements providing useful information about firms' performance to its users. The association studies are most common in value relevance research as they do not aim to answer whether the information in the financial statement was actually used by investors in the decision making process but rather seek to find the statistical association between accounting information and market value or returns. The present study will be performed as an association study.

2.3 Value Relevance and Market Efficiency

Value relevance research investigates the relation between accounting information and capital markets (e.g. Ball & Brown, 1968; Kothari; 2001). Based on the theory of efficient capital markets, where efficient capital markets are defined by Fama (1970, p. 383) as markets where "*prices always "fully reflect" available information"*, relevant accounting information should be incorporated in stock prices.

Fama (1970) presents different levels of market efficiency: weak, semi-strong and strong, in his efficient market hypothesis (EMH). The different levels of market

efficiency are characterized by what information is incorporated in the stock price: either previous prices (weak form of market efficiency), publicly available information (semi-strong form of market efficiency), or public and non-public information (strong form of market efficiency) (Fama, 1970). The degree of observed market efficiency is a strongly debated topic (Hou et al., 2020) and some researchers raise the possibility that capital markets are not fully efficient (e.g. Aboody et al., 2002; Ball & Brown, 1968; Beaver, 1968; Kothari, 2001; Holthausen & Watts, 2001; Sloan, 1996). For example, Beaver (1968) and Kothari (2001) suggest that markets are not fully efficient by documenting a delay in market reactions by providing evidence of post-announcement drifts.

Value relevance research has a tendency of assuming semi-strong market efficiency (Basu, 1983; Fama, 1970; Fama & French, 1992). Holthausen and Watts (2001) states that semi-strong market efficiency actually should be a requirement for any value relevant study. However, in the semi-strong form of market efficiency, Aboody et al. (2002) remark that the market is not entirely efficient in the processing of publicly available information.

The discussion of value relevance of accounting information will be continued with the presentation of previous research on value relevance of different types of accounting information. We will start by reviewing value relevance of earnings and book values as those accounting measures are in the center of value relevance research.

2.4 Value Relevance of Earnings and Equity Book Values

Earnings and book value of equity are recognized as the two summary measures of financial accounting information. Earnings are regarded as the “bottom line” number in the income statement and the book value of equity is regarded as the “bottom line” number on the balance sheet (Penman, 2010, p. 20). Therefore, the majority of value relevance research emphasizes the value relevance of these two accounting numbers (e.g. Ball & Brown, 1968; Barth, 1991; Beaver 1968; Collins et al., 1997; Dechow et al., 1999).

2.4.1 Value Relevance of Earnings

The value relevance of earnings and other elements of income is considered to be the primary focus of value relevance research (e.g. Ball & Brown, 1968; Beaver, 1968; Beaver et al., 1979; Miller & Modigliani, 1966). The value relevance of earnings has traditionally been studied by either regressing stock return on accounting variables (Brown et al., 1999; Lev, 1989) or regressing abnormal stock return on unexpected earnings (Ball & Kothari, 1991; Biddle & Seow, 1991). An accounting number that is found to have a significant statistical association with the dependent variable stock return is presumed to be value relevant from an investor's perspective.

Prior to association studies, it was the study by Miller and Modigliani (1966) which showed that earnings are the most important explanatory variable when valuing firms. Miller and Modigliani (1966) introduced the earnings-only approach and presented the value of a firm as the present value of permanent future earnings.

Net income further becomes the topic of seminal papers in value relevance research - the studies by Ball and Brown (1968) and Beaver (1968). Ball and Brown (1968) are the first to provide scientific evidence of the value relevance of abnormal accounting information by documenting the effect of reported net income on a firm's share returns. Their research reports an abnormal share price response to the firm-specific component of reported net income and shows both causation and association between that financial statement information and security price change: There is evidence that financial information causes security price change in the month zero, whereas there is a direct association between financial information and security price change 12 months before and prior and 6 months after report announcement date.

Supportive evidence of earnings' value relevance is further documented by Beaver who studies the trading volume response (1968) and abnormal returns (Beaver et al., 1979) in relation to earnings announcements. Beaver (1998) further suggests that earnings have information content about the value of a security if its

release changes investor's opinion on the values of the security such as claims to future dividends.

In an association study, Easton (1985) evaluated the relations between accounting earnings and present value of expected future dividends, and the valuation link in the form of the risk-adjusted dividend capitalization formula between future dividends and security price. The study provides evidence that there is a strong statistical significance between earnings and the present value of future dividends. The contemporaneous association between accounting earnings and stock prices could, thus, be explained by these relations. In accordance with other association studies, Easton (1985) does not claim to establish that investors use the information in the financial statements when making their decisions, but rather determines whether accounting information (earnings in particular) is an adequate representation of future firm's performance.

Lev (1989) studies the statistical association between earnings and stock returns and comes to the conclusion that the correlation between earnings and stock returns is low, and that the relationship between earnings and stock returns are unstable over time. The low value relevance of earnings is explained by their major deficiencies: differences between economic and accounting earnings, and potential manipulated or fraudulent earnings. His findings suggest limited usefulness of quarterly and annual earnings to investors is limited as the correlation between earnings and stock returns is low.

A number of value relevance studies acknowledge different valuation implications of various earnings types (Barth et al., 1998; Kothari & Zimmerman, 1995; Ohlson, 1999; Ramakrishnan & Thomas, 1998). Ramakrishnan and Thomas (1998) demonstrate that net income consists of different components with different levels of persistence. Earnings persistence is defined as a weighted average of the differing persistence of earnings components with transitory items affecting earnings in the current year but not in future years being one of the earnings events (Ramakrishnan & Thomas, 1998). Transitory or non-recurring earnings are, thus, earnings with very low or zero persistence.

Transitory earnings are usually caused by conservatism, certain business transactions and accruals (Pope &Walker, 1999; Scott, 2015; Sloan, 1996). Negative earnings are often regarded as less persistent as, first of all, bad news tends to be immediately and fully expensed and, secondly, losses are viewed as temporary by investors and stock owners and are not expected to continue forever (Barth et al., 1998; Basu, 1997; Collins et al., 1997; Hayn, 1995).

Ohlson (1999) further elaborated on the concept of earnings in the value relevance model. The Ohlson study (1999) presents evidence that the information inherent in the transitory earnings has much in common with dividends and, thus, is different from other income statement items. Firstly, transitory earnings are unpredictable as current transitory earnings do not impact subsequent transitory earnings. Secondly, current transitory earnings are irrelevant for the forecast of total earnings for the subsequent year. Thirdly, transitory earnings do not influence the present value estimates of a firm's expected dividends (Ohlson, 1999, p. 145).

In line with the Ohlson (1999) research, a number of value relevance studies acknowledge different valuation implications of various earnings types by excluding transitory earnings from the regression (Barth et al., 1998). Moreover, previous studies have shown that removing non-recurring items from the model can increase value relevance of earnings (Bhattacharya et al., 2003; Bradshaw & Sloan, 2002). Thus, Freeman and Tse (1992) suggest that analysts and investors are relatively uninterested in transitory earnings since trading profit, which is possible to earn from private knowledge of permanent earnings, is greater than the profit from the knowledge of dollar of transitory earnings.

2.4.2 Value Relevance of Equity Book Value

Numerous studies document the association of book values and stock prices (Barth, 1991; Barth et al., 1998; Collins et al., 1997; Dechow et al., 1999; Ohlson & Penman, 1992). Book values and earnings convey complementary information about equity value and, thus, both have explanatory power over the firm's stock prices. Equity book value measures net value of the firm's resources independent

of how resources are being used. Earnings, on the other hand, show how the firm's resources are being currently used (Burgstahler & Dichev, 1997). Consequently, a vast amount of researchers agree that models for measuring market value of equity should include both earnings and equity book value and omitting one or the other can potentially lead to model misspecification (Barth et al., 1998; Collins et al., 1997; Francis & Schipper, 1999; Kothari & Zimmerman, 1995).

Several researchers have further investigated the implications of the set of financial conditions and industry specifications on the value relevance of earnings and equity book values. Thus, financial distress and a firm’s financial health are proven to affect the explanatory power of earnings and book values. Burgstahler and Dichev (1997) claim that valuation methods based on book values are more relevant for firms with low return on equity while earnings have more explanatory power for firms with high return on equity. The findings show that earnings response coefficients increase with the level of earnings-to-book value.

These findings were supported by Barth et al. (1998) who present evidence that the coefficient and incremental explanatory power of earnings have decreased while coefficient and value relevance of book values have increased for firms in poor financial health. Moreover, Barth et al. (1998) show that firms in financial distress exhibit higher value relevance of book values compared to earnings though the results differ with respect to industries.

At the same time, some research papers mention the limitations of explanatory power of book values due to the value relevance of other book items being sensitive to differences in valuation principles applied to various asset and debt components (e.g. Barth et al., 1996; Carroll et al., 2003; Khurana & Kim, 2003).

All things considered, earnings and equity book value exhibit different roles regarding equity valuation due to the fact that these measures present complementary information on a firm’s value. Therefore, both earnings and book value of equity should be considered when evaluating the impact of financial information on stock prices.

2.5 Value Relevance of Other Accounting Information

Earnings and equity book value being the summary measures of financial statements have been in the center of value relevance research. However, investigating other accounting information also provides insight into which accounting information is considered value relevant by investors.

Other accounting information examines the value relevance of alternative accounting performance measures such as cash flows, EBITDA, operating income, income before tax and sales (e.g. Barth et al., 2021; Barton et al., 2010; Cormier et al., 2017; Dechow, 1994; Mostafa & Dixon, 2013). Others assess the value relevance of growth opportunities by investigating revenue growth or cash growth (e.g. Amir & Lev, 1996; Lev & Zarowin, 1999). Moreover, the accounting amounts intangible assets, accounts receivable, current liabilities, selling and administrative expenses and inventories are included in the value relevance literature (Barth et al., 2021; Carnes, 2006 in Dunham & Grandstaff, 2021). The listing is not exhaustive and considering all of them in our paper would be a too comprehensive task. The two accounting measures we have chosen to include in our research are cash flows and intangible assets.

The choice of cash flow measure is prompted by the fact that prior research evidence on the value relevance of cash flows compared to the value relevance of earnings is conflicting. A number of researchers find cash flows, particularly operating cash flows, more value relevant than earnings (e.g. Akbar et al., 2001; Barth et al., 2021; Sloan, 1996).

The choice of intangible assets is prompted by the fact that as the economy evolves and industries with intensive investments in intangible assets are expanding, the role of intangible assets in the financial statements are of increasing interest (Barth et al., 2021; Lev, 2018; Lev & Gu, 2016; Lev & Sougiannis, 1996). The next section will present a detailed review of previous research on the value relevance of cash flows followed by a section presenting previous research on intangible assets.

2.5.1 Value Relevance of Cash Flows

When examining the value relevance of earnings, it is also interesting to examine the value relevance of the two components of earnings: cash flows and accruals (Dechow, 1994, p.6):

$$\text{Earnings} = \text{Cash flows} + \text{Accruals} \quad (1)$$

Since cash flow is a component of earnings, it is considered as an alternative performance measure whose value relevance is well documented in prior literature (e.g. Barth et al., 2021; Dechow, 1994; Mostafa & Dixon, 2013).

Some researchers provide evidence of earnings being more value relevant than cash flows by suggesting that cash flows are a noisier measure of firm performance. Earnings are defined as cash flows adjusted by the accrual component that helps to cope with the timing and matching of revenues and expenses (Dechow, 1994). Therefore, some researchers regard earnings as more value relevant than current cash flows due to their better ability to reflect firms' performance (Barth et al., 2001; Beaver, 1989 in Lee et al., 2017; Dechow et al., 1998; Dechow, 1994; Kothari, 2001).

Other researchers suggest that cash flows are more value relevant than earnings (e.g. Akbar et al., 2001; Barth et al., 2021; Sloan, 1996). Sloan (1996) examines the extent to which information about future earnings in the two components of earnings, cash flows and accruals, are reflected in stock prices. He argues that the information content in the cash flow component of earnings has a higher persistence than the accrual component, suggesting the distinction between them is essential in valuing firms. Sloan (1996) further suggests that the market fixates on earnings due to the failure to distinguish between the two components of earnings, implying that stock prices don't fully reflect all publicly available information. Hence, cash flows are more value relevant than earnings in the long term as earnings don't necessarily reflect all future performance information included in the persistent cash flow measure.

Supportive evidence is provided by Barth et al. (2021) who investigate the U.S. data and suggest that the cash flow component and accrual component of earnings are better to predict future firm performance than earnings as operating cash flows are considered more persistent than earnings. The accrual component of earnings can be opportunistically manipulated by management and then cash flows better serve as an indicator of future firm performance unless the lower reliability of earnings is outweighed by increased relevance (Ball, 1989; Watts & Zimmerman, 1986 in Dechow, 1994). Cash flows are also deemed more value relevant when firms are suffering financial distress (Casey & Bartczak, 1985; Chan & Chen, 1991; Lee et al., 2017).

When applying cash flows in value relevance modeling, several researchers emphasize operating cash flows as they are related to the firm's operating activities (Akbar et al., 2011; Barth et al., 2001; Dechow, 1994; Lee et al., 2017; Tahat & Alhadab, 2017). Operating cash flows show net cash flows generated by a firm's operating activities. Accruals in operating cash flows are long term in nature and, thus, reduce timing and matching problems associated with a firm's investing and financing activities (Dechow, 1994). Therefore, operating cash flows are proven to have a superior value relevance over cash flows from investing and financing activities (Tahat & Alhadab, 2017). Other researchers argue that the higher persistence of operating cash flow in relation to earnings serves as a better predictor for future earnings and hence has a higher value relevance (Barth et al., 1999; Sloan, 1996). Akbar et al. (2011) study the value relevance of different earnings partitions of UK firms and find the earnings partitioning into operating cash flows and total accruals have a higher explanatory power than the similar model containing unpartitioned earnings, implying a higher value relevance of cash flows compared to earnings.

Mostafa and Dixon (2013) document both higher value relevance of operating cash flows relative to the value relevance of earnings and higher value relevance of earnings relative to the value relevance of operating cash flows. Their research implies that both performance measures, earnings, and operating cash flows, are value relevant. Those results are consistent with the findings by Cheng et al. (1996) who argue that the market emphasizes earnings when earnings are

persistent (and cash flows considered supplementary), but when earnings are extreme (low persistence) cash flows are preferred when valuing the firm and earnings considered as supplementary. Cheng and Yang (2003) elaborate on the evidence on the supplementary role of both earnings and cash flows by showing that moderate earnings, i.e. low extremity (high persistent), are more value relevant than cash flows, and extreme earnings are less value relevant than moderate cash flows.

To summarize, the research on the value relevance of cash flows is conflicting. There are studies that show cash flows as less value relevant than earnings due to the timing and matching problems. At the same time, several researchers emphasize that cash flows are more value relevant than earnings by arguing that operating cash flows are more persistent and a better predictor of future cash flows, and hence better explains stock prices.

2.5.2 Value Relevance of Intangible Assets

An intangible asset is an asset without physical substance, e.g. trademarks, customer lists, patented technology and computer software (Financial Accounting Standards Board [FASB] 2001, para. B27; International Accounting Standards Board [IASB] 2004, para. 8-9). Investments in intangible assets are reflected in financial statements either as expenses in profit or loss, typically research and development expenditures (R&D), or as capitalized assets on the balance sheet.

Accounting rules regarding intangible assets imply, in most cases, immediate expensing of costs related to investments in intangible assets (Barth et al., 2021; Lev, 2018; Lev & Zarowin, 1999). The potential benefits of the intangible assets are recognized in subsequent periods resulting in an accounting mismatch between expenses and revenues related to intangible assets. The matching principle[2] improves earnings quality and is proven to be value relevant (Beaver, 1998; Dichev & Tang, 2008; Gjerde et al., 2011; Kothari, 2001; Lev, 2018) and,

[2] The matching principle requires cash outlays associated directly with revenues to be expensed in the period in which the firm recognizes the revenue (Dechow, 1994).

hence, a violation of this principle could result in lower value relevance when expensing investments in intangible assets.

Lev (2018) documents increasing investments in intangible assets and argues for a related decreasing value relevance of earnings as a result of the expensing of investments in intangible assets. Amir and Lev (1996) find evidence of reduced value relevance of earnings and book value of equity in industries characterized by heavy investments in intangible assets as a result of the immediate expensing of costs related to investments in intangible assets. However, other researchers argue that those firms don't have a lower association between stock prices or returns and financial data than firms with less intensive investments in intangible assets (Collins et al., 1997; Francis & Schipper, 1999). Collins et al., (1997) also suggest that the book values of equity in firms with high intensive investments in intangible assets have become more value relevant than earnings. Research and development expenditures are also found to be value relevant as they are positively associated with future earnings and stock prices (Core et al., 2003; Lev & Sougiannis, 1996).

The other accounting treatment, i.e. capitalization of investments in intangible assets on the balance sheet, is documented to have a positive association with stock prices and future earnings and, hence, considered value relevant (Barth et al., 2021; Aboody & Lev, 1998). The capitalization treatment is also emphasized as more relevant than expensing the costs related to intangible assets as incurred (Aboody & Lev, 1998; Lev & Sougiannis, 1996; Lev & Zarowin, 1999). A study performed on Australian data complying with Australian GAAP which permits recognized intangible assets to be frequently revalued at fair value, indicates a positive association between recognized intangible assets and share price (Barth & Clinch, 1998).

Investments in intangible assets are often expensed as incurred rather than capitalized, yet both accounting treatments are considered value relevant. However, as the expensing of investments in intangible assets results in an accounting mismatch between revenues and expenses, the capitalization of those investments is found to be more value relevant than the immediate expensing.

There is no agreement in prior research whether the value relevance of the expensing of investments in intangible assets is more value relevant in firms with high intensive investments in intangible assets than in firms with low intensive investments in intangible assets.

So far, we have primarily discussed the comparison of different accounting measures with respect to their value relevance. The next section will focus on the development of value relevance of accounting information over time. With the increasing importance of new high technology industries and diminishing influence of others, the topic of the development of value relevance over time assumes immense importance as it can show if accounting needs to adjust to the changing environment.

2.6 Value Relevance Over Time

Literature on value relevance presents different opinions on value relevance of financial accounting information over time. On one hand, there is a point of view that the combined value relevance of book value and earnings has decreased over time (Brown et al., 1999; Lev, 2018; Lev & Gu, 2016; Lev & Zarowin, 1999). Brown et al. (1999) indicates that value relevance has declined significantly when association is measured by R^2 based on data for the period 1958-1996 and suggest that the reason for the decline is a weakening of the relation between the value of equity and accounting measures of earnings and book value[3].

Lev and Zarowin (1999) indicate that the value relevance of earnings, cash flow and the book value of equity experienced a decrease in the period 1978-1996. They identify the main reasons for the decline in value relevance as the impact of business change and inadequate accounting treatment of the change and its consequences. In particular, Lev and Zarowin (1999) document a declining association between stock price and earnings for firms with more intangible assets as a result of the immediate expensing of costs related to investments in intangible assets.

[3] R^2 will be discussed in detail in Section 2.6.1.

In his later study, Lev (2018) advocates that reported earnings do not reflect firms' performance, and the usefulness of financial information presented in the financial reporting has deteriorated significantly during the last decades by showing a drastic decrease of R^2 throughout the decades from approximately 85 percent in the 1950s to 25 percent in the 2000s. Lev (2018) identifies the shift from the income statement model to the balance sheet model and failure to adjust accounting with regards to intangible assets, as the reasons for decrease in value relevance. In the income statement model, earnings serve as an indicator of the firm's performance for the period as revenues are matched to expenses, while in the balance sheet model earnings reflect the change in net assets between two points in time (Lev, 2018). Therefore, with increasing focus on current values in the balance sheet, the value relevance of accounting information has been declining: the earnings ability to explain stock prices and explain future earnings has been deteriorating.

Moreover, Lev (2018) suggests that intangible assets (proxied by research and development expenses (R&D) and selling, general and administrative expenses (SG&A)) can explain the declining value relevance by showing the increase in R&D and SG&A as a percentage of sales throughout the decades. Lev (2018) and Lev and Gu (2016) advocate that the intangible assets (patents, brands, information technology) have become the prime value creator for the past 40 years. However, traditional accounting fails to reflect the value of these assets in the financial statements and to provide investors with information on these assets. Therefore, intangible intensity is identified as "*a primary cause*" of the deterioration in the usefulness of financial information (Lev & Gu, 2016, p. 90).

On the other hand, several papers suggest different patterns of value relevance, e.g. no decrease or even increase, over time (Barth et al., 2021; Collins et al., 1997; Ely & Waymire, 1999; Francis & Schipper, 1999). Collins et al. (1997) investigate systematic changes in the value relevance of earnings and book values of the US listed firms in the period 1953-1993. The study concludes that even though the incremental value relevance of earnings had decreased, the incremental value relevance of book value of equity had increased, and the combined value relevance of earnings and book value of equity had increased slightly. Based on

adjusted R^2 for the pooled cross-sectional time-series regression, Collins et al. (1997) propose that earnings and book values jointly explain around 54 percent of cross-sectional variation in security prices. Moreover, the paper attempts to explain the change in value relevance. They suggest that a shift in value relevance can be explained by 1) the change in firm size; 2) increased reporting of negative earnings; 3) increasing intensity of one-time non-recurring items; and 4) intangible intensity.

Francis and Schipper (1999) assess value relevance over a similar period of time from 1952 until 1994 by evaluating R^2 from annual regressions of market-adjusted returns of five hedge portfolios to assess value relevance over time. They investigate the ability of earnings to explain market-adjusted returns ("earnings relation"), the ability of book values of equity and earnings to explain market value of equity ("book value and earnings relation"), and the ability of assets and liabilities to explain market value of equity ("balance sheet relation") (Francis & Schipper, 1999, p. 332). They come to the conclusion that their study provides mixed evidence for the development of value relevance over time: a decline in earnings' ability to explain returns, but an increased ability of assets and liabilities, and earnings and book values to explain equity market values. In addition, Francis and Schipper (1999) perform the same tests for high-technology and low-technology industries but find no evidence for the common belief that the high-technology firms experience a greater decrease in value relevance than low-technology firms.

Ely and Waymire (1999) investigate time-series behavior of the value relevance of earnings, book value and combined earnings and book value during 1927-93. The research concludes with similar results to Collins et al. (1997) and Francis and Schipper (1999): though value relevance of earnings did not show significant increase, the combined relevance of earnings and equity book value had a considerable increase.

An increase in value relevance of earnings is also presented by Landsman and Maydew (2002). The study covering the period 1972-1998 is based on the two metrics from Beaver (1968), i.e. abnormal trading volume and abnormal return

volatility. The results of Landsman and Maydew (2002) indicate an increase in informativeness of quarterly earnings announcements over time.

Barth et al. (2021) in their recent study investigate the evolution of the value relevance of accounting information in the period from 1962 to 2018 as the economy transitioned from an industrial one to an economy based on services and information technology. The research is consistent with the prior findings that the value relevance of earnings has decreased but the value relevance of equity book value has increased. Moreover, the study by Barth et al. (2021) does not show any evidence of the decline in the combined value relevance of accounting information. On the contrary, accounting amounts relevant in the new economy, e.g. intangible assets, growth opportunities, and alternative performance measures, become significantly more relevant. Barth et al. (2021) incorporate any nonlinearities and interactions using a flexible, nonparametric estimation approach rather than linear regression and provide evidence of increased value relevance of both research and development expenditures and recognized intangible assets as well as growth opportunities and alternative performance measures in the period from 1962 till 2018. They conclude with the assumption that these accounting measures together with book value of equity have become more value relevant to investors in the new technological economy.

Moving towards the value relevance of cash flows, Lev and Zarowin (1999) provide evidence of its decline in the period 1977-1996, but the decline is less pronounced than decrease in the value relevance of earnings. They believe the milder decrease is due to the accrual component reflected in earnings but not in the cash flows. Other evidence shows an increasing value relevance of cash flows over time, especially for firms experiencing financial distress (Lee et al., 2017), but also pre, during and post credit crisis periods, cash flow from operations are value relevant in relation to book values and earnings (Tahat & Alhadab, 2017). The value relevance of operating cash flows is also documented by Barth et al. (2021) who find no decline in the value relevance of cash flows in the period from 1962 till 2018.

As the discussion above shows, previous research presents conflicting evidence on the development of the combined value relevance over time. At the same time, most researchers agree that value relevance of earnings has declined whereas value relevance of book value of equity has increased. Though earnings and equity book value are considered the primary aspects of value relevance research, some researchers focus on other accounting information, e.g. alternative performance measures, intangible assets and growth opportunities. Intangible assets and growth opportunities exhibit an increase in value relevance over time associated with the increased number of high technology firms emblematic of the new economy.

The remaining sections of literature review will present technical aspects of value relevance research. We will discuss how value relevance of accounting information is measured as well as the most acknowledged models to study value relevance.

2.7 Value Relevance Models

The models used to study value relevance of accounting information are traditionally divided into price and return models. Price regressions are used to explore the relation between the market value of equity on one side and earnings and/or equity book value on the other side. The most widely used price level regression under residual income framework presents stock values as a function of equity book value of a firm and its earnings. Return regressions investigate the changes in the market value of equity and how it is related to the accounting information. These models show market value of equity as a function of earnings and/or changes in earnings.

The next section will present the traditional basis for value relevance studies, i.e. the Ohlson valuation model, followed by a discussion of the price and return models in detail. We will start by introducing two ways of assessing value relevance of accounting information, R^2 and earnings response coefficient.

2.7.1 Measures of Value Relevance

Literature on value relevance presents two common methods used to measure value relevance of accounting information: R^2 and earnings response coefficient (ERC). Accounting research often uses R^2 as a measure of value relevance (Barth et al, 2021; Brown et al., 1999; Collins et al., 1997; Ely & Waymire, 1999; Francis & Schipper, 1999 among others). R^2 is a "*coefficient of determination from regressions of equity values on accounting numbers*" which shows to what extent accounting variables can explain variation in stock prices or returns (Brown et al., 1999). R^2, thus, shows the explanatory power of accounting value on market value variations: the higher the R^2, the better the accounting values explain the variations in the market value. The common complication of the use of R^2 for value relevance measuring is scale effects that can significantly affect study results if not controlled for. Scale effects will be discussed in detail in Section 2.7.3.1.

The other measure of value relevance is the earnings response coefficient (ERC). Studies that use ERC as a measure of value relevance evaluate value relevance of accounting numbers with regard to a firm's value or returns (Freeman & Tse, 1992; Kothari & Sloan, 1992; Kothari & Zimmerman, 1995; Lev & Zarowin, 1999 among others). ERC measures the magnitude of new information captured in (abnormal) stock returns (Kothari, 2001, p.123) or, as stated by Scott, ERC "*measures the extent of a security's abnormal market return in response to the unexpected component of reported earnings of the firm issuing that security*" (Scott, 2015, p. 163). The accounting information is considered value relevant if ERC is significantly different from zero. A low coefficient implies that the reported earnings do not convey useful information to investors, probably as they are regarded as transitory or subject to managerial manipulation (Lev & Zarowin, 1999). When applying ERC to assess value relevance, researchers typically use some form of the return as the dependent variable. ERC will further be discussed and shown in the regressions in Section 2.7.4 about return models.

2.7.2 The Ohlson Valuation Model

The theoretical framework developed by Ohlson (1995) serves as a basis for numerous value relevance studies as it connects a firm's market value to earnings and book value. The Ohlson model presents an explanation of differences between market value and book value of equity based on the clean surplus assumption: income statement must incorporate all changes in assets and liabilities unrelated to dividends. Barth et al. (2001) indicate that the Ohlson model presents firm value as a function of book value of equity and the present value of expected future abnormal earnings with the assumption of perfect capital markets. Ohlson (1995, p. 662) defines abnormal earnings as earnings minus the book value in the beginning of the period multiplied by the cost of capital. Normal earnings are often used as a proxy in the model as they correlate with the abnormal earnings (e.g. Dechow et al., 1999; Kothari & Zimmerman, 1995).

The Ohlson model is also known as the residual income model and can be formulated as follows (Dechow et al., 1999, p. 4):

$$MVE_t = BVE_t + \sum_{t=1}^{\infty} \frac{E(I_t - r_t \cdot BVE_{t-1})}{(1 + r_t)^t} \qquad (2)$$

where MVE_t is the market value of equity at time *t*, BVE_t is the book value of equity at time *t*, I_t is net income (earnings) in period *t*, r_t is the expected rate of return in year *t*, and BVE_{t-1} is the book value of equity in year *t* - 1. The regression shows the market value of equity as a function of equity book value and discounted future residual income.

The Ohlson model can also be presented as a linear function of book value, net income, dividends and other information with the assumptions of linear information dynamics. The model is not contingent on a concept of permanent earnings or assets and liability values; instead it is expressed in terms of accounting earnings and book value (Barth et al., 2001).

2.7.3 Price Level Regression

A vast number of researchers use a linear model derived from Ohlson model (1995) to investigate the value relevance of earnings and book values (Amir, 1993; Barth et al., 1998; Collins et al., 1999; Collins et al., 1997; Francis & Schipper, 1999; Lev & Zarowin, 1999):

$$P_{i,t} = \alpha_0 + \alpha_1 E_{i,t} + \alpha_2 BVE_{i,t} + \varepsilon_{i,t} \quad (3)$$

The dependent variable is defined as the market value of equity (price) (P) and the independent variables are earnings (E) and book value of equity (BVE) of the firm *i* at the end of year *t*, and $\varepsilon_{i,t}$ is other relevant information for the firm *i* at time *t*. Both R^2 and coefficients can be used to assess value relevance in this model. Though the price model is widely used, it exhibits a number of complications which have to be controlled for. The next sections will present the problems associated with the price model and possible solutions.

2.7.3.1 Impact of Scale Effects

A common shortcoming of price-based models are scale effects. The scale effect implies that the size of the firm impacts the results of the model when estimating value relevance (Barth et al., 1998; Collins et al., 1997; Fama & French, 1993; Hayn, 1995). Fama and French (1993) document the explanatory power of firm size proxied by stock price times number of shares and reveal that firm size is relevant for capturing risk factors influencing stock prices.

The scale effects pertain to large firms having large market capitalization, large book value, large earnings, and vice versa (Ota, 2003). Researchers present different arguments on why the distinction between large and small firms can affect value relevance. Collins et al. (1997) suggest the value of smaller firms to be driven by future earnings growth potential rather than current earnings since smaller firms are more likely to be start-up firms. Studies also show that smaller firms have lower earnings persistence implying increased value relevance of book value in relation to value relevance of earnings (Collins et al., 1997; Ohlson, 1995). Larger firms are potentially better diversified and more capable of handling

downturns in the economy, hence, larger firms are less likely to report losses than smaller firms (Collins et al., 1997; Hayn, 1995).

R^2-based comparisons between samples might be misleading if the scale factor's coefficient of variation differs between samples (Brown et al., 1998). Therefore, if not controlled for, scale effects have a significant impact on study results. As argued in Barth and Kallapur (1996, p. 528): "*Two econometric issues in …*(price-level studies)... *are cross-sectional scale differences among sample firms that can result in biased coefficient estimates and heteroscedastic regression errors that can cause biased standard error estimates and estimation inefficiency*". Brown et al. (1999) presents evidence that scale effects can lead to misleading conclusions when studying value relevance. In contrast to Collins et al. (1997) and Francis and Schipper (1999), Brown et al. (1999) argue that value relevance measured by R^2 experienced a significant decline when controlling for scale effects. Brown et al. (1999) came to the conclusion that R^2 levels must be interpreted with caution since the results are generally biased upwards if scale effects are present. Moreover, different examples with per share data or firm level data should not be compared unless scale effects are mitigated.

Various researchers present different arguments about what scale effects are contingent on. Barth and Kallapur (1996) indicate that the scale effects can be mitigated by either deflating by a scale proxy or including a scale proxy as an independent variable. Such accounting numbers as shares outstanding, sales, total assets, market value of equity, book value, and net income can be used as proxies for scale effects (Barth & Clinch, 2009). Though they argue that no scale specification is superior over the others, price and, to a lesser extent, market value of equity specifications generally better account for scale effects. Easton (1998) and Easton and Sommers (2003) suggest that the best measure for scale effects is market capitalization, i.e. market value of equity, and use of accounting data, e.g. sales, book value of equity, total assets as proxies for scale effects. Easton (1998; 1999) and Easton and Sommers (2003) further indicate that the best solution to mitigate scale effects is to use return-based models where market value of equity for the beginning of the period is used to deflate accounting variables.

2.7.3.2 Price Level Regression with Control Variables

Prior research on value relevance indicates that several factors influencing stock price, firm-specific characteristics and economic factors should be controlled for in the price level regression model in order to properly investigate the relation between earnings and book values of equity with stock price (e.g. Collins et al., 1997; Hayn, 1995). Control variables in the price level regression model are variables not of primary interest, but which potentially affects stock prices and omitting them from the model could result in variable bias in the coefficients of the variables of interest (Hill et al., 2018). Below we present an overview over the most common control variables used in price regressions.

Size of the Firm

One of the control variables widely used in the price model is SIZE which controls for scale effects discussed in detail in the previous section (Barth & Kallapur, 1996; Collins et al., 1997). The control variable is used as an alternative/ in addition to deflation by scale proxy.

Negative Earnings

Collins et al. (1997) provide evidence of declining (increasing) value-relevance of earnings (book values) when negative earnings are reported, implying that negative earnings impacts stock prices and should be included as a control variable. Supportive evidence of negative earnings' impact on stock prices are given by Barth et al. (1998), Basu (1997) and Hayn (1995). Following Core et al. (2003), negative earnings are controlled for by separating earnings into two variables, E_POS and E_NEG, containing only positive and negative earnings, respectively.

Nonrecurring Items

Collins et al. (1997) provide evidence of declining (increasing) value-relevance of earnings (book values) when nonrecurring items, defined as discontinued operations, extraordinary items and special items, are reported. Transitory, or non-

recurring, items are an earnings component with lower persistent than recurring items (Ramakrishnan & Thoma, 1998), and proven to be negatively associated with value relevance of earnings (Elliott & Hanna, 1995; Hayn, 1995). Therefore, a control variable NREC, where NREC is the amount of non-recurring items reported, could be used in the price model.

Industry

There is evidence suggesting the value relevance of accounting information depends on the industry in which the firms operate (Barth et al., 1998; Brown et al., 1999; Francis & Schipper, 1999; Lev & Zarowin, 1999). Barth et al. (1998) suggest the accounting for intangible assets as a reason for the value relevance's dependence on industry. Others point out that financial statements are losing value relevance as a result of the shift from an industrialized economy to an industry characterized by technology and service-oriented firms (Brown et al., 1999; Collins et al., 1999; Francis & Schipper, 1999; Lev & Zarowin, 1999). Hence, industry affects stock price and indicator variables representing different industries, IND, are included in the model.

Market Volatility

Francis and Schipper (1999) provide evidence that value relevance of accounting information depends on market volatility since market volatility creates noise in the stock market. Therefore, the value relevance model should control for the market volatility in order to cope with the market volatility's negative effect (Francis & Schipper, 1999; Gjerde et al., 2011). Barth et al. (1998) control for market volatility as a proxy of risk that potentially affects the value relevance of accounting information. The control variable related to market volatility included in the model is VOL.

Leverage

The leverage of a firm is a potential control variable as it is a proxy for the restrictiveness of loan covenants and hence may impact share prices (Aboody & Lev, 1998). The control variable related to leverage included in the model is LEV.

Price Level Regression with Control Variables

Then, the price level regression model in (3) could, when controlling for other variables that could potentially affect share price, be extended to:

$$P_{i,t} = \alpha_0 + \alpha_1 E\_POS_{i,t} + \alpha_2 E\_NEG_{i,t} + \alpha_3 BVE_{i,t} + \alpha_4 NREC_{i,t} + \alpha_5 SIZE_{i,t} + \alpha_6 VOL_{i,t} + \alpha_7 LEV_{i,t} + \gamma IND_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $P_{i,t}$ is share price, $E\_POS_{i,t}$ is net earnings > 0, $NI\_NEG_{i,t}$ is net earnings ≤ 0, $BVE_{i,t}$ is book value of equity, $NREC_{i,t}$ is reported non-recurring items, $SIZE_{i,t}$ is book value of total assets, $VOL_{i,t}$ is market volatility, $LEV_{i,t}$ is leverage, $\gamma IND_{i,t}$ is a vector of industry indicator variables, and ε is the error term reflecting other information not included in the model.

2.7.4 Return Model

The return-based model is applied to study changes in the market value of equity (Barth et al., 2001; Beaver, 2002). The simple earnings return regression is estimated as follows (Easton & Harris, 1991):

$$R_{i,t} = \alpha_0 + \alpha_1 E_{i,t} + \varepsilon_{i,t} \quad (5)$$

where $R_{i,t}$ is stock return, $E_{i,t}$ is net earnings of firm *i* at time *t*, $\varepsilon_{i,t}$ is other relevant information for the firm *i* at time *t*. The coefficient α_1 is referred to as earnings response coefficient that shows the relation between stock returns and earnings.

The return model can also incorporate unexpected returns rather than stock returns itself (Ball & Kothari, 1991; Freeman & Tse, 1992):

$$AR_{i,t} = \beta_0 + \beta_1 UE_{i,t} + \varepsilon_{i,t} \quad (6)$$

where $AR_{i,t}$ is abnormal returns of firm *i* at time *t*, $UE_{i,t}$ is unexpected earnings, $\varepsilon_{i,t}$ is other relevant information for the firm *i* at time *t*. Abnormal returns are calculated by subtracting expected returns from stock returns. The slope coefficient from the linear return regression of AR on UE (β_1) is also referred to as ERC that shows the relation between abnormal stock returns and unexpected earnings.

Easton and Harris (1991) present the value relevance of earnings as a function of earnings levels, earnings changes and other unspecified factors with earnings serving as proxy for residual earnings:

$$R_{i,t} = \gamma_0 + \gamma_1 E_{i,t} + \gamma_2 \Delta E_{i,t} + \varepsilon_{i,t} \qquad (7)$$

where $R_{i,t}$ is stock return of firm *i* at time *t*, $E_{i,t}$ is net earnings of firm *i* at time *t*, $\Delta E_{i,t}$ is change in earnings, $\varepsilon_{i,t}$ is other relevant information for the firm *i* at time *t*. Lev and Zarowin (1999) define ERC in this model as the sum of the slope coefficients of the level and change in earnings ($\gamma_1 + \gamma_2$ in regression (7)). It reflects the average change in the security price associated with a dollar change in earnings (Lev & Zarowin, 1999). The model is derived from the Ohlson model/Residual income model and is employed by many empirical studies (Francis & Schipper, 1999; Lev & Zarowin, 1999 among others).

2.7.5 Price vs Return Models

The main difference between the price and return models is that the former concentrate on determining what is reflected in firm value and the latter focus on determining what is reflected in changes in value over a specific period of time (Barth et al, 2001). Therefore, the choice of the model should depend on the research question of the study and on econometric considerations (Barth et al, 2001; Landsman & Magliolo, 1988). Barth et al. (2001) further indicate that studies focusing on establishing if accounting information is timely shall investigate changes in value by implementing the return model.

When choosing the research model, it is necessary to be familiar with the strengths and weaknesses of the two models. Kothari and Zimmermann (1995) illustrate that price models are better specified since the price of a stock is directly tied to the level of earnings. Econometrically, this translates into unbiased coefficient estimates. However, return models have less serious other econometric problems. As a consequence, the combined use of both models may become optimal.

Furthermore, the return models are better specified to meet the assumptions of statistical tools such as regression analysis since price regressions are often subject to heteroscedasticity and model misspecifications (Kothari & Zimmerman, 1995). Kothari and Zimmerman (1995) argue that the current stock price in the price regression shows the cumulative information about expected earnings and surprise component of earnings. In the return model, the expected component is irrelevant in explaining current returns. It leads to the fact that earnings response coefficient in the return model are biased towards zero. At the same time, current earnings are not associated with the information about future earnings reflected in the current stock price. Hence, the price regressions have an uncorrelated omitted variable, which reduces explanatory power.

Moreover, the return-based model is regarded to be less affected by scaling effects since in return regression earnings are usually scaled by market value of equity (Easton & Harris, 1991; Easton & Sommers, 2003).

Both price and return models are affected by the transitory components of earnings. However, return-based models are more affected by the complications of transitory earnings due to expectational error in the earnings variable (Kothari & Zimmerman, 1995).

When possible, using both models will help to ensure that the conclusions derived from the model are free from econometric misspecifications (Kothari & Zimmerman, 1995). Model differences lead to some researchers using the return model as a robustness test even if they have presented price regression as a primary model in the study (Beisland & Hamberg, 2008).

2.8 Value Relevance for Norwegian Data

Previous studies have shown that research performed in different countries and industries provide varying results with regards to the variations of the value relevance of accounting information (Ali & Hwang, 2000; King & Langli, 1998; Misund, 2016; Misund et al., 2008; Quirin et al., 2000*)*. Therefore, research evidence based on the data for the firms which are not listed on the Oslo Stock Exchange in Norway won't necessarily be applicable to firms listed on the Norwegian stock market. The last section of the literature review chapter will summarize previous research on value relevance based on the accounting information from the firms listed on the Norwegian Stock Exchange. The value relevance research on Norwegian data is rather narrow as the researchers examine mainly the value relevance of earnings and book values of equity. The value relevance of cash flows and intangible assets for firms traded at the Oslo Stock Exchange in Norway is almost non-existent.

The value relevance of book values and earnings of firms listed on Oslo Stock Exchange in Norway is examined in relation to two different accounting regulations: Norwegian Generally Accepted Accounting Principles (NGAAP) and International Financial Reporting Standards (IFRS). NGAAP is earnings oriented and emphasizes the use of historical cost accounting whereas IFRS is balance sheet oriented and emphasizes the use of fair value (Gjerde et al., 2008). According to Feltham and Ohlson (1995), NGAAP is more conservative than IFRS. Up until 2005, Norwegian firms listed on the Oslo Stock Exchange could prepare their financial statements according to NGAAP. As of 1 January 2005, compliance with IFRS became mandatory which implied increased use of fair value and increased capitalization of intangible assets (European Commission, 2002; Gjerde et al., 2008).

Research prior to the adoption of IFRS in 2005 presents evidence that during 1965 - 2004, firms listed on the Oslo Stock Exchange were subject to an increased value relevance over time of both earnings and book values (Gjerde et al., 2011). This contradicts some value relevance studies performed on U.S. data that showed

the declining trend of earnings' value relevance (Collins et al., 1997; Francis & Schipper; 1999; Lev & Zarowin, 1999).

Reported earnings and book values of equity complying with NGAAP are based on the matching of revenues with expenses (Gjerde et al., 2011). Gjerde et al. (2011) demonstrate that the matching principle in NGAAP is value relevant when controlling for other possible explanatory variables such as firm size, industry, and volatility. This result is in accordance with the studies by Beaver (1998), Kothari (2001) and Dichev and Tang (2008) who present evidence of reduced number of transitory items when using matching principle, and, hence, show the value relevance of the matching principle itself.

Several researchers have examined how the value relevance of book values and earnings changed with the mandatory implementation of IFRS in 2005. There is evidence that IFRS leads to increased value relevance of book values of equity, but a decrease in value relevance of earnings (Gjerde et al., 2008; Beisland & Knivsflå, 2015; Beisland, 2012). The improved value relevance of book values using IFRS is caused by the increased use of fair value and the increasing capitalization of intangible assets reflected in the balance sheet. Investments in intangible assets that would be expensed according to NGAAP, would to a larger extent be capitalized according to IFRS yielding more intangible assets recognized on the balance sheet after 2005. In line with international evidence, Gjerde et al. (2008) demonstrated that the capitalization of intangible assets was more value relevant than expensing the investments as incurred (Aboody & Lev, 1998; Gjerde et al., 2008; Lev & Sougiannis, 1996; Lev & Zarowin, 1999). The findings of reduced earnings value relevance after IFRS transition are in accordance with Ohlson (1995) who suggested that earnings are less value relevant when they are subject to more frequent and larger revaluations as required by IFRS which allows for broad use of fair value compared to the historical cost accounting under NGAAP. Gjerde et al. (2008) show that the increased value relevance of book values using IFRS is offset by the decrease in value relevance of earnings, resulting in NGAAP being more value relevant than

IFRS. That is, the implementation of IFRS is not documented to result in increased value relevance compared to using NGAAP.

The research on the value relevance of cash flows based on the Norwegian data is scarce. A positive association between market value of equity and cash flows is documented by Beisland (2011) who demonstrated that the division of earnings into cash flow and accrual components exhibit higher value relevance than the value relevance of the earnings summary measure.

To summarize, previous research based on the data from firms listed on the Oslo Stock Exchange does not show evidence of an increased value relevance of accounting information after transition to IFRS in 2005. At the same time, there is a shift from earnings being more value relevant than equity book value under NGAAP to equity book values being more value relevant under IFRS as a result of the broader use of fair value accounting and increased capitalization of assets.

3. Research Design and Data

This chapter presents research design and data sampling. First, we introduce the research question followed by five hypotheses which are tested in the course of the study. Then, we move to the presentation of the research method to be used in the empirical part of the thesis. We further elaborate on the data collection and data cleaning processes. We conclude the chapter by presenting the summary statistics of the collected data.

3.1. Research Question and Hypotheses

The previous research based on the financial information of firms listed on the Oslo Stock Exchange mostly coincides with international studies although Norwegian data prior to 2005 were based on a different accounting regulation. As prior research on the value relevance in the Norwegian market is scarce, we find the topic very attractive to study. We formulate our main research question as follows:

Is accounting information value relevant in the Norwegian stock market?

We expect that the accounting information of firms listed on the Oslo Stock Exchange is value relevant for investors based on studies confirming the association between market value and accounting information. The main research question is answered by testing five hypotheses.

Value relevance of the two summary measures of financial accounting information is considered the primary focus of value relevance research. Several researchers emphasize a necessity of incorporating both earnings and equity book value in the value relevance models as these accounting measures present complementary information on equity valuation (Barth, 1991; Beaver 1968; Collins et al., 1997; Dechow et al., 1999). Therefore, our first hypothesis tests the combined value relevance of earnings and book value of equity:

Hypothesis 1: *Financial statement summary measures, earnings and book value of equity, are value relevant in the Norwegian stock market.*

Early studies indicate earnings as the most value relevant measure of accounting information (Ball & Brown, 1968; Beaver, 1968; Beaver et al., 1979; Miller & Modigliani, 1966). At the same time, relying solely on earnings when considering value relevance of financial information is problematic due to several factors: unstable character of value relevance of earnings over time, possible managerial earnings manipulations, effect of transitory earnings components, negative earnings to name a few (Basu, 1997; Hayn, 1995; Kothari & Zimmerman, 1995). Researchers show an increased importance of book value of equity when measuring value relevance of accounting information and present a shifting trend in value relevance from earnings to equity book value (Barth et al., 2021; Collins et al., 1997). With the help of the second hypothesis, we wish to compare the separate value relevance of earnings and equity book value of the firms listed on the Oslo Stock Exchange. The hypothesis is formulated as follows:

Hypothesis 2: *The value relevance of equity book value is higher than the value relevance of earnings in the Norwegian stock market evaluated by incremental explanatory powers (adjusted R^2) of book value of equity relative to net income in price regressions.*

The development of value relevance of accounting information over time is another prominent topic of value relevance research. There is no consensus in the literature regarding the changes of combined value relevance of earnings and equity book value over time. At the same time, most researchers agree that value relevance of earnings experienced a decline whereas the value relevance of equity book value has increased over time (Barth et al., 2021; Collins et al. 1997). Following Brown et al., 1999, Lev, 2018 and Lev and Gu, 2016, we hypothesize that the combined value relevance of book value and earnings on the firms listed on the Oslo Stock Exchange has decreased over time.

Hypothesis 3: *The combined value relevance of earnings and book values of equity has decreased in the Norwegian stock market.*

A decomposition of earnings into a cash flow component and accrual component allows for an investigation of the value relevance of operating cash flows relative to earnings. The operating component of cash flows is considered a better predictor of future firm performance than earnings due to its higher persistence (e.g. Akbar et al., 2011; Barth et al, 1999; Sloan, 1996). Therefore, operating cash flows are predicted to be more value relevant than earnings, and our fourth hypothesis is formulated as follows:

Hypothesis 4: *The value relevance of operating cash flows is higher than that of earnings in the Norwegian stock market.*

The last hypothesis will focus on the value relevance of intangible assets. The research on the role of intangible assets in the value relevance of accounting information is increasing its popularity due to the evolution of the economy and expansion of industries with intensive investments in intangible assets (Barth et al., 2021; Lev, 2018). Though both research and development expenditures in the income statement and the capitalized intangible assets in the balance sheet are considered value relevant, previous studies have shown that the capitalization treatment of intangible assets has a higher value relevance than the immediate expensing of investments in intangible assets (Aboody & Lev, 1998; Lev & Sougiannis, 1996; Lev & Zarowin, 1999). Moreover, the increasing role of

intangible assets along with the shift from the income statement model to the balance sheet model are regarded as the most prominent reasons for the changed trend of value relevance over time (Lev, 2016; Lev, 2018). The fifth hypothesis of our research tests the value relevance of intangible assets for the firms listed on the Oslo Stock Exchange:

Hypothesis 5: *Intangible assets, including research and development expenditures and recognized intangible assets, are value relevant accounting information in the Norwegian stock market.*

3.2 Research Method

In line with the majority of recent value relevance studies, we perform an association study based on Francis and Schipper's (1999) fourth definition of value relevance, to find the statistical association between accounting information and market value. The present research covers a 16-year period from 2005 until 2020. The years prior to 2005 are excluded to avoid comparability issues of the accounting information issued under IFRS and NGAAP. Therefore, the sample only consists of IFRS observations. By using panel data, we perform both a cross-sectional as well as a time-series analysis of the value relevance of selected accounting data of firms listed on the Oslo Stock Exchange in Norway.

The choice of model depends on the research question and the viewpoint of the researcher (Easton & Sommers, 2003). Following a vast number of researchers (Barth et al., 1998; Collins et al., 1999; Collins et al., 1997; Francis & Schipper, 1999; Lev & Zarowin, 1999), we conduct a price level regression to test our hypotheses. Since price level regression explains the value relevance of accounting figures, it is better suited as a basic model for our study. All models are deflated by number of shares outstanding and include appropriate control variables. The firms in our sample comply with IFRS and are therefore prohibited from reporting extraordinary items explicitly (International Accounting Standards Board [IASB], 2011, para. 87). It leads to a variable controlling for non-recurring items being omitted from our models.

3.3 Data Sampling

Due to the relatively small number of firms listed on the Oslo Stock Exchange, the starting point for the research is all listed firms in the time period 2005-2020. For our research not to have a survivorship bias, we include both listed and delisted firms (Kothari et al., 1995). In our thesis, we employ data from Refinitive Datastream, and clean data with Microsoft SQL Server. The data cleaning process was performed in several steps. Table 1 presents the data cleaning process and changes in the number of firms and firm-year observations.

Table 1. *Yearly Datastream Sample Selection 2005-2020.*

Sample Restriction	**Number of firm-years**	**Number of firms**
Raw sample	10 892	1 001
No minor securities	- 1 187	- 142
No secondary quote	- 391	- 36
No industries: bank, financial services, life insurance, non-life insurance[1]	- 1 151	- 97
Missing ticker information[2]	- 4 805	- 313
Missing variable data[3]	- 706	- 37
Sample before controlling for outliers	**2 652**	**376**
Outliers	- 111	- 25
Sample after controlling for outliers	**2 541**	**351**

1. Firms in the industries bank, financial services, life insurance and nonlife insurance as they comply with different accounting rules.

2. Data is not available in Datastream for firms with missing ticker information. Raw sample included firms that were dead at some period of the study resulting in a large number of firms with missing ticker information.

3. We require non-missing information on price, book value of equity, net income and cash flow.

The final step was to ensure that the results of estimated regressions are not sensitive to extreme observations. Following prior literature, we have trimmed observations at the 1 percent tails of the variables stock price, book value of equity per share and net income per share (Francis & Schipper, 1999; Gjerde et al., 2011; Kothari & Zimmerman, 1995; Lee et al., 2017). Since there has been an overlap among extreme observations, the final sample after the data processing consists of 351 firms with 2 541 firm-year observations - a reduction of 4.2 percent.

3.4 Summary Statistics

Figure 2 and Table 2 - 4 present descriptive statistics for the sample. The variables of interest are on a per share basis except the market value of equity variable (MVE). Due to missing data in Refintiv Datastream and as firms are continuously listed and delisted at the Oslo Stock Exchange, the number of firms in the sample are not constant over time as shown in Figure 2. The highest (lowest) number of firms in the sample are in 2020 (2005) with 229 (111) firms.

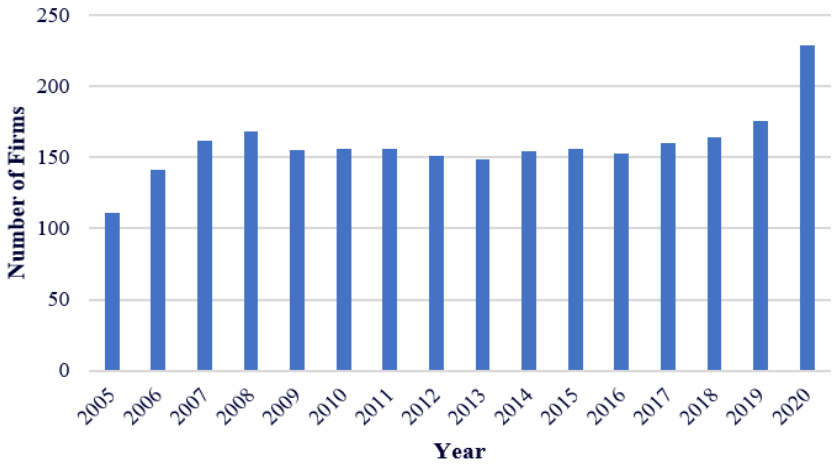

Figure 2. Number of Firms in the Sample in the Period 2005-2020.

Table 2 documents that the market value of equity of the firms in our sample ranges from NOK 1 million to NOK 10 866 050 million. The average market value of equity is NOK 13 441 million whereas the median is NOK 930 million, implying a positively skewed distribution. Table 2 also reveals that the highest (lowest) spread of values on a per share basis relates to book value of equity (research and development expenditures) which has a standard deviation of NOK 105.413 (NOK 0.986). Furthermore, Table 2 documents that, on average, net income per share is negative (NOK -0.449) but the median of NOK 0.133 shows that the number of firms having a negative net income per share is less than the number of firms having a positive net income per share. Most firms in the sample have a book value of equity per share less than the mean of NOK 34.150 since the median of NOK 8.289 is less than the mean, which implies a positively skewed distribution. The spread in book values of equity per share (NOK 105.413) is

approximately two thirds of net income per share (NOK 159.430) implying different earnings-to-book value of equity ratios for the firms in the sample.

Table 2 demonstrates a difference between the two performance measures net income and operating cash flow. In our sample, net income per share has a lower mean (NOK -0.499) than operating cash flow per share (NOK 2.735) which indicates that non-cash items which are not present in the cash flow statement, on average, reduce net income. As the accrual component of net income may smooth earnings, the standard deviation of net income (NOK 45.464) is expected to be lower than the standard deviation of operating cash flow (NOK 49.66) as reported in Table 2. Moreover, Table 2 reveals that the average change in capitalized intangible assets on the balance sheet (NOK 18.521) is larger than the average amount expensed in the income statement (NOK 0.207). Since the median of research and development expenditures is zero, at least half of the firms in the sample have not expensed investments in intangible assets as research and development expenditures. On the contrary, the median of intangible assets is greater than zero (NOK 0.122) and, hence, the majority of the firms in the samples have recognized intangible assets on their balance sheets.

Table 2. *Descriptive Statistics for Firm-Year Observations for the Years 2005-2020.*

Variable	Mean	Median	Standard deviation	Min.	Max.
Market value of equity (MVE) (million)	13 440.730	930.343	219 622.200	1.035	10 866 050.000
Net income per share (NIPS)	-0.449	0.103	45.464	-955.099	1 334.029
Book value of equity per share (BVPS)	34.150	8.289	105.413	-6.403	1 299.908
Operating cash flow per share (CF)	2.735	0.650	49.616	-1 756.558	524.603
Research and development	0.207	0.000	0.986	0.000	21.375

expenditures per share (RD)					
Intangible assets per share (IA)	3.231	0.122	11.432	-9.824	168.035
Change in IA	18.521	21.480	73.995	-136.378	132.199

All amounts in NOK except MVE which is presented in million NOK. Number of firm-year observations is 2 541. MVE is market value of equity calculated as P*Shares where P is share price three months after end of period *t* and Shares are weighted average common shares outstanding, NIPS is net income after tax excluding extraordinary items deflated by number of weighted average common shares outstanding, BVPS is book value of equity divided by weighted average common shares outstanding, CF is operating cash flow divided by weighted average common shares outstanding, RD is research and development expenditures divided by weighted average common shares outstanding, IA is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding, and change in intangible assets per share is the change in IA from time *t - 1* to time *t*.

The correlation matrix in Table 3 indicates that all independent variables are significantly correlated at 1 percent level with share price except net income and research and development expenditures. Furthermore, the correlation matrix shows that share price is more highly correlated with book value of equity (0.493) than with net income (0.022) and cash flows from operations (0.105). The operating cash flows' higher correlation with price (0.105) relative to net income (0.022) suggests hypothesis 4 to be true. Finally, Table 3 reports a positive association between share price and capitalized intangible assets (0.176) and a relatively small positive association with research and development expenditures (0.013). However, the association with research and development expenditures is not significant at 5 percent level and the correlation matrix therefore only gives partially evidence of hypothesis 5. Table 3 shows no pairwise correlation that exceeds 0.80, suggesting multicollinearity does not create problems in the regressions (Gujarati & Porter, 2009).

Table 3. *Pearson Correlation Matrix Among the Variables.*

	Price per share (P)	Net income per share (NIPS)	Book value of equity per share (BVPS)	Operating cash flow per share (CF)	Research and development expenditures per share (RD)	Intangible assets per share (IA)
Price per share (P)	1					
Net income per share (NIPS)	0.022	1				
Book value of equity per share (BVPS)	0.493**	0.044*	1			
Operating cash flow per share (CF)	0.105**	-0.023	-0.042*	1		
Research and development expenditures per share (RD)	0.013	0.002	0.089**	0.056**	1	
Intangible assets per share (IA)	0.176**	0.003	0.470**	-0.260**	0.088**	1

* Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). P is share price three months after end of period *t*, NIPS is net income after tax excluding extraordinary items deflated by number of weighted average common shares outstanding, BVPS is book value of equity divided by weighted average common shares outstanding, CF is operating cash flow divided by weighted average common shares outstanding, RD is research and development expenditures divided by weighted average common shares outstanding, and IA is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding.

Summary statistics for each industry in the sample presented in Appendix B is reported in Table 4. All industries have a higher book value of equity per share than net income per share as well as low research and development expenditures per share (less than NOK 1 in all industries). All eleven industries have positive book value of equity per share. Six industries have a negative net income per share (basic materials, consumer discretionary, health care, industrials, technology and unclassified) whereas the remaining five industries have a positive net income per share (consumer staples, energy, real estate, telecommunications, and utilities). Except for the industries basic materials, industrials, real estate and unclassified, all industries that on average have a positive (negative) net income per share also have a positive (negative) operating cash flow per share.

Table 4 reports that the consumer discretionary industry differs from the other industries as it has the highest book value per share (NOK 100.803) and lowest operating cash flow per share (NOK -7.852) as well as the largest spread in values for all variables except MVE documented by the standard deviations in Table 4. The energy industry has the highest market value of equity (NOK 33 863.210 million) along with the largest spread in market value of equity (NOK 441 179.900 million). The health care industry has the lowest market value of equity (NOK 886.646 million) and, at the same time, the lowest spread in market value of equity (NOK 1 972.203 million).

Table 4. *Summary Statistics Partitioned into Industry. Means (Standard Deviations) for Regression Variables.*

Industry	**Market value of equity (MVE) (million)**	**Net income per share (NIPS)**	**Book value of equity per share (BVPS)**	**Operating cash flow per share (CF)**	**Research and development expenditures per share (RD)**	**Intangible assets per share (IA)**
Basic materials (n = 88)	17 790.490 (28 802.570)	-0.559 (6.024)	23.091 (26.094)	3.581 (5.464)	0.071 (0.186)	1.314 (3.953)
Consumer discretionary (n = 166)	2 631.333 (8 383.884)	-3.320 (86.178)	100.803 (225.991)	-7.852 (164.366)	0.212 (1.777)	12.312 (29.312)
Consumer staples (n = 241)	11 914.780 (21 305.900)	2.168 (8.607)	25.006 (28.189)	2.277 (8.624)	0.061 (0.403)	6.859 (11.265)
Energy (n = 624)	33 863.210 (441 179.900)	0.415 (74.308)	50.152 (154.002)	7.483 (46.460)	0.194 (0.790)	2.077 (7.821)
Health care (n = 150)	886.646 (1 972.203)	-6.435 (23.559)	18.145 (50.804)	-5.611 (22.771)	0.110 (0.366)	2.014 (4.612)
Industrials (n = 612)	3 201.687 (5 301.100)	-0.518 (24.722)	24.652 (60.987)	4.784 (17.195)	0.339 (1.376)	1.213 (4.117)
Real estate (n = 103)	4 119.616 (6 422.341)	2.365 (13.865)	47.209 (56.400)	-1.513 (23.991)	0.000 (0.000)	2.048 (7.731)
Technology (n = 261)	3 294.511 (9 033.277)	-1.550 (12.871)	13.091 (27.908)	-0.055 (10.780)	0.153 (0.664)	4.387 (16.398)
Telecommunications (n = 81)	38 436.54 (75 988.04)	1.959 (3.770)	12.919 (16.517)	5.567 (8.357)	0.315 (0.847)	6.028 (9.116)
Utilities (n = 30)	7 240.025 (7 498.428)	1.678 (26.524)	44.647 (80.990)	9.835 (21.068)	0.044 (0.086)	1.503 (2.055)

Unclassified (n = 185)	7 790.513 (22 241.52)	-0.479 (8.317)	11.970 (22.070)	0.310 (8.029)	0.312 (0.878)	0.899 (2.369)

All amounts in NOK except MVE which is presented in million NOK. Total firm-year observations are 2 541, n is the number of observations in each industry, P is share price three months after end of period *t*, NIPS is net income after tax excluding extraordinary items deflated by number of weighted average common shares outstanding, BVPS is book value of equity divided by weighted average common shares outstanding, CF is operating cash flow divided by weighted average common shares outstanding, RD is research and development expenditures divided by weighted average common shares outstanding, and IA is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding.

4. Empirical Findings

This chapter presents empirical results from the examination of stock price response to book value of equity, net income, operating cash flows, and intangible assets including research and development expenditures by applying traditional price level regressions discussed in Chapter 2. In particular, we study how much variation in stock prices is explained by accounting information with the help of adjusted R^2 of regression models. In addition, we examine if particular pieces of accounting information are significantly related to the stock prices by reviewing the significance level of individual regression coefficients.

Following Barth et al. (2021), Brown et al. (1998) and Collins et al. (1997), we use the stock price three months after the end of reporting period *t* when testing our hypotheses, i.e. price as of 31.03 or first available price before that. The summary measure "earnings" in this paper is referred to as "net income".

We begin the chapter by testing hypothesis 1 with focus on the combined value relevance of equity book value and net income and discuss the effects of the control variables defined in Appendix C. Section 4.2 presents the analysis of incremental explanatory powers of book value of equity and net income as well as the discussion of value relevance over time from 2005 until 2020 (hypotheses 2 and 3). Tests of hypotheses 4 and 5 are performed in section 4.3 and 4.4

respectively. We conclude the chapter by performing several robustness tests to support the main empirical findings.

4.1 Model I: Value Relevance of Earnings and Equity Book Values

4.1.1 Model Specifications

The purpose of model I is to test hypothesis 1 by using a price level regression model. We follow several researchers who suggest deflating both main and control variables in price level regressions by the number of shares in order to mitigate scaling effects (e.g. Barth & Clinch, 2009; Brown et al., 1999). Model I is formulated as follows:

$$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t} \quad (8)$$

where $P_{i,t}$ is the share price three months after end of period *t*, $NIPS_{i,t}$ is net income after tax excluding extraordinary items in the period *t* deflated by weighted average common shares outstanding, $BVPS_{i,t}$ is book value of equity at time t divided by weighted average common shares outstanding, $Controls_{i,t}$ is a vector of control variables including a separation of positive and negative income, firm size, security returns volatility, leverage and indicator variables for industries, $\varepsilon_{i,t}$ is the error term reflecting other information affecting share price that is not included in the model. All variables are defined in Appendix C and the vector of control variables are elaborated in Appendix D.

First, a pooled regression of P on NIPS and BVPS is conducted without any control variables. Then, this regression is extended by including control variables step by step until the final model is in accordance with model I. Finally, model I is performed separately for each industry since the impact of accounting information on firm value may differ across industries (Barth et al., 2021). We expect $\alpha_1 > 0$ and $\alpha_2 > 0$ if investors value book value of equity and net income, respectively. Table 5 presents the pooled results of the regressions with and without all control variables whereas Table 6 presents regression results separated by industry.

4.1.2 Result of Regression Without Control Variables

The adjusted R^2 in the regression without any control variables in Table 5 (regression (i)) shows that book value of equity and net income jointly explains 24.2 percent of the variation in share prices on Oslo Stock Exchange. Compared to prior literature, our result yields a lower explanatory power of earnings and book value of equity. However, since our results are based on a newer sample size, Lev (2018) suggests such a decline in value relevance relative to studies performed on older data. Previous literature on the value relevance of US GAAP earnings and book value of equity using older data, document that those summary measures jointly explains 53.6 percent of the variation in stock prices when not considering control variables (Collins et al., 1997). Easton (1998) documents explanatory powers in the range 18 to 81 percent in the unpooled sample period 1963-1994 whereas Francis and Schipper (1999) suggests a mean adjusted R^2 of 62.0 percent in the time period 1952-1994. Furthermore, the study by Barth et al. (1998) which focuses on the value relevance of earnings and book value of equity as firms approach bankruptcy, documents that earnings and book value of equity jointly explains 80, 78, 84, 65 and 53 percent of the variation in stock prices the respective five years preceding bankruptcy. However, following econometricians, Gu (2007) explains that R^2 are incomparable across samples as a consequence of inherent sampling variations.

The regression without control variables in Table 5 yields coefficients of BVPS and NIPS of 0.745 and 0.002, respectively. With only the coefficient of BVPS being significant, the regression gives only partially evidence of hypothesis 1.

Table 5. *Regression of Price on Earnings and Book Value of Equity for the Period 2005 – 2020 (Pooled) With and Without Control Variables.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \varepsilon_{i,t}$ (i)

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$ (ii)

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$ (iii)

	(i)	**(ii)**	**(iii)**
BVPS	0.745	0.482	0.486
	(28.51**)	(11.65**)	(10.71**)
NIPS	0.002	0.281	
	(0.04)	(4.18**)	
NIPS_POS			0.263
			(2.66**)
NIPS_NEG			0.303
			(2.54*)
SIZE		0.049	0.050
		(10.49**)	(9.42**)
VOL		-5.758	-5.698
		(-0.67)	(-0.66)
LEV		0.039	0.038
		(1.65)	(1.55)
IND1		4.444	4.424
		(0.25)	(0.25)
IND2		-2.981	-3.195
		(-0.20)	(-0.22)
IND3		10.451	10.437
		(0.79)	(0.79)
IND4		21.485	21.545
		(1.89)	(1.89)
IND5		-8.063	-7.977
		(-0.54)	(-0.54)
IND6		20.042	20.060
		(1.76)	(1.77)
IND7		-11.698	-11.727

		(-0.70)	(-0.70)
IND8		-0.597	-0.577
		(-0.05)	(-0.04)
IND9		6.357	6.356
		(0.35)	(0.35)
IND10		-6.799	-6.736
		(-0.26)	(-0.25)
Adj. R^2	**0.242**	**0.280**	**0.279**

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $NIPS_{i,t}$ is net income after tax excluding extraordinary items divided by number of weighted average common shares outstanding, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $NIPS\_POS_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) > 0, $NIPS\_NEG_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) ≤ 0, $SIZE_{i,t}$ is average book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), $IND1_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the basic materials industry, $IND2_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer discretionary industry, $IND3_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer staples industry, $IND4_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the energy industry, $IND5_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the health care industry, $IND6_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the industrials industry, $IND7_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the real estate industry, $IND8_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the technology industry, $IND9_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the telecommunications industry, and $IND10_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the utilities industry, and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

4.1.3 Results of Regressions with Control Variables

The addition of control variables to the regression model has three main effects: First, it significantly reduces the coefficient estimates of BVPS. To wit, the coefficient estimate drops from a post estimate of 0.745 to 0.482. Second, the coefficient estimate of NIPS increases and also becomes statistically significant (from 0.002 to 0.281). Third, the adjusted R^2 of the regression increases somewhat from 24.2 percent to 28.0 percent.

Inclusion of Control Variables Step-by-Step

A step-by-step inclusion of control variables allows for an investigation of the marginal effects of the respective control variables (Collins et al., 1997; Gjerde et al., 2011). The pooled regression results are presented in Table D.1 in Appendix D. The adjusted R^2 changes from 24.2 percent (without control variables) to 24.7, 27.6, 27.6, 27.7 and 27.9 percent when controlling for negative net income, firm size, security returns volatility, leverage, and industry, respectively. Furhtermore, the incremental changes in adjusted R^2 are 0.5, 2.9, 0.0, 0.1 and 0.2 percent, respectively, revealing that the firm size has the greatest impact on share prices relative to the sign of net income, security returns volatility, leverage, and industry.

Negative net income

Regression (2) in Table D.1 controls for negative net income by separating net income (NIPS) into two variables: positive net income (NIPS_POS) and negative net income (NIPS_NEG). The explanatory power decreases by 0.5 percent which is expected as prior research suggest negative earnings are less informative than positive earnings (Hayn, 1995) and their association with market value is suggested to be low or zero (Basu, 1997; Beisland & Knivsflå, 2008; Collins et al., 1997). The significant coefficients of NIPS_POS and NIPS_NEG which are 0.330 and -0.293, respectively, support those findings.

Firm size

Regression (3) in Table D.1 controls for firm size (SIZE). The regression coefficient estimate is 0.052 (significant) and we expect it to take both positive and negative values as firm size can influence share prices both negatively and positively (Collins et al., 1997; Gjerde et al., 2011; Hayn, 1995; Ohlson, 1995). The explanatory power of the model increases to 27.6 percent whereas the coefficient of BVPS and NIPS_POS decreases and the coefficient of NIPS_NEG increases.

Security returns volatility

Regression (4) in Table D.1 controls for security returns volatility (VOL). As the variable VOL is a measure of risk, high volatility firms are expected to have lower equity book value coefficients than low volatility firms (Barth et al., 1998). However, our sample does not separate high volatility firms from low volatility firms and the change in equity book value coefficient (and positive net income coefficient) does not change as the explanatory power of the model remains unchanged at 27.6 percent. The coefficient estimate of VOL is -4.574 (significant) is expected to be negative since security return volatility creates noise in the market and, hence, affects value relevance negatively (Francis & Schipper, 1999).

Leverage

Regression (5) in Table D.1 controls for leverage (LEV). The inclusion of leverage as a control variable increases the explanatory power to 27.7 percent. The estimated coefficient of 0.052 is significant at 5 percent level suggesting leverage is value relevant on Oslo Stock Exchange.

Industry

Regression (6) in Table D.1 controls for industries (IND1-IND10). The explanatory power increases to 27.9 percent, implying their inclusion is successive in explaining variation in stock prices on the Oslo Stock Exchange.

The coefficients take both positive and negative values, but all are insignificant. However, the coefficients of BVPS, NIPS_POS and NIPS_NEG changes, indicating that industry factors affect the value relevance of those accounting variables.

Inclusion of all Control Variables

Table 5 reports that the addition of all control variables (regression (iii)) yields an explanatory power of 27.9 percent. Prior literature demonstrates that the explanatory power of a model is dependent on the choice of control variables. Results from prior research on US data reveal that equity book value and net income explain 45.0 percent of the variation in stock prices when controlling for negative income (Collins et al., 1997). Although using a different scaling variable (book value of equity), Core et al. (2003) document an adjusted R^2 of 35.0 percent when controlling for negative income, research and development expenditures, advertising expenditures, capital expenditures and changes in sales. When controlling for firm size, book-to-market ratio, leverage, liquidity and industry. Tahat and Alhadab (2017) document that book value of equity and earnings explain 87.7 percent of the variation in share prices in the post-crisis period (2000 - 2006), 84.1 percent during crisis period (2007 - 2008) and 86.8 percent post-crisis period (2009 - 2015). Thus, our model has a lower explanatory variable than previous findings but, as previously argued, seems reasonable according to the findings by Lev (2018).

Further, the regression coefficient estimates of BVPS, NIPS_POS and NIPS_NEG (0.486, 0.263 and 0.303) reported in Table 5 are significant. Both Hayn (1995) and Barth et al. (1998) point out that negative net income has a lower value relevance than positive net income as negative income is transitory. Therefore, the coefficient estimate of NIPS_NEG is expected to be both lower than the coefficient of NIPS_POS as well as having a negative sign. Contrary to the predictions, our model yields both a positive and higher regression coefficient estimate of NIPS_NEG than NIPS_POS. However, when regressing share price on negative net income only, the coefficient of NIPS_NEG is -1.127 (p<0.000) with an adjusted R^2 of 5.2 percent. Similarly, regressing share price on positive

net income, the coefficient of NIPS_POS is 1.354 (p<0.000) with an adjusted R^2 of 7.1 percent. Thus, negative net income has a significant impact on share price (negative association), but when controlling for BVPS the relation between P and NIPS_NEG is statistically insignificant.

Thus, the statistically significant coefficients of book value of equity and net income reported in Table 5 (regression (iii)), support a positive relation between share price and both book value of equity and net income. In addition, book value of equity explains most of the variation in share price. Hence, we can accept hypothesis 1: *Financial statement summary measures, earnings and book value of equity, are value relevant in the Norwegian stock market.*

4.1.4 Results of Regressions per Industry

Table 6 reports the pooled regression of share price on earnings and book value of equity for different industries and demonstrates differences across industries regarding the value relevance of earnings and equity book values. Eight of the eleven industries have a positive association between equity book value and share price, however the association is only significant at 1 (5) percent level in four (five) industries and insignificant in the remaining two industries. NIPS_POS is both positively associated with share price and significant at 1 percent level for the consumer staples, health care, industrials, real estate and unclassified industries, whereas the other industries are insignificant with mostly positive coefficients. There are only three significant coefficients of NIPS_NEG.

We expect the value relevance of book value of equity and net income to be lower in industries characterized by heavy investments compared to other industries because of the immediate expensing of those investments (Amir & Lev, 1996). Industries characterized by heavy investments in intangible assets are health care, technology, and telecommunications (Francis & Schipper, 1999). However, there is no indication of lower value relevance of BVPS or NIPS in those industries as reported in Table 6.

The explanatory power of model I across the industries differs from 3.8 to 67.6 percent as reported in Table 6. Our results support prior findings of Barth et al. (1998; 2021) suggesting accounting information has a different impact on firm value across industries due to differences in risk, growth, earnings persistence, and industry-specific accounting practices.

Table 6. *Regression of Price on Earnings and Book Value of Equity in the Period 2005 – 2020 (Pooled) for Different Industries.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \varepsilon_{i,t}$

	Basic Materials	**Consumer Discretionary**	**Consumer Staples**	**Energy**	**Health Care**	**Industrials**	**Real Estate**	**Technology**	**Telecommunications**	**Utilities**	**Unclassified**
N	88	166	241	624	150	612	103	261	81	30	185
BVPS	6.076	0.185	2.806	1.177	-2.099	-0.453	0.436	3.990	-0.520	0.089	1.102
	(2.48*)	(2.11*)	(6.32**)	(10.34**)	(-7.05**)	(-1.17)	(1.62)	(4.51**)	(-0.51)	(0.16)	(2.12*)
NIPS_POS	3.065	-0.807	5.914	0.040	11.575	3.105	3.893	1.929	0.033	0.480	22.091
	(0.55)	(-1.76)	(5.53**)	(0.28)	(4.31**)	(3.49**)	(3.42**)	(0.62)	(0.02)	(0.90)	(6.63**)
NIPS_NEG	1.653	1.468	1.067	0.435	-0.310	0.030	-3.510	1.925	6.449	0.406	-1.604
	(0.33)	(2.45*)	(1.27)	(1.66)	(-1.02)	(0.06)	(-4.95**)	(2.34*)	(1.46)	(1.39)	(-0.91)
SIZE	-2.835	0.075	-0.962	0.003	2.338	0.358	-0.024	-1.055	1.080	0.338	-0.743
	(-2.02*)	(4.38**)	(-2.44)	(0.05)	(7.61**)	(3.20**)	(-0.25)	(-2.65**)	(1.54)	(1.13)	(-2.36*)
VOL	0.846	77.773	-10.504	-45.304	6.122	-5.020	-3.987	38.209	19.744	9.303	-34.932
	(0.01)	(1.82)	(-0.43)	(-1.47)	(0.49)	(-0.42)	(-0.17)	(1.12)	(1.35)	(0.36)	(-1.44)
LEV	2.169	0.648	1.002	-0.193	-6.947	0.166	-0.311	0.959	-0.505	-0.481	3.399
	(1.15)	(3.88**)	(1.02)	(-2.09*)	(-5.36**)	(1.28)	(-1.73)	(1.10)	(-0.45)	(-1.37)	(2.52*)
Adj. R^2	**0.038**	**0.547**	**0.478**	**0.396**	**0.633**	**0.243**	**0.429**	**0.117**	**0.505**	**0.676**	**0.283**

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $NIPS_{i,t}$ is net income after tax excluding extraordinary items divided by number of weighted average common shares outstanding, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $NIPS\_POS_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) > 0, $NIPS\_NEG_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) ≤ 0, $SIZE_{i,t}$ is average book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

4.2 Model II and III: Changes in Value Relevance of Earnings and Equity Book Values Over Time

4.2.1 Model Specifications

The purpose of this section is to test hypotheses 2 and 3. To test hypothesis 2, we adapt the method proposed by Collins et al. (1997, p. 45) to assess separate explanatory power of earnings and equity book value in order to determine whether the value relevance of book value of equity is higher than the value relevance of earnings. Following Collins et al. (1997) we employ regressions without control variables in this model. We decompose total explanatory power into three parts: the common explanatory power of net income and book values of equity, the incremental explanatory power of net income, and the incremental explanatory power of book value:

$$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$P_{i,t} = \beta_0 + \beta_1 NIPS_{i,t} + \varepsilon_{i,t} \quad (10)$$

$$P_{i,t} = \delta_0 + \delta_1 BVPS_{i,t} + \varepsilon_{i,t} \quad (11)$$

The coefficients of determination from regressions (9), (10) and (11) are denoted R^2_T, R^2_{10}, and R^2_{11}, respectively. Then $R^2_T - R^2_{10} = R^2_{BVPS}$ provides the incremental explanatory power of book value per share, and $R^2_T - R^2_{11} = R^2_{NIPS}$ provides the incremental explanatory power of net income per share. The remaining $R^2_T - R^2_{10} - R^2_{11} = R^2_{COMMON}$ represents the explanatory power common to both earnings and book value of equity. We further perform regressions for each year from 2005 till 2020 to assess value relevance of accounting information over time.

4.2.2 Results of Model II and III

Table 7 presents the yearly cross-sectional regressions of (9) - (11) for each year from 2005 until 2020. The two last columns demonstrate the incremental explanatory powers of net income per share and book value of equity per share.

The adjusted R^2 for the pooled time-series regression (9) suggests that earnings and book value of equity jointly explain 24.2 percent of the cross-sectional variation in stock prices. The total explanatory power of net income and equity book value, R^2, is at its highest in 2018 (85.1 percent), and at its lowest in 2011 (6.2 percent).

According to the findings in Table 7, the explanatory power in the pooled regression (10) focusing on net income per share is only 0.1 percent suggesting that net income does not explain variation in security prices, while the explanatory power of book value of equity (regression (11)) is 24.2 percent. Moreover, book value of equity is significant at the 1 percent level every year in both regressions (9) and (11). Net income, on the other hand, is significant only in some years. It is important to notice that when controlling for BVPS, the coefficient of NIPS for years 2006, 2008, 2018 and 2020 in the pooled regression (9) becomes negative suggesting that the relation between stock price and level of current earnings is statistically insignificant.

When comparing incremental explanatory powers of book values of equity and net income, we remark a clear trend of the incremental explanatory power of equity book value being considerably higher than the incremental explanatory power of net income, both for yearly and pooled regressions (e.g. R^2_{BVPS} = 24.2 percent and R^2_{NIPS} = 0.03 percent for pooled regressions).

Figure 3 illustrates the trend in the incremental explanatory power of net income, book value of equity and the explanatory power common to both net income and book value of equity from 2005 till 2020. The common component takes into account that book value of equity and net income can substitute each other to some extent when explaining stock prices. Incremental values show, at the same time, that net income and book value of equity act as complements by providing additional explanatory power (Collins et al., 1997).

Table 7. *Regression of Price on Earnings and Book Value of Equity, Combined and Separately, for the Years 2005 – 2020.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \varepsilon_{i,t}$ (9)

$P_{i,t} = \beta_0 + \beta_1 NIPS_{i,t} + \varepsilon_{i,t}$ (10)

$P_{i,t} = \delta_0 + \delta_1 BVPS_{i,t} + \varepsilon_{i,t}$ (11)

		(9)			(10)		(11)		(9) – (11)	(9) – (10)
Year	**N**	**α_1**	**α_2**	**Adj. R^2_T**	**β_1**	**Adj. R^2_{10}**	**δ_1**	**Adj. R^2_{11}**	**Incr. R^2_{NIPS}**	**Incr. R^2_{BVPS}**
2005	111	0.960 (5.50**)	0.257 (0.33)	**0.483**	3.758 (7.70**)	**0.346**	1.008 (10.30**)	**0.483**	0.002	0.139
2006	141	1.259 (5.88**)	-0.936 (-1.2)	**0.213**	1.509 (2.05)	**0.022**	1.122 (6.18**)	**0.210**	0.002	0.190
2007	162	1.584 (11.60**)	0.12 (0.4)	**0.480**	2.071 (3.03**)	**0.049**	1.601 (12.34**)	**0.484**	-0.002	0.434
2008	168	0.628 (8.96**)	-0.930 (-3.66)	**0.491**	0.198 (0.74)	**-0.003**	0.501 (7.93**)	**0.271**	0.221	0.494
2009	155	0.491 (4.27**)	0.147 (0.31)	**0.122**	0.905 (2.12*)	**0.022**	0.472 (4.83**)	**0.126**	-0.004	0.099
2010	156	0.622 (4.56**)	0.307 (0.6)	**0.118**	0.643 (1.32)	**0.005**	0.588 (4.73**)	**0.117**	0.001	0.113
2011	156	0.543 (3.48**)	0.912 (2.62**)	**0.062**	0.067 (0.28)	**-0.005**	0.213 (2.26**)	**0.026**	0.036	0.067
2012	151	0.776 (5.92**)	1.846 (4.03**)	**0.182**	0.209 (0.52)	**-0.005**	0.458 (4.17**)	**0.098**	0.084	0.187
2013	149	0.431 (6.52**)	0.968 (1.03)	**0.226**	1.519 (1.44)	**0.007**	0.437 (6.64**)	**0.225**	0.0004	0.219
2014	145	0.184 (4.28**)	0.962 (2.73**)	**0.110**	0.541 (1.52)	**0.009**	0.151 (3.59**)	**0.072**	0.038	0.101
2015	156	0.554 (9.98**)	0.218 (5.45)	**0.632**	0.435 (10.12**)	**0.395**	0.719 (14.16**)	**0.563**	0.069	0.236
2016	153	1.008 (10.3**)	0.281 (0.96)	**0.519**	1.690 (5.90**)	**0.185**	0.946 (12.86**)	**0.519**	0.0002	0.334
2017	160	0.301 (2.88**)	1.919 (2.33*)	**0.103**	2.699 (3.39**)	**0.062**	0.380 (3.81**)	**0.078**	0.025	0.041
2018	164	1.320 (10.44**)	-0.653 (-4.11**)	**0.851**	2.111 (22.00**)	**0.751**	1.781 (28.82**)	**0.836**	0.015	0.100
2019	176	0.963 (8.00**)	4.112 (4.19**)	**0.492**	8.465 (8.89**)	**0.208**	1.243 (11.86**)	**0.444**	0.048	0.284
2020	229	1.907 (12.85**)	-0.389 (-0.74**)	**0.440**	1.98 (3.05**)	**0.035**	1.869 (13.45**)	**0.431**	0.009	0.405

Pooled	2 541	0.745 (28.51**)	0.002 (0.04)	**0.242**	0.079 (1.13)	**0.001**	0.745 (28.54**)	**0.242**	0.0003	0.242

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. The calculation of the incremental explanatory powers of earnings and book values of equity are presented in the last two columns. $P_{i,t}$ is share price three months after end of period *t*, $NIPS_{i,t}$ is net income after tax excluding extraordinary items divided by number of weighted average common shares outstanding, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

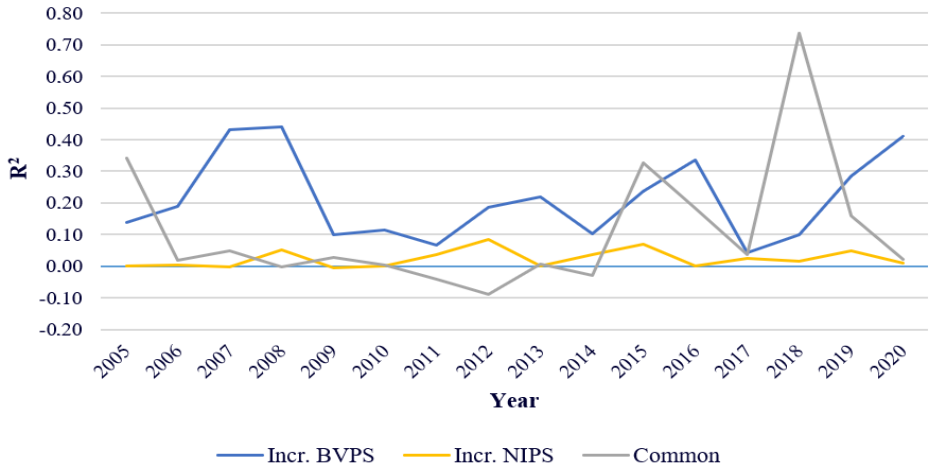

Figure 3. Common Explanatory Power (Adjusted R^2) to both BVPS and NIPS, Incremental Explanatory Power of BVPS and Incremental Explanatory Power of Incremental NIPS.

Figure 4 presents the development of total explanatory power (R^2_T) and incremental explanatory power of BVPS (R^2_{BVPS}) and NIPS (R^2_{NIPS}) from 2005 until 2020. The main difference between Figure 3 and 4 is that the former presents the common explanatory power to both BVPS and NIPS (gray line) and the latter shows the total explanatory power of BVPS and NIPS (orange line). Total explanatory power as well as incremental BVPS are volatile having almost the same pattern. Figure 3 illustrates that the incremental explanatory power of book value of equity is higher than the incremental explanatory power of net income throughout the reported time period. Therefore, based on the findings presented in Table 7 and Figure 4 we can accept hypothesis 2: *The value relevance of equity book value is higher than the value relevance of earnings in the Norwegian stock market evaluated by incremental explanatory powers (adjusted R^2) of book value of equity relative to net income in price regressions.*

Figure 4 demonstrates the trend in total and incremental explanatory power of earnings and equity book value over time. The combined explanatory power of net income per share and equity book value per share has been increasing over the time period, with a drop in 2009, 2011, 2014 and 2017.

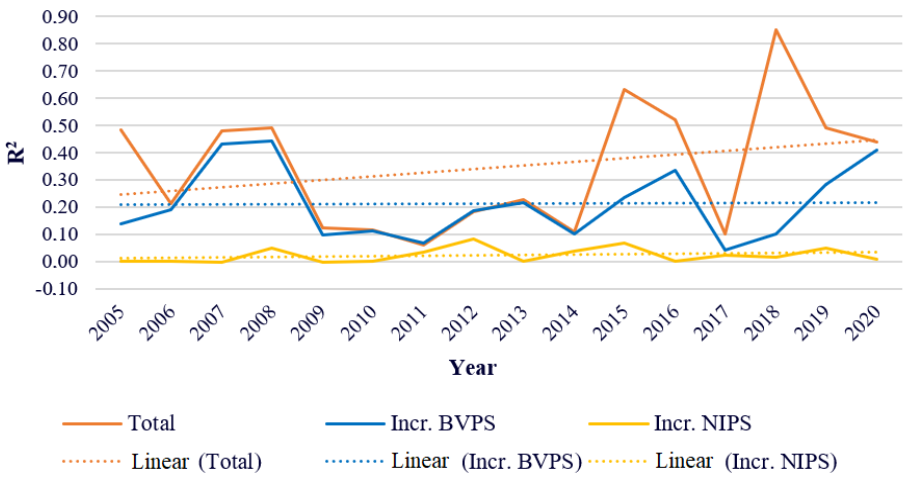

Figure 4. Total Explanatory Power (Adjusted R^2) of BVPS and NIPS, Incremental BVPS and Incremental NIPS over the Time Period 2005-2020 with Trend Lines

A slightly increasing total explanatory power of net income and book value of equity from 2005 till 2020 implies that we cannot accept hypothesis 3: *The*

combined value relevance of earnings and book values of equity has decreased in the Norwegian stock market for the sample period from 2005 till 2020.

Our results contradict the findings of Lev (2018), Lev and Gu (2016) and Lev and Zarowin (1999) who suggest the decrease of value relevance of accounting information over time. It is important to note that the conclusions by Lev (2018), Lev and Gu (2016) and Lev and Zarowin (1999) were made based on the study of value relevance throughout several decades with the investigation of the impact of change of accounting policies on value relevance. Therefore, our findings of increasing value relevance over time for only 16 years are not fully comparable with the studies by Lev.

The results of our study are more in line with the recent findings by Barth et al. (2021) who in their study suggested no decline in combined value relevance of earnings and book values in the period from 1962 to 2018 based on the US data. The total R^2 for the pooled time-series regression in our model is 24 percent which is in accordance with explanatory power of 25 percent in the 2000s obtained by Lev (2018). Moreover, our findings coincide with the results by Gjerde et al. (2011) who show evidence of slightly increasing value relevance of book value of equity and earnings over time in the period 1965 - 2004. At the same time, the findings by Gjerde et al. (2011) are based on the Norwegian data prior to the adoption of IFRS in Norway.

Moving towards the incremental value relevance of net income per share and book value per share, it is noticeable from the dotted trend line of NIPS in Figure 4 that the incremental explanatory power of net income has a slight increase over time, while the incremental explanatory power of equity book values has been unchanged since 2005. Our research concludes with different results than the prominent findings by Ely and Waymire (1999), Collins et al. (1997) and Francis and Schipper (1999) who presented evidence of decreasing incremental value relevance of earnings and increasing value relevance of equity book value throughout several decades. We believe that the reason for the contradicting results is the short sample period of our study.

4.3 Model IV: Value Relevance of Cash Flows

4.3.1 Model Specifications

The purpose of model IV is to test hypothesis 4. Previous research examining the value relevance of operating cash flows decomposes the earnings variable in the price level regression model into the two components cash flow from operations (CF) and accruals (ACC) (e.g. Akbar et al., 2011). Hence, model IV is a decomposition of model I where NIPS = CF + ACC:

$$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t} \qquad (15)$$

where $CF_{i,t}$ is cash flow from operations as reported in the cash flow statement deflated by weighted average common shares outstanding and $ACC_{i,t}$ is operating accruals calculated as net income after tax excluding extraordinary items less cash flow from operations deflated by weighted average common shares outstanding, i.e. NIPS - CF.

First, a pooled regression of P on BVPS, CF and ACC is conducted without any control variables. Second, the regression is extended to include control variables in accordance with model IV. Then we follow Akbar et al. (2011) and Dechow (1994) and compare the explanatory powers of model IV (regression (15)) model I (regression (8)) to examine the value relevance of operating cash flow in relation to earnings (net income). The model with the highest R^2 reveals which performance measure is most value relevant.

4.3.2 Results of Model IV

Table 8 reports the results from the pooled time-series regressions of P on BVPS, CF and ACC with and without control variables. The inclusion of control variables in regression (15) is successful in increasing the explanatory power of the model as adjusted R^2 is improved from 25.8 to 30.7. Moreover, BVPS and CF are both significant without including control variables. Thus, the missing impact in NIPS seems to be driven by the accrual component of earnings. Finally, the coefficients of BVPS, CF and ACC in model IV are all positive and statistically

significant at 1 percent level when including control variables. Among the accounting variables BVPS, CF and ACC, model IV suggests that operating cash flow explains most of the variation in shares prices for the companies listed on Oslo Stock Exchange with a coefficient of 1.073, followed by BVPS (coefficient of 0.596) and ACC (coefficient of 0.441). Operating cash flow and accruals are separately value relevant as the regression coefficients of CF and ACC are statistically distinguishable.

The splitting of net income into an operating cash flow and accrual component increases the explanatory power from 27.9 percent (model I) to 30.7 percent (model IV). These findings are similar to the findings of Akbar et al. (2011) who report an increase from 33.3 percent to 35.2 percent when splitting net income into its two components. The partitioning is, hence, considered value relevant. Our results are in accordance with previous studies by Akbar et al. (2011), Barth et al. (1999) and Sloan (1996) that present operating cash flow as more value relevant than earnings. Therefore, we accept hypothesis 4: *The value relevance of operating cash flows is higher than that of earnings in the Norwegian stock market.*

Table 8. *Regression of Price on Operating Cash Flow, Accruals and Book Value of Equity for the Years 2005 – 2020 (Pooled) With and Without Control Variables.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \varepsilon_{i,t}$ (i)

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$ (15)

	(i)	**(15)**
BVPS	0.753	0.596
	(29.08**)	(14.14**)
CF	0.415	1.073
	(5.04**)	(10.41**)
ACC	0.011	0.441
	(0.19)	(6.51**)
SIZE		0.064
		(13.24**)
VOL		-1.984
		(-0.23)
LEV		-0.099
		(-3.67**)
IND1		1.915
		(0.11)
IND2		-9.048
		(-0.62)
IND3		7.910
		(0.61)
IND4		20.704
		(1.84)
IND5		-4.600
		(-0.32)
IND6		18.077
		(1.62)
IND7		-11.109
		(-0.68)
IND8		-0.367
		(-0.03)
IND9		3.050

		(0.17)
IND10		-11.487
		(-0.44)
Adj. R^2	**0.258**	**0.307**

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $CF_{,t}$ is cash flow from operations as reported in the cash flow statement, $ACC_{,t}$ is operating accruals per share calculated as net income after tax excluding extraordinary items less cash flow from operations divided by weighted average common shares outstanding, i.e. NIPS – CF, $SIZE_{i,t}$ is average book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), $IND1_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the basic materials industry, $IND2_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer discretionary industry, $IND3_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer staples industry, $IND4_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the energy industry, $IND5_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the health care industry, $IND6_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the industrials industry, $IND7_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the real estate industry, $IND8_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the technology industry, $IND9_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the telecommunications industry, and $IND10_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the utilities industry, and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

4.4 Model V: Value Relevance of Intangible Assets

4.4.1 Model Specifications

The purpose of model V is to test hypothesis 5. Previous research examining the value relevance of intangible assets incorporates research and development expenditures and/or recognized intangible assets into a price level regression model as additional explanatory variables (e.g. Aboody & Lev, 1998; Akbar et al., 2011; Core et al., 2003). Following previous researchers, the price level regression (8) is expanded by adding two additional independent variables, research and development expenditures (RD) and capitalized intangible assets (IA), in order to test the value relevance of intangible assets. RD is included in net income and, hence, NIPS in previous models is in this model adjusted for RD by adding RD back. Similarly, the book value of equity is adjusted by IA by subtracting IA from BVPS. The model V is as follows:

$$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_2 NIPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \gamma Controls + \varepsilon_{i,t} \quad (16)$$

where $BVPS2_{i,t}$ is book value of equity *less* capitalized intangible assets (IA) of firm *i* at time *t*, $NIPS2_{i,t}$ is net income per share *plus* research and development expenditures per share for firm *i* at time *t*, $RD_{i,t}$ is research and development expenditures per share reported in the income statement for firm *i* in period *t*, $IA_{i,t}$ is capitalized intangible assets excluding goodwill for firm *i* at time *t*.

If investors value research and development expenditures and the cumulative amount of capitalized intangible assets, then we expect $\alpha_3 > 0$ and $\alpha_4 > 0$, respectively.

4.4.2 Results of Model V

The results of the pooled time-series regressions of model V with and without control variables are presented in Table 9. The exclusion of control variables yields only one statistically significant coefficient estimate: the coefficient estimate of BVPS2 of 0.799 is significant at the 1 percent level. When including control variables, the coefficient estimates of RD and IA remain rather unchanged

(negative and statistically insignificant). In addition, the inclusion of control variables has four main effects: First, it reduces the coefficient estimates of BVPS2 from 0.799 to 0.548. Second, it increases the coefficient estimate of NIPS2 as well as it becomes statistically significant (from -0.003 to 0.288). Third, the adjusted R^2 of the regression increases from 24.7 percent to 28.1 percent. Fourth, the separation of net income suggests that negative net income explains more of the variation in stock prices (coefficient of 0.304) than positive net income (coefficient of 0.275).

A comparison of the explanatory power of model V (28.1 percent) with that of model I (27.9 percent) suggests RD and IA to be value relevant as the separation of RD and IA from NIPS and BVPS respectively, better explains the variation in stock prices. However, both versions of model V, i.e. with and without control variables, yield negative and insignificant coefficients of RD (-5.099 and -5.077, respectively) and IA (-0.096 and -0.102, respectively). Thus, model V documents no value relevance of research and development expenditures and intangible assets.

Several firms in our sample have neither research and development expenditure nor recognized intangible assets in their financial statements. Therefore, we reduce our sample size to 1 563 consisting of firms having at least research and development expenditures or recognized intangible assets not equal to zero (RD or IA $\neq 0$). Regression (16) is performed on the new sample and the results are presented in Table 10.

The reduction of the sample size has three main results: First, the explanatory power decreases to 25.8 percent. Second, it suggests intangible assets recognized on the balance sheet (IA) to be value relevant as its coefficient estimate of 0.998 becomes statistically significant. Finally, there is still no indication of value relevance of research and development expenditures in the income statement as the regression coefficient estimate of RD (-4.695) remains insignificant. Thus, our results give only partially evidence of hypothesis 5: *Intangible assets, including research and development expenditures and recognized intangible assets, are value relevant accounting information in the Norwegian stock market.*

Table 9. *Regression of Price on Earnings, Book Value of Equity and Intangible Assets Including Research and Development Expenditures and Capitalized Intangible Assets for the Years 2005 – 2020 (Pooled) With and Without Control Variables.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_2 NIPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \varepsilon_{i,t}$ (i)

$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_2 NIPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$ (ii)

$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$ (16)

	(i)	**(ii)**	**(16)**
BVPS2	0.799	0.548	0.551
	(27.01**)	(10.90**)	(10.37**)
NIPS2	-0.003	0.288	
	(-0.04)	(4.29**)	
RD	-4.501	-5.077	-5.099
	(-1.61)	(-1.84)	(-1.85)
IA	-0.183	-0.102	-0.096
	(-0.70)	(-0.36)	(-0.34)
NIPS2_POS			0.275
			(2.76**)
NIPS2_NEG			0.304
			(2.56*)
SIZE		0.049	0.050
		(10.52**)	(9.42**)
VOL		-5.849	-5.808
		(-0.68)	(-0.67)
LEV		0.014	0.013
		(0.55)	(0.50)
IND1		2.993	2.972
		(0.17)	(0.17)
IND2		1.161	-1.339
		(-0.08)	(-0.09)
IND3		12.350	12.317
		(0.93)	(0.92)
IND4		20.997	21.037
		(1.84)	(1.85)

IND5		-8.775	-8.718
		(-0.59)	(-0.59)
IND6		20.068	20.083
		(1.77)	(1.77)
IND7		-13.902	-13.931
		(-0.83)	(-0.84)
IND8		0.805	0.804
		(0.06)	(0.06)
IND9		9.708	9.692
		(0.54)	(0.54)
IND10		-8.714	-8.673
		(-0.33)	(-0.33)
Adj. R^2	**0.247**	**0.281**	**0.281**

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $NIPS2_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding (i.e. NIPS + RD), $BVPS2_{i,t}$ is book value of equity *less* capitalized intangible assets, divided by weighted average common shares outstanding (i.e. BVPS – IA), $RD_{i,t}$ is research and development expenditures divided by weighted average common shares outstanding, $IA_{i,t}$ is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding, $NIPS2\_POS_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD > 0), $NIPS2\_NEG_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD ≤ 0), $SIZE_{i,t}$ is average book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), $IND1_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the basic materials industry, $IND2_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer discretionary industry, $IND3_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer staples industry, $IND4_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the energy industry, $IND5_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the health care industry, $IND6_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the industrials industry, $IND7_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the real estate industry, $IND8_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the technology industry, $IND9_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the telecommunications industry, and $IND10_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the utilities industry, and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

Table 10. *Regression of Price on Earnings, Book Value of Equity and Intangible Assets Including Research and Development Expenditures and Capitalized Intangible Assets for the Years 2005 – 2020 (Pooled) for a Smaller Sample Size.*

$$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,} \quad (16i)$$

	(16i)
BVPS2	0.226
	(3.30**)
RD	-4.695
	(-1.79)
IA	0.998
	(3.34**)
NIPS2_POS	0.148
	(1.51)
NIPS2_NEG	0.279
	(2.24*)
SIZE	0.055
	(10.66**)
VOL	-21.736
	(-2.19*)
LEV	0.052
	(1.48)
IND1	17.749
	(0.93)
IND2	-8.591
	(-0.53)
IND3	8.746
	(0.60)
IND4	38.551
	(2.91**)
IND5	-17.503
	(-1.03)
IND6	27.917
	(2.08*)
IND7	5.552
	(0.20)
IND8	-16.707
	(-1.16)

IND9	1.975
	(0.11)
IND10	-9.388
	(-0.32)
Adj. R^2	**0.258**

The coefficients of the control variables are not reported. T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 1 563. $P_{i,t}$ is share price three months after end of period *t*, $NIPS2_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding (i.e. NIPS + RD), $BVPS2_{i,t}$ is book value of equity *less* capitalized intangible assets, divided by weighted average common shares outstanding (i.e. BVPS – IA), $RD_{i,t}$ is research and development expenditures divided by weighted average common shares outstanding, $IA_{i,t}$ is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding, $NIPS2\_POS_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD > 0), $NIPS2\_NEG_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD $\leq$ 0), $SIZE_{i,t}$ is average book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), $IND1_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the basic materials industry, $IND2_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer discretionary industry, $IND3_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer staples industry, $IND4_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the energy industry, $IND5_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the health care industry, $IND6_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the industrials industry, $IND7_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the real estate industry, $IND8_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the technology industry, $IND9_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the telecommunications industry, and $IND10_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the utilities industry, and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

4.5 Robustness Tests

4.5.1 6-Month Price Lead

The models used in the present study employ share price three months after the end of the reporting period as the dependent variable in the price regressions. To assure that the market is able to react to accounting information after the end of the reporting period, we perform a robustness test using a 6-month price lead.

The use of share price six months after the end of the reporting period is motivated by Lev and Sougiannis (1996) who document an association between financial accounting information and subsequent stock returns. More specifically, they suggest that research and development expenditures are associated with stock returns six months after the end of the year. A possible explanation for using a 6-month price lead is to allow for all firms to publicly disclose their financial statements as well as market inefficiency.

The following pooled regressions are estimated using share price as of 30 June as dependent variable, and the results are presented in Table 11.

Model I:

$$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t} \quad (17)$$

Model IV:

$$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t} \quad (18)$$

Model V:

$$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_2 NIPS2\_POS_{i,t} + \alpha_3 NIPS2\_NEG_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \gamma Controls + \varepsilon_{i,t} \quad (19)$$

where $P_{i,t,6}$ is the share price six months after the end of period *t* for firm *i*.

The use of a 6-month price lead as the dependent variable has four primary results: First, the explanatory power decreases in all models (from 27.9 to 24.0 percent in model I, 30.7 to 26.8 percent in model IV, and 28.1 to 24.3 percent in model V). Second, the regression coefficient of NIPS_POS decreases and becomes statistically insignificant (from 0.263 to 0.212). Third, the coefficient estimate of IA decreases and becomes statistically insignificant (from 0.998 to -0.292). All other coefficient estimates are still significant with unchanged signs. Finally, book value of equity and net income remain value relevant with book value of equity explaining most of the variation in share prices.

Performing the same robustness test of model V on the smaller sample size introduced in section 4.4.2, yields robust results, see Table 12. The explanatory power decreases from 25.8 percent to 19.5 percent, however the sign and significance of the regression coefficient estimates remain unchanged.

Table 11. *Robustness Test of Model I, Model IV and Model V Using 6-Months Price Lead.*

Model						
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$ (8)						
$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$ (17)						
Model IV						
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \gamma Controls_{i,t,} + \varepsilon_{i,t}$ (15)						
$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 CF_{i,t} + \alpha_3 ACC_{i,t} + \gamma Controls_{i,t,} + \varepsilon_{i,t}$ (18)						
Model V						
$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$ (16)						
$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$ (19)						
	(8)	**(17)**	**(15)**	**(18)**	**(16)**	**(19)**
BVPS	0.486	0.539	0.596	0.634		
	(10.71**)	(10.82**)	(14.14**)	(13.70**)		
NIPS_POS	0.263	0.212				
	(2.66**)	(1.95)				
NIPS_NEG	0.303	0.466				
	(2.54*)	(3.58**)				
CF			1.073	1.166		
			(10.41**)	(10.32**)		
ACC			0.441	0.492		
			(6.51**)	(6.62**)		
BVPS2					0.551	0.628
					(10.37**)	(10.78**)
RD					-4.695	-4.959
					(-1.79)	(-1.64)
IA					0.998	-0.292
					(3.34**)	(-0.94)
NIPS2_POS					0.275	0.230
					(2.76**)	(2.11*)
NIPS2_NEG					0.304	0.466
					(2.56*)	(3.58**)
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Adj. R^2	**0.279**	**0.240**	**0.307**	**0.268**	**0.281**	**0.243**

The coefficients of the control variables are not reported. T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $P_{i,t,6}$ is share price six months after end of period *t*, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $NIPS\_POS_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) > 0, $NIPS\_NEG_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) ≤ 0, $CF_{,t}$ is cash flow from operations as reported in the cash flow statement, $ACC_{,t}$ is operating accruals per share calculated as net income after tax excluding extraordinary items less cash flow from operations divided by weighted average common shares outstanding, i.e. NIPS – CF, $BVPS2_{i,t}$ is book value of equity *less* capitalized intangible assets, divided by weighted average common shares outstanding (i.e. BVPS – IA), $RD_{i,t}$ is research and development expenditures divided by weighted average common shares outstanding, $IA_{i,t}$ is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding, $NIPS2\_POS_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD > 0), $NIPS2\_NEG_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD ≤ 0), $\gamma Controls_{i,t} = \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t}$, and $\varepsilon_{i,t}$ is the error term capturing other information not included in the model.

Table 12. *Robustness Test of Model I, Model IV and Model V Using 6-Months Price Lead using a Smaller Sample Size.*

Model V		
$P_{i,t} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$		(16i)
$P_{i,t,6} = \alpha_0 + \alpha_1 BVPS2_{i,t} + \alpha_3 RD_{i,t} + \alpha_4 IA_{i,t} + \alpha_5 NIPS2\_POS_{i,t} + \alpha_6 NIPS2\_NEG_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t}$		(19)
	(16i)	**(19)**
BVPS2	0.226	0.233
	(3.30**)	(3.24**)
RD	-4.695	-3.956
	(-1.79)	(-1.44)
IA	0.998	1.054
	(3.34**)	(3.36**)
NIPS2_POS	0.148	0.033
	(1.51)	(0.32)
NIPS2_NEG	0.279	0.301
	(2.24*)	(2.31*)
Controls	Yes	Yes
Adj. R^2	**0.258**	**0.195**

The coefficients of the control variables are not reported. T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 1 563. $P_{i,t}$ is share price three months after end of period *t*, $P_{i,t,6}$ is share price six months after end of period *t*, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $NIPS\_POS_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) > 0, $NIPS\_NEG_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) ≤ 0, $CF_{,t}$ is cash flow from operations as reported in the cash flow statement, $ACC_{,t}$ is operating accruals per share calculated as net income after tax excluding extraordinary items less cash flow from operations divided by weighted average common shares outstanding, i.e. NIPS – CF, $BVPS2_{i,t}$ is book value of equity *less* capitalized intangible assets, divided by weighted average common shares outstanding (i.e. BVPS – IA), $RD_{i,t}$ is research and development expenditures divided by weighted average common shares outstanding, $IA_{i,t}$ is capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding, $NIPS2\_POS_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD > 0), $NIPS2\_NEG_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0 (i.e. NIPS + RD ≤ 0), $\gamma Controls_{i,t} = \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t}$, and $\varepsilon_{i,t}$ is the error term capturing other information not included in the model.

4.5.2 Change of Deflator

Performing an additional robustness test of Model I, IV and V, we deflate the models by total assets instead of number of shares as in regression (8) in order to mitigate heteroskedasticity. The following models deflate price regressions by total assets at the end of the reporting period:

Model I:

$$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE_{i,t}/TA_{i,t} + \beta_2 NI\_POS_{i,t}/TA_{i,t} + \beta_3 NI\_NEG_{i,t}/TA_{i,t} + \gamma Controls_{i,t}/TA_{i,t} + \varepsilon_{i,t} \quad (20)$$

Model IV:

$$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE_{i,t}/TA_{i,t} + \beta_2 TOT\_CF_{i,t}/TA_{i,t} + \beta_3 TOT\_ACC_{i,t}/TA_{i,t} + \gamma Controls_{i,t}/TA_{i,t} + \varepsilon_{i,t} \quad (21)$$

Model V:

$$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE2_{i,t}/TA_{i,t} + \beta_2 NI2\_POS_{i,t}/TA_{i,t} + \beta_3 NI2\_NEG_{i,t}/TA_{i,t} + \beta_3 TOT\_RD_{i,t}/TA_{i,t} + \beta_4 TOT\_IA_{i,t}/TA_{i,t} + \gamma Controls/TA_{i,t} + \varepsilon_{i,t} \quad (22)$$

where $MVE_{i,t}$ is market value of equity for firm i at time t calculated as P*Shares, $BVE_{i,t}$ is book value of equity for firm *i* at time *t*, $NI\_POS_{i,t}$ is net income after tax excluding extraordinary items > 0 for firm *i* in the period *t*, $NI\_NEG_{i,t}$ is net income after tax excluding extraordinary items ≤ 0 for firm *i* in the period *t*, $TA_{i,t}$ is average book value of total assets for firm *i* at time *t*, $TOT\_CF_{i,t}$ is total cash flow from operations as reported in the cash flow statement for firm *i* in the period *t*, $TOT\_ACC_{i,t}$ is operating accruals for firm *i* in the period *t* calculated as net income after tax excluding extraordinary items less cash flow from operations, i.e. NI - TOT_CF, $BVE2_{i,t}$ is book value of equity less capitalized intangible assets for firm *i* at time *t*, i.e. BVE - TOT_IA, $NI2\_POS_{i,t}$ is net income after tax excluding extraordinary items plus research and development expenditure > 0 for firm *i* in the period *t*, i.e. NI + TOT_RD > 0, $NI2\_NEG_{i,t}$ is net income after tax excluding

extraordinary items plus research and development expenditure > 0 for firm *i* in the period *t*, i.e. NI + TOT_RD ≤ 0, $TOT\_RD_{i,t}$ is total research and development expenditures for firm *i* in the period *t*, $TOT\_IA_{i,t}$ is total capitalized intangible assets excluding goodwill for firm *i* at time *t*.

The introduction of new independent variables in the robustness test of changing the deflator requires outliers to be removed to ensure the estimated regressions are not sensitive to extreme observations. Following our previous approach, we remove observations at the 1 percent tails of the variables MVE, BVE, NI and TA. The final sample in this robustness test consists of 338 firms with 2 378 firm-year observations - a reduction of 6.4 percent.

The results, together with the regressions using the number of shares as deflator, are presented in Table 13. In the robustness test, Model I, IV and V still indicate that book value of equity is value relevant by reporting significant coefficients. However, the estimated coefficients of book value of equity are, on average, 19 times larger than when using the number of shares as deflator. Evaluating model I, there has been a change in the value relevance of net income. In model I, the coefficient of positive net income is no longer significant whereas the coefficient of negative income has both changed from a positive sign (0.303) to a negative sign (-5.728), and the significance level has improved from 5 percent level to 1 percent level. Thus, the value relevance of net income found in model I is not robust. In addition, the new model I reveals that book value of equity and net income jointly only explains 9.7 percent of the variation in stock prices which is both lower than our precious finding (27.9 percent) and lower than previous research (Collins et al., 1997; Core et al, 2003; Tahat & Alhadab, 2017).

Table 13. *Robustness Test with Change of Deflator.*

Model I

$MVE_{i,t}/Shares_{i,t} = \alpha_0 + \alpha_1 BVE_{i,t}/Shares_{i,t} + \alpha_2 NI\_POS_{i,t}/Shares_{i,t} + \alpha_3 NI\_NEG_{i,t}/Shares_{i,t} + \gamma Controls_{i,t}/Shares_{i,t} + \varepsilon_{i,t}$ (8)

$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE_{i,t}/TA_{i,t} + \beta_2 NI\_POS_{i,t}/TA_{i,t} + \beta_3 NI\_NEG_{i,t}/TA_{i,t} + \gamma Controls_{i,t}/TA_{i,t} + \varepsilon_{i,t}$ (20)

Model IV

$MVE_{i,t}/Shares_{i,t} = \alpha_0 + \alpha_1 BVE_{i,t}/Shares_{i,t} + \alpha_2 TOT\_CF_{i,t}/Shares_{i,t} + \alpha_3 TOT\_ACC_{i,t}/Shares_{i,t} + \gamma Controls_{i,t}/Shares_{i,t} + \varepsilon_{i,t}$ (15)

$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE_{i,t}/TA_{i,t} + \beta_2 TOT\_CF_{i,t}/TA_{i,t} + \beta_3 TOT\_ACC_{i,t}/TA_{i,t} + \gamma Controls_{i,t}/TA_{i,t} + \varepsilon_{i,t}$ (21)

Model V

$MVE_{i,t}/Shares_{i,t} = \alpha_0 + \alpha_1 BVE2_{i,t}/Shares_{i,t} + \alpha_2 NI2\_POS_{i,t}/Shares_{i,t} + \alpha_3 NI2\_NEG_{i,t}/Shares_{i,t} + \alpha_3 TOT\_RD_{i,t}/Shares_{i,t} + \alpha_4 TOT\_IA_{i,t}/Shares_{i,t} + \gamma Controls/Shares_{i,t} + \varepsilon_{i,t}$ (16i)

$MVE_{i,t}/TA_{i,t} = \beta_0 + \beta_1 BVE2_{i,t}/TA_{i,t} + \beta_2 NI2\_POS_{i,t}/TA_{i,t} + \beta_3 NI2\_NEG_{i,t}/TA_{i,t} + \beta_3 TOT\_RD_{i,t}/TA_{i,t} + \beta_4 TOT\_IA_{i,t}/TA_{i,t} + \gamma Controls/TA_{i,t} + \varepsilon_{i,t}$ (22)

	Model I		**Model IV**		**Model V**	
Deflator (denominator)	Number of Shares	Total Assets	Number of Shares	Total Assets	Number of Shares	Total Assets
Accounting information (numerator):	(8)	(20)	(15)	(21)	(16i)	(22)
BVE	0.486	10.341	0.596	10.135		
	(10.71**)	(9.08**)	(14.14**)	(8.83**)		
NI > 0	0.263	4.061				
	(2.66**)	(1.66)				
NI ≤ 0	0.303	-5.728				
	(2.54*)	(-6.17**)				
TOT_CF			1.073	-5.394		
			(10.41**)	(-5.35**)		
TOT_ACC			0.441	-2.302		
			(6.51**)	(-2.01*)		
BVE2					0.226	13.283
					(3.30**)	(8.96**)
NI2 > 0					0.148	22.814
					(1.51)	(5.21**)
NI2 ≤ 0					0.279	-13.780
					(2.24*)	(-9.21**)
TOT_RD					-4.695	-16.649

					(-1.79)	(-3.24**)
TOT_IA					0.998	13.153
					(3.34**)	(5.50**)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	**0.279**	**0.097**	**0.307**	**0.094**	**0.258**	**0.129**

The coefficients of the control variables are not reported. T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm-year observations are 2 378 except in regression (16i) where number of firm-year is 1 563. $MVE_{i,t}$ is market value of equity calculated as $P_{i,t}$*$Shares_{i,t}$, $P_{i,t}$ is share price three months after end of period *t*, $Shares_{i,t}$ is weighted average shares outstanding, $BVE_{i,t}$ is total book value of assets, $NI\_POS_{i,t}$ is net income after tax excluding extraordinary items > 0, $NI\_NEG_{i,t}$ is net income after tax excluding extraordinary items ≤ 0, $TA_{i,t}$ is average book value of total assets, $TOT\_CF_{i,t}$ is total cash flow from operations as reported in the cash flow statement, TOT_ACC is operating accruals calculated as net income after tax excluding extraordinary items less cash flow from operations, i.e. NI - TOT_CF, $BVE2_{i,t}$ is book value of equity *less* capitalized intangible assets, i.e. BVE - TOT_IA, $NI2\_POS_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure > 0, i.e. NI + TOT_RD > 0 , $NI2\_NEG_{i,t}$ is net income after tax excluding extraordinary items *plus* research and development expenditure ≤ 0, i.e. NI + TOT_RD ≤ 0, $TOT\_RD_{i,t}$ is total research and development expenditures, $TOT\_IA_{i,t}$ is total capitalized intangible assets excluding goodwill, $\gamma Controls_{i,t}/TA_{i,t} = \gamma_1 TOT\_SIZE_{i,t}/TA_{i,t} + \gamma_2 TOT\_VOL_{i,t}/TA_{i,t} + \gamma_3 TOT\_LEV_{i,t}/TA_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t}$ where $TOT\_SIZE_{i,t}$ is average book value of total assets, i.e. TA, TOT_VOL is security returns volatility measured as the standard deviation of prior four quarterly returns, $TOT\_LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity. $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.

In model IV, estimated coefficients of BVE, TOT_CF and TOT_ACC are still statistically significant, however the sign of TOT_CF and TOT_ACC has flipped from positive to negative. In addition, the explanatory power of regression (21) has decreased from 30.7 to 9.4 percent. Comparing the explanatory power of regression (21) of 9.4 percent with the explanatory power of regression (20) of 9.7 percent indicate that the value relevance of operating cash flow is not higher than that of net income, i.e. the opposite result as in section 4.3.2. Thus, our result in model IV is not robust.

Model V using the number of shares as deflator were performed on both the original sample size as defined in section 3.3 (regression 16) and a smaller sample size defined in section 4.4.2 (regression (16i). In this robustness test, regression (22) is compared to regression (16i) which suggested only recognized intangible assets to be value relevant. However, regression (22) suggests both research and development expenditures to be value relevant as the estimated coefficient of research and development expenditures (-16.649) and intangible assets (13.153) both are significant at 1 percent level. Thus, the value relevance of intangible assets recognized on the balance sheet is robust, whereas the robustness test also suggests research and development expenditures to be value relevant. Similarly to the other models, the explanatory power of the model has decreased by approximately 20 percent (R^2 = 12.9 percent).

5. Conclusion

In this master thesis, we study the value relevance of accounting information for the companies listed on the Oslo Stock Exchange. The aim of the research is to investigate whether book value of equity, net income, operating cash flow and intangible assets are able to explain variations in stock prices on Oslo Stock Exchange in the period from 2005 to 2020. The main research question is answered by testing five hypotheses with the help of cross-sectional price level regressions derived from the Ohlson model (1995).

Overall results from the model tests indicate that financial statement information produced by Norwegian firms is value relevant. Our findings are based on

regression analysis, models' coefficients and total explanatory power (R^2). The examination of individual regression coefficients' significance level of book value of equity, net income, operating cash flow and recognized intangible assets suggests that these accounting items are significantly associated with stock prices. By evaluating the explanatory power of different regression models, we find how much of the variation in stock prices are explained by accounting information. In particular, we document that book value of equity and net income jointly explain 27.9 percent of the variation in stock prices for the firms listed on Oslo Stock Exchange. In addition, a partitioning of net income into an accrual and operating cash flow component suggests operating cash flow to be more value relevant that net income as the partitioning increases the explanatory power from 27.9 to 30.7 percent.

With regard to value relevance over time, we find a slight increase in the value relevance of earnings as well as an increase in the combined value relevance of book value of equity and net income over time. Our results contradict findings of Lev (2018), Lev and Gu (2016) and Lev and Zarowin (1999) who demonstrate the decrease of value relevance of accounting information over time. However, our findings are not fully compatible with conclusions by Lev as we employed a considerably shorter time period in our study.

Our findings are robust to inclusion of control variables that also potentially explain variation in stock prices. These include firm size, negative income, security returns volatility, leverage and industry. Furthermore, the robustness test using 6-month price lead concludes with almost the same results as the main tests, and, hence, demonstrates that the findings from the main models are robust, whereas the results from the robustness test with the change of deflator from number of shares to total assets only partially confirm the findings from the main tests.

The present master thesis contributes to the existing value relevance literature since we are the first to analyze value relevance of accounting information for the firms listed on Oslo Stock Exchange in the period from 2005 to 2020. Moreover,

there is a very limited number of studies exploring the value relevance of operating cash flows and intangible assets for the Norwegian data.

At the same time, though the main research question is answered in the course of the study, the present research exhibits a number of limitations with the most profound ones being the sample period and sample size. The large sample size would increase generalizability of the study as well as, probably, would improve the statistical significance of the results. The longer sample period would allow for better comparability with the studies based on the U.S. data. Therefore, the suggestion for future research is to conduct a value relevance study with an enhanced sample size by using a longer sample period. Moreover, since the value relevance research of intangible assets is almost non-existent for the Norwegian data, an interesting topic for future research would be to study the value relevance of intangible assets in firms with high versus low intensity of intangible asset investments.

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Appendix

Appendix A - Sample Firms

Table A.1. *The Firms in the Sample and their Corresponding Ticker and Sector at the Oslo Stock Exchange*

Company	Ticker	Sector
2020 BULKERS	20202.OL	Industrial Transportation
24SEVEN TECHNOLOGY GP.	TFSO.OL^F13	Software and Computer Services
5TH PLANET GAMES	5PG.OL	Leisure Goods
ABILITY DRILLING	ADRL.OL^F09	Oil Equipment and Services
ADEVINTA	ADEA.OL	General Retailers
ADS MARITIME HOLDING	ADSA.OL	Industrial Transportation
AF GRUPPEN 'A'	AFGA.OL	Construction and Materials
AGILYX	AGLX.OL	Support Services
AGR GROUP	AGRGR.OL^A15	Oil Equipment and Services
AIRTHINGS	AIRX.OL	-
AKASTOR	AKAST.OL	Oil Equipment and Services
AKER BIOMARINE	AKBM.OL	Food Producers
AKER BIOMARINE	AKBM.OL^A13	Food Producers
AKER BP	AKRBP.OL	Oil and Gas Producers
AKER DRILLING	AKD.OL^K11	Oil Equipment and Services
AKER FLOATING PRODUCTION	AKFP.OL^D12	Oil Equipment and Services
AKER SOLUTIONS	AKSOA.OL	Oil Equipment and Services
AKVA GROUP	AKVA.OL	Industrial Engineering
ALTERNUS ENERGY GROUP	ALTA.OL	Electricity
AMERICAN SHIPPING	AMSCM.OL	Industrial Transportation
ANDFJORD SALMON	ANDF.OL	Food Producers
AQUA BIO TECHNOLOGY	ABTA.OL	Personal Goods
AQUALISBRAEMAR LOC	AQUA.OL	-
ARCHER	ARCHA.OL	Oil Equipment and Services
ARCTIC FISH HOLDING	AFISH.OL	Food Producers
ARCTICZYMES TECHNOLOGIES	AZT.OL	Pharmaceuticals and Biotechnology
ARCUS	ARCUS.OL^I21	Beverages
ARRIBATEC GROUP	ARRA.OL	Household Goods and Home Construction
ASIA OFFSHORE DRILLING	AOD.OL^F13	Oil Equipment and Services
ATEA	ATEA.OL	Software and Computer Services
ATLANTIC LUMPUS	ATLU-ME.OL^G19	Food Producers
ATLANTIC SAPPHIRE (OSL)	ASA.OL	Food Producers
AUSTEVOLL SEAFOOD	AUSS.OL	Food Producers
AVANCE GAS	AGAS.OL	Industrial Transportation
AWILCO DRILLING	AWDR.OL	-
AWILCO LNG	ALNG.OL	Industrial Transportation
AYFIE GROUP	AYFIE.OL	-

BAKKAFROST	BAKKA.OL	Food Producers
BALTIC SEA PROPERTIES	BALT.OL	Real Estate Investment and Services
BELSHIPS	BELCO.OL	Industrial Transportation
BERGENBIO	BGBIO.OL	Pharmaceuticals and Biotechnology
BEWI	BEWI.OL	General Industrials
BJORGE	BJORGE.OL^L10	Oil Equipment and Services
BLACK SEA PROPERTY	BSPC.OL	Household Goods and Home Construction
BONHEUR	BONHR.OL	General Industrials
BORGESTAD 'A'	BOR.OL	Industrial Engineering
BORGESTAD INDUSTRIES	BINU.OL^I13	Construction and Materials
BORR DRILLING	BORR.OL	Oil Equipment and Services
BORREGAARD	BRGB.OL	Chemicals
BOUVET	BOUV.OL	Software and Computer Services
BULK INVEST	BULKIN.OL^E16	Industrial Transportation
BW ENERGY	BWE.OL	Oil and Gas Producers
BW EPIC KOSAN	BWEK.OL	Industrial Transportation
BW IDEOL	BWIDL.OL	Alternative Energy
BW LPG	BWLPG.OL	Industrial Transportation
BW OFFSHORE	BWO.OL	Oil Equipment and Services
BWG HOMES	BWG.OL^F14	Household Goods and Home Construction
BYGGMA	BMA.OL	Construction and Materials
CADELER	CADLR.OL	-
CAMBI	CAMBI.OL	-
CARASENT	CARAC.OL	-
CARBON TRANSITION	CARBN.OL	Oil Equipment and Services
CECON	CECON.OL^I15	Oil Equipment and Services
CELLCURA	CELLC.OL^B15	Health Care Equipment and Services
CERMAQ	CEQ.OL^K14	Food Producers
CO2 CAPSOL	CAPSL.OL	Industrial Engineering
CODFARMERS	COD.OL^D13	Food Producers
COMROD COMMUNICATION	COMROD.OL^I14	Aerospace and Defense
CONTEXTVISION	CONTX.OL	Software and Computer Services
CRAYON GROUP HOLDING	CRAYN.OL	Software and Computer Services
CRUDECORP	CRUDE.OL^C14	Oil and Gas Producers
CSAM HEALTH GROUP	CSAM.OL	-
CXENSE	CXEN.OL^J19	Software and Computer Services
CYVIZ	CYVIZ.OL	Technology Hardware and Equipment
DATA RESPONS	DAT.OL^E20	Software and Computer Services
DEEP SEA SUPPLY	DESSC.OL^F17	Industrial Transportation
DET NORS.OLJESELSKAP	DETNOR.OL^L09	Oil and Gas Producers
DLT	DLTX.OL	Software and Computer Services
DNO	DNO.OL	Oil and Gas Producers
DOCKWISE	DOCK.OL^E13	Oil Equipment and Services

DOF	DOF.OL	Oil Equipment and Services
DOF SUBSEA	DOFSUB.OL^C18	Oil Equipment and Services
DOLPHIN GROUP	DLPH.OL^L15	Technology Hardware and Equipment
DOMSTEIN	DOMS.OL^K14	Food Producers
EIDESVIK OFFSHORE	EIOF.OL	Oil Equipment and Services
EITZEN CHEMICAL	ECHEM.OL^C15	Industrial Transportation
EKORNES	EKO.OL^J18	Household Goods and Home Construction
ELECTROMAG.GEOSVS.	EMGS.OL	Oil Equipment and Services
ELEKTROIMPORTOREN	ELIMP.OL	General Retailers
ELKEM	ELK.OL	Chemicals
ELLIPTIC LABORATORIES	ELABS.OL	Software and Computer Services
ELOP	ELOP.OL	-
ELTEK	ELTEK.OL^D15	Electronic and Electrical Equipment
EMAS OFFSHORE	EMAO.OL^I20	Oil Equipment and Services
EMS SEVEN SEAS	EMS.OL^G14	Industrial Transportation
ENDUR	ENDUR.OL	General Industrials
ENSURGE MICROPOWER	ENSU.OL	Electronic and Electrical Equipment
ENTRA	ENTRA.OL	Real Estate Investment and Services
EQUINOR	EQNR.OL	Oil and Gas Producers
EUROPRIS	EPR.OL	General Retailers
EVERFUEL	EFUEL.OL	Alternative Energy
EVRY	EVRY.OL^L19	Software and Computer Services
EXENSE	EXE.OL^D09	Software and Computer Services
FAIRSTAR HEAVY TRAN.	FAIR.OL^K12	Industrial Transportation
FAKTOR EIENDOM	FAKTOR.OL^J11	Real Estate Investment and Services
FARA ASA	FARA.OL^C13	Electronic and Electrical Equipment
FARSTAD SHIPPING	FAR.OL^F17	Oil Equipment and Services
FJORD1	FJORD.OL^H21	Travel and Leisure
FJORDKRAFT HOLDING	FKRFT.OL	Electricity
FLOATEL INTERNATIONAL	FLOA.OL^I11	Oil Equipment and Services
FLYR	FLYR.OL	Travel and Leisure
FOSEN	FOS.OL^B09	Travel and Leisure
FRED OLSEN PRDN.	FOP.OL^A14	Oil and Gas Producers
FRONTLINE	FRO.OL	Industrial Transportation
FROY	FROY.OL	Industrial Transportation
FUNCOM	FUNCOM.OL^G20	-
GAMING INNOVATION GROUP	GIG.OL	Travel and Leisure
GANGER ROLF	GRO.OL^E16	Oil Equipment and Services
GC RIEBER SHIPPING	RISH.OL	Industrial Transportation
GENTIAN DIAGNOSTICS	GENT.OL	Pharmaceuticals and Biotechnology
GLOBAL IP SLTN.HOLDING	GIPS.OL^H10	Software and Computer Services
GNP ENERGY	GNP.OL	Electricity
GOLDEN ENERGY OFFSHORE SERVICES	GEOS.OL	Oil Equipment and Services
GOODTECH	GOD.OL	-

GRENLAND GROUP ASA	GREN.OL^E11	Oil Equipment and Services
GRIEG SEAFOOD	GSFG.OL	Food Producers
GYLDENDAL	GYL.OL	Media
HAFNIA	HAFNI.OL	Industrial Transportation
HAFSLUND 'A'	HNA.OL^H17	Electricity
HARMONYCHAIN	HMONY.OL	Technology Hardware and Equipment
HAV GROUP	HAVH.OL	Industrial Transportation
HAVILA ARIEL	HAVA.OL^F12	Real Estate Investment and Services
HAVILA SHIPPING	HAVI.OL	Oil Equipment and Services
HAVYARD GROUP	HYARD.OL	Industrial Transportation
HEXAGON COMPOSITES	HEX.OL	-
HEXAGON PURUS	HPUR.OL	-
HJELLEGJERDE	HJE.OL^K10	Household Goods and Home Construction
HOEGH LONG HOLDINGS	HOEG.OL^E21	Industrial Transportation
HOFSETH BIOCARE	HBC.OL	Food Producers
HOUSE OF CONTROL GROUP	HOCH.OL	Software and Computer Services
HUDDLESTOCK FINTECH	HUDL.OL	Software and Computer Services
HUDDLY	HDLY.OL	Technology Hardware and Equipment
HUNTER GROUP	HUNT.OL	Oil Equipment and Services
HURTIGRUTEN	HURT.OL^B15	Travel and Leisure
HYDROGENPRO	HYPRO.OL	Alternative Energy
ICE FISH FARM	IFISH.OL	Food Producers
ICELANDIC SALMON	ISLAX.OL	Food Producers
IDEX BIOMETRICS	IDEX.OL	-
INDUCT	INDCT.OL	Software and Computer Services
INFRATEK	INFRAT.OL^C14	Construction and Materials
INFRONT	INFRNT.OL^F21	Support Services
INMETA CRAYON	INM.OL^B12	Software and Computer Services
INTEROIL EXP.&. PRDN.	IOX.OL	Oil and Gas Producers
INVIVOSENSE	INVIVO.OL^L09	Health Care Equipment and Services
ITERA	ITERA.OL	Software and Computer Services
JASON SHIPPING	JSHIP.OL^H13	Industrial Transportation
JINHUI SHIPPING AND TRANSPORTATION	JINJ.OL	Industrial Transportation
KAHOOT!	KAHOT.OL	Software and Computer Services
KALERA	KALK.OL	Food Producers
KID	KID.OL	General Retailers
KINGFISH COMPANY	KING.OL	Food Producers
KITRON	KIT.OL	Electronic and Electrical Equipment
KLAVENESS COMBINATION CARRIERS	KCCK.OL	Industrial Transportation
KMC PROPERTIES	KMCP.OL	Real Estate Investment and Services
KONGSBERG AUTV.HOLDING	KOA.OL	Automobiles and Parts
KONGSBERG GRUPPEN	KOG.OL	General Industrials
KYOTO GROUP	KYOTO.OL	Alternative Energy

LAVO TV	LAVO-ME.OL^K20	Software and Computer Services
LEROY SEAFOOD GROUP	LSG.OL	Food Producers
LIFECARE	LIFEA.OL	Pharmaceuticals and Biotechnology
LIGHTHOUSE CALEDONIA	LHC.OL^G10	Food Producers
LINK MOBILITY GROUP	LINK.OL^J18	Fixed Line Telecommunications
LINK MOBILITY GROUP HOLDING	LINK.OL	Software and Computer Services
LUXO	LUXO.OL^G09	Electronic and Electrical Equipment
MAGNORA	MGN.OL	Alternative Energy
MAGSEIS FAIRFIELD	MSEIS.OL	Oil Equipment and Services
MAMUT	MAMUT.OL^G11	Software and Computer Services
MARINE FARMS	MAFA.OL^K10	Food Producers
MARITIME INDL.SVS.	MAIS.OL^I11	Industrial Transportation
MEDI-STIM	MEDI.OL	Health Care Equipment and Services
MELTWATER	MWTR.OL	-
MERCELL HOLDING	MRCEL.OL	Software and Computer Services
MINTRA HOLDING	MNTR.OL	Software and Computer Services
MORPOL	MORPOL.OL^K13	Food Producers
MOWI	MOWI.OL	Food Producers
MPC CONTAINER SHIPS	MPCC.OL	Industrial Transportation
MULTICLIENT GEOPHYSICAL	MCG.OL^E17	Oil Equipment and Services
MULTICONSULT	MULTI.OL	-
NAPATECH	NAPA.OL	Technology Hardware and Equipment
NATTOPHARMA	NATTO.OL^F21	Food Producers
NAVAMEDIC	NAVA.OL	Pharmaceuticals and Biotechnology
NEAS	NEAS.OL^E12	Real Estate Investment and Services
NEKKAR	NKR.OL	-
NEL	NEL.OL	Alternative Energy
NETCONNECT	NETCO.OL^C14	Software and Computer Services
NETOIL CAPITAL	NOCN.OL	Oil and Gas Producers
NEXT BIOMETRICS GROUP	NEXT.OL	Electronic and Electrical Equipment
NEXTGENTEL	NGT.OL^D19	Technology Hardware and Equipment
NEXUS FLOATING PRDN.	NEXUS.OL^I13	Oil Equipment and Services
NORBIT	NORBT.OL	Electronic and Electrical Equipment
NORCOD	NCOD.OL	Food Producers
NORDIC AQUA PART	NOAP.OL	Food Producers
NORDIC MINING	NOM.OL	Mining
NORDIC NANOVECT	NANOVN.OL	Pharmaceuticals and Biotechnology
NORDIC SEMICONDUCTOR	NOD.OL	Technology Hardware and Equipment
NORDIC UNMANNED	NUMND.OL	Electronic and Electrical Equipment
NORSK HYDRO	NHY.OL	Industrial Metals and Mining
NORSKE SKOG	NSKOG.OL	Forestry and Paper
NORSKE SKOGINDUSTRIER	NSG.OL^B18	Forestry and Paper
NORTEL	NTEL.OL	Fixed Line Telecommunications

NORTH ENERGY	NORTH.OL	Oil and Gas Producers
NORTHERN DRILLING	NODL.OL	Oil Equipment and Services
NORTHERN OCEAN	NOL.OL	Oil Equipment and Services
NORTHERN OFFSHORE	NOF.OL^H15	Oil and Gas Producers
NORWAY PELAGIC	NPEL.OL^K13	Food Producers
NORWAY ROYAL SALMON	NRS.OL	Food Producers
NORWEGIAN AIR SHUTTLE	NAS.OL	Travel and Leisure
NORWEGIAN CAR CARRIERS	NOCC.OL^D14	Industrial Transportation
NORWEGIAN ENERGY CO.	NOR.OL	Oil and Gas Producers
NORWEGIAN PROPERTY	NPRO.OL^H21	Real Estate Investment and Services
NRC GROUP	NRC.OL	-
NTS	NTSN.OL	Industrial Transportation
NYKODE THERAPEUTIC	NYKD.OL	Pharmaceuticals and Biotechnology
OBSERVE MEDICAL	OBSRV.OL	Health Care Equipment and Services
OCEAN YIELD	OCY.OL^L21	Industrial Transportation
OCEANTEAM	OTS.OL	Oil Equipment and Services
ODFJELL A	ODF.OL	Industrial Transportation
ODFJELL DRILLING	ODLO.OL	-
ODIM	ODIM.OL^D10	Industrial Engineering
OKEA	OKEA.OL	Oil and Gas Producers
OKEANIS ECO TANKERS	OET.OL	Industrial Transportation
OLAV THON EIEP.	OLT.OL	Real Estate Investment and Services
ORIGIO	ORIGIO.OL^H12	Pharmaceuticals and Biotechnology
ORKLA	ORK.OL	Food Producers
ORN SOFTWARE HOLDING	ORNO.OL	Software and Computer Services
OTELLO CORPORATION	OTEC.OL	Software and Computer Services
OTOVO	OTOVO.OL	Alternative Energy
OTRUM	OTR.OL^I09	Technology Hardware and Equipment
PANORO ENERGY	PENR.OL	Oil and Gas Producers
PATIENTSKY GROUP	PSKY.OL	-
PCI BIOTECH HOLDING	PCIB.OL	Pharmaceuticals and Biotechnology
PETROJACK	JACK.OL^C10	Oil Equipment and Services
PETROLIA E&P HOLDINGS	PSE.OL	Oil Equipment and Services
PETROMENA	PMENA.OL^A10	Oil Equipment and Services
PETROPROD	PPROD.OL^D09	Oil Equipment and Services
PEXIP HOLDING	PEXIP.OL	Software and Computer Services
PGS	PGS.OL	Oil Equipment and Services
PHILLY SHIPYARD	PHLY.OL	Industrial Transportation
PHOTOCURE	PHO.OL	Pharmaceuticals and Biotechnology
PLAY MAGNUS	PMGP.OL	-
POLARCUS	PLCS.OL^G21	Oil Equipment and Services
POLARIS MEDIA	POL.OL	Media
POLIGHT	PLT.OL	Electronic and Electrical Equipment
POWEL	POWEL.OL^A10	Software and Computer Services

PRONOVA BIOPHARMA	PRON.OL^B13	Pharmaceuticals and Biotechnology
PROXIMAR SEAFOOD	PROXI.OL	Food Producers
PRYME	PRYME.OL	Support Services
Q-FREE	QFR.OL	-
QUANTAFUEL	QFUEL.OL	Support Services
RAK PETROLEUM	RAKP.OL	Oil and Gas Producers
RANA GRUBER	RANA.OL	Industrial Metals and Mining
REACH SUBSEA	REACH.OL	Oil Equipment and Services
REC SILICON	RECSI.OL	Chemicals
REM OFFSHORE	REM.OL^L16	Oil Equipment and Services
REMEDIAL (CYPRUS)	ROFF.OL^B11	Oil Equipment and Services
RENONORDEN	RENO.OL^K17	Support Services
REPANT	REPANT.OL^F15	Industrial Engineering
RESERVOIR EXP.TECH.'B'	RXT.OL^G13	Oil Equipment and Services
RIEBER & SON	RIE.OL^E13	Food Producers
RIVER TECH	RIVER.OL	Software and Computer Services
ROCKSOURCE	RGT.OL^F15	Oil and Gas Producers
ROMREAL	ROMR.OL	Real Estate Investment and Services
ROXAR	ROX.OL^E09	Oil Equipment and Services
S D STANDARD ETC	SDSD.OL	Oil Equipment and Services
SAFEROAD HOLDING	SAFER.OL^I18	Construction and Materials
SAGA PURE	SAGAS.OL	Industrial Transportation
SALMAR	SALM.OL	Food Producers
SALMON EVOLUTION	SALME.OL	Food Producers
SATS	SATSS.OL	Travel and Leisure
SCAN GEOPHYSICAL	SCANG.OL^G09	Oil Equipment and Services
SCANA	SCANA.OL	Oil Equipment and Services
SCANARC	SCRC.OL^K12	Real Estate Investment and Services
SCATEC	SCATC.OL	Alternative Energy
SCHIBSTED A	SCHA.OL	Software and Computer Services
SEABIRD EXPLORATION	GEG.OL	Oil Equipment and Services
SEAJACKS INTERNATIONAL	SEAJ.OL^A10	Oil Equipment and Services
SEAWAY 7	SEAW7.OL	Oil Equipment and Services
SELF STORAGE GROUP	SSG.OL	-
SELVAAG BOLIG	SBOS.OL	Real Estate Investment and Services
SERENDEX PHARMS.AS	SENDEX.OL^E16	Pharmaceuticals and Biotechnology
SERODUS	SERD.OL^B17	Pharmaceuticals and Biotechnology
SEVAN DRILLING	SEVDRL.OL^G18	-
SHELF DRILLING	SHLF.OL	Oil Equipment and Services
SIEM OFFSHORE	SIOFF.OL	Oil Equipment and Services
SIEM SHIPPING INC.	SSIP.OL^B17	Industrial Transportation
SIKRI HOLDING	SIKRI.OL	Software and Computer Services
SIMRAD OPTRONICS	SITO.OL^G10	Aerospace and Defense
SIMTRONICS	SIMTRO.OL^E11	Industrial Engineering
SINOCEANIC SHIPPING	SINOC.OL^G13	Industrial Transportation

SKANDIA GREENPOWER	SKAND.OL	Electricity
SOFTOX SOLUTIONS	SOFTX.OL	Pharmaceuticals and Biotechnology
SOFTWARE INNOVATION	SOIF.OL^D09	Software and Computer Services
SOLON EIENDOM	SOLON.OL^B22	Real Estate Investment and Services
SOLSTAD OFFSHORE	SOFF.OL	Oil Equipment and Services
SOLVANG	SOLV.OL^B18	Industrial Transportation
SONANS HOLDING	LUMI.OL	-
SPECTRUM	SPU.OL^H19	Oil Equipment and Services
STATOIL FUEL & RETAIL	SFRET.OL^G12	Oil and Gas Producers
STAVANGER AFTENBLAD	STA.OL^F09	Media
STOLT-NIELSEN	SNI.OL	Industrial Transportation
STRONGPOINT	STRO.OL	Software and Computer Services
STX EUROPE	STXEUR.OL^B09	Industrial Engineering
SUBSEA 7	SUB.OL^A11	Oil Equipment and Services
SUBSEA 7	SUBC.OL	Oil Equipment and Services
SYNNOVE FINDEN	SFM.OL^H09	Food Producers
TANDBERG	TAA.OL^D10	Technology Hardware and Equipment
TANDBERG DATA	TAD.OL^E09	Software and Computer Services
TANDBERG STORAGE	TGBS.OL^E09	Oil Equipment and Services
TANKER INVEST	TANIL.OL^K17	Oil Equipment and Services
TARGOVAX	TRVX.OL	Pharmaceuticals and Biotechnology
TEAM TANKERS INTL.	TEAM.OL^J20	Industrial Transportation
TECHSTEP	TECH.OL	Software and Computer Services
TECO MARITIME	TECOC.OL^E12	Industrial Transportation
TEKNA HOLDING	TEKNA.OL	-
TELENOR	TEL.OL	Fixed Line Telecommunications
TGS	TGS.OL	Oil Equipment and Services
THE SCOTTISH SALMON	SSCOM.OL^C20	Food Producers
TIDE	TIDE.OL^B17	Travel and Leisure
TOMRA SYSTEMS	TOM.OL	Industrial Engineering
ULTIMOVACS	ULTI.OL	Pharmaceuticals and Biotechnology
UNIFIED MSG SYSTEMS	UMES.OL^E18	Software and Computer Services
VEIDEKKE	VEI.OL	Construction and Materials
VISTIN PHARMA	VISTN.OL	Pharmaceuticals and Biotechnology
VIZ R T	VIZ.OL^C15	Software and Computer Services
VOLUE	VOLUE.OL	Software and Computer Services
VOW	VOW.OL	Industrial Engineering
WALLENIUS WILHELMSEN	WAWI.OL	Industrial Transportation
WAVEFIELD INSEIS	WAVE.OL^B09	Oil Equipment and Services
WEBSTEP	WSTEP.OL	Software and Computer Services
WEGA MINING	WEMI.OL^G09	Mining
WEIFA	WEIFA.OL^J17	Pharmaceuticals and Biotechnology
WESTERN BULK CHARTERING	WEST.OL	Industrial Transportation
WILHS.WILHELMSEN HDG.'A'	WWI.OL	Industrial Transportation
WILSON	WILS.OL	Industrial Transportation

WR ENTERTAINMENT	WRE-ME.OL^D20	-
XPLORA TECHNOLOGIES	XPLRA.OL	Leisure Goods
XXL	XXL.OL	General Retailers
YARA INTERNATIONAL	YAR.OL	-
ZALARIS	ZAL.OL	Software and Computer Services
ZAPTEC	ZAP.OL	Electronic and Electrical Equipment
ZWIPE	ZWIPEZ.OL	Software and Computer Services

Appendix B - Sample Industries

The reported sectors in Refinitiv Datastream are categorized into industries in Table B.1 using the Industry Classification Benchmark (ICB) classification system (Euronext, 2021). The industry indicator variables are presented in Table B.2 where the variable takes the value 1 if it is in that particular industry and 0 otherwise.

Table B.1. *The Relation Between Sector and Industry at the Oslo Stock Exchange.*

Sector	**Industry**
Aerospace and defense	Basic materials
Alternative energy	Energy
Automobiles and parts	Consumer discretionary
Beverages	Consumer staples
Chemicals	Basic materials
Construction and materials	Industrials
Electricity	Utilities
Electronic and electrical equipment	Industrials
Fixed line telecommunications	Telecommunications
Food and drug retailers	Consumer staples
Food producers	Consumer staples
Forestry and paper	Basic materials
Gas, water and multiutilities	Utilities
General industrials	Industrials
General retailers	Consumer discretionary
Health care equipment and services	Health care
Household goods and home construction	Consumer discretionary
Industrial engineering	Industrials
Industrial metals and mining	Basic materials
Industrial transportation	Industrials
Leisure goods	Consumer discretionary
Media	Consumer discretionary

Mining	Basic materials
Oil and gas producers	Energy
Oil equipment and services	Energy
Personal goods	Consumer staples
Pharmaceuticals and biotechnology	Health care
Real estate investment and services	Real estate
Software and computer services	Technology
Support services	Utilities
Technology hardware and equipment	Telecommunications
Travel and leisure	Consumer discretionary
Unclassified	Unclassified

Table B.2. *Industry Indicator Variables.*

Industry	**Indicator variable**
Basic materials	IND1
Consumer discretionary	IND2
Consumer staples	IND3
Energy	IND4
Health care	IND5
Industrials	IND6
Real estate	IND7
Technology	IND8
Telecommunications	IND9
Utilities	IND10

The industry indicator variables take the value 1 if the firm is in the related industry and 0 otherwise. The omitted industry category when all industry categories included in the model are zero, is the unclassified industry category.

Appendix C - Variable Definitions

The following variables are used in this paper, sorted alphabetically in each category. All variables are denoted with indices *i* and *t* where *i* denotes firm *i* ranging from *i* = 1, 2, 3, …352, and *t* denotes the reporting period (year) ranging from *t* = 2005, 2006, 2007, …, 2020 corresponding to the years 2005 - 2020.

Table C.1. *Variable Definitions.*

Variable Name	**Definition**
Shares	
P	Share price three months after the end of period *t* (Barth et al., 2021; Brown et al., 1998; Collins et al., 1997). The share price six months after the end of period *t* is used as a robustness check.
$P_{i,t,6}$	Share price six months after the end of period *t* for firm *i*.
Shares	Weighted average common shares outstanding
Financial Accounting Information	
ACC	Operating accruals per share, calculated as net income after tax excluding extraordinary items less cash flow from operations, i.e. NIPS - CF
BVE	Total book value of equity
BVE2	Book value of equity *less* capitalized intangible assets, i.e. BVE - TOT_IA
BVPS	Book value of equity divided by weighted average common shares outstanding
BVPS2	Book value of equity *less* capitalized intangible assets, divided by weighted average common shares outstanding, i.e. BVPS - IA
CF	Cash flow from operations as reported in the cash flow statement divided by weighted average common shares outstanding
IA	Capitalized intangible assets excluding goodwill divided by weighted average common shares outstanding
LEV	Leverage calculated as total long term debt divided by book value of equity deflated by number of shares (Aboody & Lev, 1998)

MVE	Market value of equity, calculated as P*Shares
NI	Net income after tax excluding extraordinary items
NI_NEG	Net income after tax excluding extraordinary items ≤ 0
NI_POS	Net income after tax excluding extraordinary items > 0
NI2_NEG	Net income after tax excluding extraordinary items *plus* research and development expenditure ≤ 0, i.e. NI + TOT_RD ≤ 0
NI2_POS	Net income after tax excluding extraordinary items *plus* research and development expenditure > 0, i.e. NI + TOT_RD > 0
NIPS	Net income after tax excluding extraordinary items deflated by number of shares
NIPS_NEG	Net income after tax excluding extraordinary items per share (NIPS) ≤ 0
NIPS_POS	Net income after tax excluding extraordinary items per share (NIPS) > 0
NIPS2	Net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding, i.e. NIPS + RD
NIPS2_NEG	Net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding ≤ 0, i.e. NIPS + RD ≤ 0
NIPS2_POS	Net income after tax excluding extraordinary items *plus* research and development expenditure, divided by weighted average common shares outstanding > 0, i.e. NIPS + RD > 0
RD	Research and development expenditures divided by weighted average common shares outstanding
SIZE	Average book value of total assets divided by weighted average common shares outstanding
TA	Average book value of total assets (Barth et al., 2001; Dichev & Tang, 2008)

TOT_ACC	Operating accruals calculated as net income after tax excluding extraordinary items less cash flow from operations, i.e. NI - TOT_CF
TOT_CF	Total cash flow from operations as reported in the cash flow statement
TOT_IA	Total capitalized intangible assets excluding goodwill
TOT_LEV	Leverage calculated as total long term debt divided by book value of equity (Aboody & Lev, 1998)
TOT_RD	Total research and development expenditures
TOT_SIZE	Average book value of total assets, i.e. TA
Industries	
IND1	An indicator variable equal to 1 if a firm is operating in the basic materials industry and 0 otherwise
IND2	An indicator variable equal to 1 if a firm is operating in the consumer discretionary industry and 0 otherwise
IND3	An indicator variable equal to 1 if a firm is operating in the consumer staples industry and 0 otherwise
IND4	An indicator variable equal to 1 if a firm is operating in the energy industry and 0 otherwise
IND5	An indicator variable equal to 1 if a firm is operating in the health care industry and 0 otherwise
IND6	An indicator variable equal to 1 if a firm is operating in the industrials industry and 0 otherwise
IND7	An indicator variable equal to 1 if a firm is operating in the real estate industry and 0 otherwise
IND8	An indicator variable equal to 1 if a firm is operating in the technology industry and 0 otherwise

IND9	An indicator variable equal to 1 if a firm is operating in the telecommunications industry and 0 otherwise
IND10	An indicator variable equal to 1 if a firm is operating in the utilities industry and 0 otherwise
The omitted industry category when all industry categories included in the model are zero, is the unclassified industry category.	
Other	
ε	Error term capturing other information not included in the model
TIME	1, 2, 3, …., 16 corresponding to the years t = 2005-2020
TOT_VOL	Security returns volatility measured as the standard deviation of prior four quarterly returns
VOL	Security returns volatility measured as the standard deviation of prior four quarterly returns divided by weighted average common shares outstanding

Appendix D - Model I With Step-by-Step Inclusion of Control Variables

Table D.1. *Regression of Price on Earnings and Book Value of Equity (Pooled) Including the Incremental Inclusion of Control Variables.*

$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS_{i,t} + \varepsilon_{i,t,}$	(1)
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \varepsilon_{i,t,}$	(2)
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \varepsilon_{i,t,}$	(3)
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \varepsilon_{i,t,}$	(4)
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \varepsilon_{i,t,}$	(5)
$P_{i,t} = \alpha_0 + \alpha_1 BVPS_{i,t} + \alpha_2 NIPS\_POS_{i,t} + \alpha_3 NIPS\_NEG_{i,t} + \gamma_1 SIZE_{i,t} + \gamma_2 VOL_{i,t} + \gamma_3 LEV_{i,t} + \gamma_4 IND1_{i,t} + \gamma_5 IND2_{i,t} + \gamma_6 IND3_{i,t} + \gamma_7 IND4_{i,t} + \gamma_8 IND5_{i,t} + \gamma_9 IND6_{i,t} + \gamma_{10} IND7_{i,t} + \gamma_{11} IND8_{i,t} + \gamma_{12} IND9_{i,t} + \gamma_{13} IND10_{i,t} + \varepsilon_{i,t,}$	(6)

	(1)	(2)	(3)	(4)	(5)	(6)
NIPS	0.002					
	(0.04)					
BVPS	0.745	0.665	0.529	0.529	0.469	0.486
	(28.51**)	(20.30**)	(15.23**)	(15.20**)	(10.62**)	(10.71**)
NIPS_POS		0.330	0.270	0.270	0.274	0.263
		(3.26**)	(2.71**)	(2.71**)	(2.76**)	(2.66**)
NIPS_NEG		-0.293	0.364	0.361	0.284	0.303
		(-3.09**)	(3.22**)	(3.19**)	(2.40*)	(2.54*)
SIZE			0.052	0.052	0.049	0.050
			(10.22**)	(10.21**)	(9.32**)	(9.42**)
VOL				-4.574	-4.850	-5.698
				(-0.53)	(-0.56)	(-0.66)
LEV					0.052	0.038
					(2.18*)	(1.55)
IND1						4.424
						(0.25)
IND2						-3.195
						(-0.22)

IND3						10.437
						(0.79)
IND4						21.545
						(1.89)
IND5						-7.977
						(-0.54)
IND6						20.060
						(1.77)
IND7						-11.727
						(-0.70)
IND8						-0.577
						(-0.04)
IND9						6.356
						(0.35)
IND10						-6.736
						(-0.25)
Adj. R^2	**0.242**	**0.247**	**0.276**	**0.276**	**0.277**	**0.279**

T-values in parentheses. *Significant at 0.05 level, ** Significant at 0.01 level (two-tailed). Number of firm observations are 2 541. $P_{i,t}$ is share price three months after end of period *t*, $NIPS_{i,t}$ is net income after tax excluding extraordinary items divided by number of weighted average common shares outstanding, $BVPS_{i,t}$ is book value of equity per share (weighted average common shares outstanding), $NIPS\_POS_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) > 0, $NIPS\_NEG_{i,t}$ is net income after tax excluding extraordinary items per share (NIPS) ≤ 0, $SIZE_{i,t}$ is book value of total assets divided by number of weighted average common shares outstanding, $VOL_{i,t}$ is security returns volatility measured as the standard deviation of prior four quarterly returns, $LEV_{i,t}$ is leverage calculated as total long term debt divided by book value of equity deflated by number of shares (weighted average common shares outstanding), $IND1_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the basic materials industry, $IND2_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer discretionary industry, $IND3_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the consumer staples industry, $IND4_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the energy industry, $IND5_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the health care industry, $IND6_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the industrials industry, $IND7_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the real estate industry, $IND8_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the technology industry, $IND9_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the telecommunications industry, and $IND10_{i,t}$ is an industry indicator variable equal to 1 if firm *i* is operating in the utilities industry, and $\varepsilon_{i,t,}$ is the error term capturing other information not included in the model.