BI Norwegian Business School - campus Oslo

GRA 19703

Master Thesis

Thesis Master of Science

The value relevance of reported biological assets at fair value in the salmon farming industry

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Start:	15.01.2019 09.00
Finish:	01.07.2019 12.00

1.0 Acknowledgments

This master thesis is written as the final assignment in our master's programme MSc in Business with major in business law, tax and accounting at BI Norwegian Business School.

The objective with this thesis has been to evaluate the value relevance of reported biological assets in the salmon farming industry. Writing this thesis has been a demanding, but very exciting and instructive process. We have acquired knowledge on both the concept of value relevance and financial reporting in the salmon farming industry. We are confident that this new insight will be beneficial and valuable to us in the years to come.

We would like to thank Erlend Kvaal, our supervisor, for providing guidance and valuable feedback along the way. We are very grateful for his patience, always taking the time to address our concerns.

Magnus Flinstad Ludvigsen
Oslo, June 2019

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Oslo, June 2019

2.0 Abstract

The implementation of IFRS in 2005 and the following adoption of fair value accounting represents a comprehensive change in the field of accounting in recent times. This legislation, requiring fair value on reported biological assets (IAS 41), has led to conflicting opinions regarding the accounting quality requirements relevance and reliability. For the salmon farming industry, this meant reporting their biological assets including fair value adjustments. There is, however, an ongoing debate on whether these fair value estimates are reliable and relevant enough to be reflected in a company's market value of equity.

This thesis takes on the value relevance of biological assets in the salmon farming industry. In the first part of our study, we will present and discuss relevant accounting theory and empirical results from the value relevance research and the salmon farming industry. Based on this, we have developed a set of hypotheses that will be tested in our empirical study. Here, we will test the value relevance of reported biological assets in the salmon farming industry. Due to a small amount of existing research on the topic, we believe our findings will contribute to the area of study. Our sample consist of 214 observations, retrieved from six salmon companies listed on Oslo Stock Exchange. We have used the Ohlson price model to examine the relation between the reporting of biological assets and the market value of equity. Both own accounting estimates at historical cost and reported financials including fair value adjustments have been used in our analysis.

The study finds the reporting of biological assets to be value relevant at fair value. Historical cost measures are also to be considered value relevant, even though there is indication of higher value relevance when including fair value estimates. Additional tests support our findings but shows that it is no longer obvious that fair value estimates are value relevant together with other publicly available information.

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3.0 Introduction

One main objective of financial reporting is to provide stakeholders with useful information. There are many different stakeholders, but Penman (2013) considers the investors as the most important one. The investors expect companies to generate profit, which creates a growing value of equity. In the process of evaluating a company's ability to create positive returns on invested capital, the financial statements are an important source, if not the most important source of information. One main objective is therefore to produce accurate financial statements, in order to advice the investors whether or not they should invest (Penman, 2013). The degree of how financial information gives an accurate estimation of a company's market value represent its *value relevance*. Value relevance research examine this relation, where the sensitivity of a company's market value is explained by accounting numbers and how these financials may explain the stock price fluctuations.

Value relevance can be categorized as a discipline within the capital market-based accounting research (CMBAR) (Beaver, 2002). Prior research has used reported income and balance statements, where reported net income and book value of equity are variables explaining the relevance. Ball & Brown (1968) and Beaver (1968) are considered the first to study the relation between financial statements and stock prices. The general accepted view is that value relevance of income has declined over time, while the relevance on book value of equity remains stable. Still, there is an ongoing debate on which valuation method, such as fair value accounting versus historical cost, is considered the most value relevant.

This thesis aims to expand this area of research by investigating the value relevance of reported biological assets at fair value in the salmon farming industry. Although fair value accounting and value relevance have been widely discussed, most of the academic literature on these topics addresses fair value in the context of financial assets. There is also some existing academic literature discussing value relevance related to IAS 41, but most of them are

looking at agriculture in general. We want to narrow our research down to the salmon farming industry and the reporting of biological assets, which we think will have some scientific contribution. This is because we believe that the biological assets in the salmon farming industry might include some individual aspects, standing out from the general agriculture industry. We think that the biological asset in the salmon farming industry might be more susceptible to diseases and unforeseen events like algae, which potentially could result in more uncertain estimates. The historical volatility of salmon prices may also increase the uncertainty regarding reliable fair value measurements (Fish Pool). By looking at an industry with these different features, our results might stand out and contribute to the existing field of research.

The International Financial Reporting Standards (IFRS) and the International Accounting Standard (IAS) 41 have brought along challenges for both producers and users of financial statements in the salmon farming industry. One of the problematic aspects revolves around the valuation of biological assets, after IAS 41 required fair value assessments on all assets related to biological activity. This requirement has created difficulties when determining reliable fair values for some biological assets, such as farmed salmon. Bernhoft & Fardal (2007) claims this might lead to a reality where users of the financial statements tend to look away from the fair value adjustment, creating their own subjective valuation. This does not only apply for the external user such as investors and lenders, but also the management of the companies when they are in the process of financial decision making. With this legislation at hand, we base our thesis on the valuation of farmed salmon, questioning the value relevance of the reported financials. This study will therefore focus on the following research question:
Are reported biological assets in the salmon farming industry value relevant at fair value under IAS 41?

The aim for our thesis is to investigate the association between the valuation of biomass in the salmon farming industry and the market value of equity for the

respective companies. We will therefore look into how a change in the reported biological assets will impact the market value of equity. These results, together with a historical cost comparison, where we remove the fair value adjustment, will give new insight to the standard setters of whether the use of fair value on biological assets in the salmon farming industry are value relevant under IAS 41.

Salmon farming is an industry where the average spot price of salmon has grown rapidly over the last couple of years and where companies in the industry has grown exponentially. Through historical performance of the industry, we have examined that over the last two decades, the average turnover has increased ten times the amount. Furthermore, the average spot price of salmon has increased from NOK 25/kg in 2005 to NOK 76/kg in 2018 (Fish Pool), and the percentage of biological assets on total assets are on average 30-50% (Berg, 2017). This proves that the valuation of these assets has a substantial impact when determining the value of a company in the salmon farming industry.

Fair valued biological assets consist of an historical cost measurement and a fair value adjustment. These two components will therefore be tested in our three hypotheses, in order to answer our research question regarding value relevance on fair valued biological assets. From this outset, we have developed the following alternative hypotheses supporting our research question:

Hypothesis 1: *Reporting biological assets at historical cost is value relevant.*

Hypothesis 2A: *Fair value adjustments on biological assets in the balance statement are value relevant.*

Hypothesis 2B: *Fair value adjustments on biological assets in the income statement are value relevant.*

To answer our research question and our set of hypotheses, we are using the Ohlson price model. This formulates a company's market value as a function of book value of equity and net income. We will also perform additional tests,

supplementing our primary analysis. We have limited our dataset to include farming salmon companies currently listed on the Norwegian stock exchange in the period 2008-2018. Share prices are gathered from Bloomberg and the reported financials are manually retrieved from quarterly reports.

We find statistical significance for all our hypotheses. Reported biological assets without fair value adjustment (at historical cost) has a positive relation to the market value of equity. Fair value adjustments do also have a significant relation to the market value of equity. There is also a stronger explanatory power to price fluctuations when including fair value adjustments. This indicates a stronger presence of value relevance when including fair value. The results from our additional tests support our original answer to the research question, when only considering the value relevance of the reported financials. However, they also show that it is no longer certain that fair value estimates are value relevant when additional publicly available information like salmon spot prices is included in the analysis.

In the first part of our thesis, we will describe the regulations in IFRS 13 and IAS 41, legislating how to report biological assets. Further, we will take on the theoretical framework describing the capital market-based accounting research and existing research on value relevance. We will then take on value relevance in connection to biological assets, mainly focusing on past research regarding the salmon farming industry. In the next part, we will introduce the research method that is used to answer our research question. Last, we will present the results from our analysis and determine whether reported biological assets in the salmon farming industry are value relevant at fair value under IAS 41.

4.0 Accounting regulations for biological assets

The reporting of biological assets in the agriculture industry are under the jurisdiction of IAS 41 and IFRS 13. We will in this chapter present these legislations.

4.1 IAS 41

IAS 41 regulates the accounting method for biological assets during their period of biological transformation. Agricultural assets are measured at fair value less cost of sale at the point of harvest. The reason for this, results from the fact that the transformation process is immediately represented in the financial statements and then the investor alone has the possibility of estimating the future economic benefit (Lefter & Roman, 2007). A valuation, based on historical costs, would not reflect this process because in agriculture, the production income appears much later. The unique exception allowed is only when a market-determined price is not available, and the entity cannot assure a reliable estimate of fair value (IAS 41.30). If this is the case, an entity is permitted to use the "unreliability clause" and recognize the biological assets concerned at cost less depreciation and impairment.

IAS 41 divide biological assets into" bearer biological assets" and "consumable biological assets". Unlike agricultural produce, "bearer biological assets" are self-regenerating, for example, livestock for milk production and fruit trees. In contrast, "consumable biological assets" are harvested at agricultural produce or sold as biological assets. Here, we have examples such as livestock intended for meat production, farmed fish and trees planted for lumber. Unlike many other IFRS standards, the changes in fair value are immediately recognized in the profit or loss account, which also influences the result. Recognizing the changes in value in the income statement due to the transformation process has the advantage of a better relevance for the decision-making process (Lefter & Roman, 2007). In other words, this should increase the value relevance of the reported agricultural financial statements. On the other hand, the immediate recognition in the income statement caused by the adjustments in fair value, leads to higher volatility of reported earnings and by that a higher uncertainty for the financial statement user.

4.2 IFRS 13

IFRS 13 is the standard that sets out the framework for measuring fair value. Fair value is defined as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date" (IFRS 2012). The fact that it is incorporating more information into financial statements is seen as the biggest advantage of fair value accounting (Barth, 2001). Barth also claim that fair value provides more relevant information than historical cost whenever there is an observable market price.

There are primarily three valuation methods in IFRS 13. Market-based methods (based exclusively on market price), present value-methods and replacement cost methods. It has further been developed a value measurement hierarchy that works as a guide for which method that has the best fit, given different circumstances. Level 1 inputs are quoted prices in active markets for identical assets or liabilities that the entity can access at the measurement date (IFRS 2012, 13:76). The next level inputs other than quoted market prices included within Level 1 that are observable for the asset or liability, either directly or indirectly (IFRS 2012, 13:81). This can, for example, be market prices for identical assets in inactive markets. Level 3 is the weakest one related to reliability, including unobservable inputs for assets or liabilities (IFRS 2012, 13:86). The basis for the regulation in relation to market value is that the determined value should be based on a hypothetical buyer in an objective and balanced market. The hypothetical buyer should be independent and voluntary and there should exists no asymmetrical information. The buyer should also be representative of the market and not possess special abilities (IFRS 2012). Level 2 and 3 has received a lot of criticism due to its use of subjectivism measurement. Penman (2012) goes far and states that level 3 even raises concerns, because it is against the idea that accounting information should be based on objective and reliable evidence. Further, he claims that the informativeness of fair value accounting declines as subjective measurements are introduced.

This is the so-called real value hierarchy, and after the rework of IAS 41 in 2013, this is relevant for our thesis, because it is the valuation method used for determining the fair value on biomass in the salmon farming industry.

4.3 Implementation of IFRS in the salmon farming industry

Before 2005, biological assets in the Norwegian market were valued after the Norwegian accounting standards (NASB). The assets were valued as an ordinary inventory, and by that the lowest of historical cost and fair value after Rskl § 5-2, while salmon under 4 kg should be considered at historical cost.

After the implementation of IFRS in 2005, biological assets were valued at fair value, after IAS 41. When first implemented, the salmon industry was critical, saying it was impossible to account the biomass under 4 kg at fair value, which contended the provisions in IAS 41 (Bernhoft & Fardal, 2007). As a result, the industry made use of the exemption rule in IAS 41.30, which as wrap up says; where there is no existing market and where it is unreliable measurements, historical cost should be used. The industry meant the salmon had to be over 4 kg to be valued at fair value, while Finanstilsynet meant 1 kg. The result was that Finanstilsynet decided that salmon under 4 kg also should be valued at fair value. Since there is no existing relevant market for that class of salmon, meaning no observable market price, the valuation should therefore be the estimated harvest volume, corrected for the accumulated future costs (Finanstilsynet, 2011). However, Finanstilsynet did not specify how this adjustment should be made, and the result is claimed to be subjective judgements between the different companies in the industry.

In 2013, IAS 41 got reworked and the standard of how fair value should be determined was now under IFRS 13. The reason for the rework was to eliminate the different interpretations on how the fair value should be measured under IAS 41. Finanstilsynet has on several occasions conducted industry-supervision in the aquaculture industry, where the main goal was to uncover whether there existed a uniform practice regarding the measurement of fair value. The industry supervision in 2015 showed that even after 13 years

of IFRS regulations, there is still different practices on how the fair value are estimated in the industry (Finanstilsynet, 2015).

5.0 Theoretical framework

In the following chapters, we will present relevant literature to support our research question and hypotheses. First, we will look at the purpose of financial statements and the general interpretation of value relevance. We will then take on past studies covering different aspects of value relevance, before we will connect it all to biological assets and the salmon farming industry. Our objective is not to give an inclusive description of value relevance literature, but rather to give an understanding to this line of research. This paper places value relevance research in perspective within capital market-based accounting research. Hopefully, it provides the reader with a fair knowledge of some of the most important conclusions from value relevance research.

5.1 The purpose of financial statements

Barth (2006) states that the objective of financial reporting is to provide stakeholders with useful information for making economic decisions. The International Accounting Standards Board (IASB) categorize the purpose of financial statements in two parts, where the first and main objective is, to provide decision-relevant information to the user (IASB, 2018, ch. 1). Second, there is a control purpose, which means that the financial statements should work as a "control-system" within the companies. With its control purpose, the financial statements should provide useful information to evaluate control-performance and stewardship (Kothari, Ramanna & Skinner, 2010). Further, the information in financial statements should be relevant and reliable. The accounting amount is relevant if it is capable of making a difference in the users decision-making process, and reliable if it represents what it purports to present.

5.2 Capital market-based accounting research

Studies on the relationship between capital markets and financial statements have a broad field of research that originated with Ball & Brown (1968) and Beaver (1968). The literature has later grown rapidly (Kothari, 2001), and the empirical research on the relation between capital markets and financial statements are in general now referred to as capital markets-based accounting research (CMBAR) (Beisland, 2009). Market efficiency is an important field in this study, described as when a market and its security prices fully reflect all available information (Kothari, 2001). In the late 1960s and 70s, capital markets were described as quite efficient and unbiased (Ball & Brown, 1968). This meant that if the information is useful in forming capital asset prices, the market will quickly adjust their asset prices to that information. Both Beaver (2002) and Kothari (2001) have, later on, reviewed prior market-based research. One of the key findings is that later established evidence of existing market inefficiency has created an entirely new area of research, examining long-horizon stock-price performance following accounting events. This is in contrast to short-window event studies in the late 1960s, 1970s, and 1980s. These later studies by Kothari and Beaver have concluded that the capital markets are not as efficient and unbiased as stated by Ball & Brown.

Because of the broad field of CMBAR, it can be categorized into several subfields. Kothari (2001) refer to them as sources of the demand for market-based research in accounting that explain its popularity. He presents the subfields as (i) fundamental analysis and valuation, (ii) tests of capital market efficiency, (iii) role of accounting in contracts and in the political process and (iv) disclosure regulation.

Beaver (2002) also presents sub-categories within CMBAR, which are: (i) market efficiency, (ii) Feltham-Ohlson modelling, (iii) value relevance and (iv) analysts' and discretionary behaviour. One can argue the categorization of CMBAR is a matter of preference. Beaver views value relevance as a field of its own, but it is also possible to consider it as being part of both market efficiency and fundamental analysis and valuation, like Kothari.

5.3 Value Relevance

Value relevance studies comprise an important part of capital market-based accounting research (CMBAR). Defined in the most general sense, value relevance research has a long history (Miller and Modigliani 1966). However, the term came into common usage in the early 1990s by Beaver (2002). Value relevance has been a major area of empirical research over the last decades. Holthausen and Watts (2001) identify 54 value-relevance studies, where only three of which were published before 1990. We will primarily focus on recent research, with literature from the last twenty years.

Although there exist many definitions of value relevance, Francis & Schipper (1999) claimed it can be interpreted as the statistical association between financial information and market values or returns. As the covariation grows, so does the usefulness of accounting information to investors when they determine a firm's market value, representing the value relevance of the information. Consistent with this interpretation, Beisland (2009) defines value relevance as "*the ability of financial statement information to capture and summarise information that determines the firm's value"*. This may capture how value relevance research is conducted and how the research does not focus on how accounting information is used, but rather asks if the accounting information is able to explain variations in market values over time.

As mentioned, value relevance can be measured in short term event studies and long-term association studies. The primary purpose of value relevance research is according to Barth et al. (2001) is to extend our knowledge regarding the relevance and reliability of accounting amounts as reflected in equity values. Studies by Holthausen & Watts (2001) built on this, classifying value-relevance studies into three categories:

(i) Relative association studies compare the association between stock market values and other alternative bottom-line measurement. This study might, for example, examine the differences in value relevance of reported financial

information under two different standard setters, like Van der Meulen, Gaeremynck & Willekens (2007) did with IFRS and GAAP.
R^2 of a regression using different bottom line accounting numbers is often here used to express the explanatory power of the standard, where a higher R^2 indicates a higher value relevance.

(ii) Incremental association studies investigate whether an accounting number of interests can be used in explaining value, given other specified variables. That accounting number is usually value relevant if its estimated regression coefficient is significantly different from zero.

(iii) Marginal information content studies examine whether and to what degree accounting numbers add information beyond existing information sets, available to investors. Studies in this category are typically short window event studies to look at the association between changes in stock prices and other market values and the release of an accounting number. The release of new information and price reactions are considered evidence of value relevance. An example of this study is Beaver et.al. (1980) where they examined security price behaviours at the release of new accounting series.

Our study will be an incremental association study, where we are investigating to what degree financial information (especially reported biological assets) can describe movements in market value.

5.4 Models for measuring value relevance

The objective of value relevance studies is to investigate reported financial statements and its relation to the market value of equity and returns (Barth et al. 2001). Financial theory states that the theoretical value of a company's equity or enterprise value is equal to the present value of all future free cash flows to equity (FCE) or paid out dividends. Holthausen & Watts (2001) argues that there are three different valuation models used in different value relevance studies; *earnings model, balance sheet model and Ohlson model.*

5.4.1 *Balance sheet model*

Many incremental studies taking on balance sheet components, uses the balance sheet model *(*Holthausen & Watts, 2001). Here, the basic assumption is that the market value of equity equals the market value of assets minus the market value of liabilities (e.g., Barth 1991). The raised concern with this model is that it will only hold if the relevant market exists (i.e. an efficient market for each assets and liabilities) and if all of the markets are competitive. This means there could be no abnormal returns. If the company is generating abnormal earnings, it will not be discounted in the model as long as it is not sold separately from the company (Holthausen & Watts, 2001). The model also implicitly assumes no corporate control frictions, which means that the management would liquidate the company if that is the optimal action. The association between the market value of equity and the accounting numbers is the book value of assets and liabilities, which together convey information about how the market is valuing the company. Due to these concerns, we will not use this model to measure of the market value of equity.

5.4.2 *Earnings model*

The second model is used in earnings associated studies, where earnings are assumed directly linked to future cash flows (FCF) or valued directly. In this model, the market value of equity is determined by the present value of all forecasted future cash flows. Barth et. al. (2001) makes the assumption that the most relevant user of financial statements are the investors, and how they use it to determine a company's value of equity. According to Bart et.al, their valuation is defined as the present value of future free cash flows going into the book value of equity. It is therefore also referred to as the discounted cash flow model (DCF).

$$MVE = \sum_{n=i}^{\infty} \frac{CF_n}{(1+r)^n}$$

MVE = *market value of equity*

n = *time periods from one to infinity*

r = *discount rate*

CF = *cash flow*

5.4.3 *Ohlson Model*

The last model derives from the income model and is based on the theory that the market value of equity equals the present value of future residual earnings, discounted by the cost of equity (firm-specific). Ohlson (1995) proved that the DCF/dividend model can be expressed by accounting variables if the clean surplus relation (CSR) holds. This requires that book value of equity only changes with net income and dividends to owners and can be expressed as:

$$BV_t = BV_{t-1} + Earnings_t - Div_t$$

BV_t = *book value of equity at time t*

$Earnings_t$ = *net income after tax at time t*

Div_t = *net dividends at time t*

Using the result from these models into the dividend model, the residual income model can be derived. The market value of the company's equity is the book value of equity plus the discounted value of future residual earnings. Here, residual earnings are defined as the difference between accounting earnings and the required return on the book value of equity (cost of equity). The residual income model will always be equal to the dividend model if the clean surplus relation holds in the future. This model provides a more detailed specification of the relationship between the market value of equity and future residual earnings (earnings over the required rate of return), and the current book value of equity (Ohlson, 1995). If the CSR holds in the future, the residual income model can be derived:

$$MVE_0 = BV_0 + \sum_{t=1}^{\infty} \frac{Earnings_t - r(BV_{t-1})}{(1+r)^t}$$

MVE_0 = *market value of equity at time 0*

BV_t = *book value of equity at time t*

r = *discount rate*

$Earnings_t$ = *net income at time t*

In this model, the market value of equity is equal to the book value of equity plus the present value of residual earnings. The market value of equity is in this model a function of both the book value of equity and future income. Ohlson also expresses this in his article, claiming that the core of the valuation model is that it expresses value as a weighted average of capitalized current earnings (adjusted for dividends) and the current book value of equity. This is the fundament of the Ohlson price model, which can be expressed as:

$$MVE_t = \beta_0 + \beta_1 BV_t + \beta_2 Earnings_t + \varepsilon_t$$

MVE_t=*Market value of equity at time t*

BV_t= *Book value of equity at time t*

$Earnings_t$ = *Earnings at time t*

This regression model will describe how the book value of equity and earnings (independent variables) impact the market value of equity (dependent variable). By analysing these variables, it will therefore be possible to make assessments on their value relevance. It will be possible to determine to what degree the variables are related to the market value of equity, and how they are related. This is the most used model in value relevance research (King & Langli, 1998; Francis & Schipper, 1999; Collins et al.,1997 etc.), and is also the appropriate one to use in our study.

5.4.4 *Return model*

Another tool for measuring value relevance is return models, which also are based on the concept of clean surplus accounting. If this concept holds, the change in book value of equity will be equal to net income of the period, given no dividend pay-outs. In order to analyse how the changes in market value of equity are related to the value creation (from the financial reports), will return-specifications be used to determine the relation between changes in market value of equity (ΔMVE) and earnings. The model may then according to (Kothari & Zimmerman, 1995) be expressed as:

$$\Delta MVE = \beta_0 + \beta_1 Earnings + \varepsilon$$

The variables in the return model are usually divided by total outstanding shares. Then, we get a model describing changes in stock price as a function of earnings per share (*EPS*).

$$\Delta P = \beta_0 + \beta_1 EPS + \varepsilon$$

This model is only using information from the income statement, while the above price model is using both balance and income financials. The earnings response coefficient is the commonly used estimate in regressions with return-specifications. This coefficient expresses the level of relation between the stock return and the net income (Kothari, 2001). The variables are often scaled/deflated on last periods stock price. Then we get the following model:

$$\frac{\Delta P}{P_{t-1}} = \beta_0 + \beta_1 \frac{Earnings}{P_{t-1}} + \varepsilon$$

Value relevance researchers debate differences between the price model above and the return model, regarding their ability to explain the relation between a company's market value and its financial information. One of the most well-

known researchers on this field are Kothari & Zimmerman (1995), saying there is no flawless methodological option. Still, they conclude that the price model is a more specified option because its coefficients are unbiased. The return model has, on the other hand, less econometry issues. We will use the price model for our primary analysis and use the return model to test its robustness.

5.5 Past studies on the value relevance of accounting information

In this chapter, we will present past research discussing the value relevance of accounting information. Value relevance research can, according to Beisland (2009), be categorized into the following: Value relevance of (i) earnings and other flow measures, (ii) equity and other stock measures, (iii) value relevance over time and (iv) value relevance of alternative accounting measures. We will look at existing research and structure them into these four categories, with a focus on the value relevance of income statements (earnings) and balance sheets (equity). This is because we will use accounting information from these two categories in our following analysis.

5.5.1 Value relevance of income statements

Much of the existing value relevance literature takes on how accounting measures influence the market value of equity, where the measurement of interest generally is bottom line earnings. Ball & Brown (1968) are considered the first to study the relation between annual income reports and the market value of equity. They examined abnormal returns before and after announcement dates, with results indicating that income captures 50% or more of all the information about a company that becomes available during a year. From this outset, they concluded that income can be informative to describe the fluctuation of stock prices. Further, Ball & Brown argues that earnings announcements do not lead to any unusual movements in stock prices, mostly because this information already is incorporated in the stock price even before it is available. On the other hand, the market will react if there is a divergence between the expected and the actual income statement.

This is, in general, supported by Beaver (1968) who examined the extent to which stock investors perceive earnings to possess informational value. His study indicates a large growth in trade volumes of stocks in the week earnings are announced, and that the magnitude of changes in stock prices in the week of announcement is much larger than in a non-report period. With these findings, he concludes that information from the respective income statements is significant.

Later on, Lev (1989) points out that it has, after the publication of Ball & Brown (1968) and Beaver (1968), become increasingly evident that earnings usefulness does not lend itself to a straightforward assessment. As opposed to earlier research, he claims that income statements do not have the same relevance to investors as predicted earlier. His earnings research evidence suggests that while earnings appear to be used by investors, the extent of earnings usefulness is rather limited. This is indicated by the weak correlation between stock returns and earnings and by the modest contribution of earnings to the prediction of stock prices and return. Lev (1989) points out various reasons for the "poor showing" of earnings, among which are the investors irrationality (noise trading), the low information content and the quality of financial statements.

Later studies confirm the view of the limited explanatory power of financial statements. Francis & Schipper (1999) raised their concern about the fact that financial statements might have lost a significant portion of its relevance in the last 40 years. To test their concern, they measured value relevance by examining relations between market value measurements and accounting information. The first relation investigated the ability of earnings to explain market-adjusted returns, where they regressed security returns on the change in earnings during the period of 1952-94. Their analysis showed that returns to trading strategies based on the sign and magnitude of earnings have decreased over the sample period. Consistent with these claims of a loss in value-

relevance, Alford (1993) and Collins et al. (1997) report of a steady decline in the value-relevance of earnings over time.

In addition, studies by Basu (1997) and Hayn (1995) suggest that negative earnings and nonrecurring items can affect the value relevance of earnings. Basu (1997) points to the conservatism principle on reported financial statements and that in recent years, firms have become increasingly likely to report negative earnings and nonrecurring items. This also suggests a decline in the value relevance of earnings across time. The relation between negative results and declining informativeness is supported by Hayn (1995), who claims that because investors hold a liquidation option, negative results cannot last forever and are less relevant and informative. Her price-earnings and return-earnings regressions show that a larger portion of negative results leads to lower value relevance. The use of strong, positive results in the income statement will, according to Hayn (1995), on the contrary boost the informativeness. In her analysis, both the earnings response coefficient and the return-earnings correlation almost tripled when loss cases are excluded. The majority of value relevance research focus on the value relevance of earnings, but earnings are exposed to accruals. The size of accruals is made by accountants and managers and is to an extent a result of subjective judgments (Beisland 2008). This subjectivity has led a debate whether if it might lead to earnings management. Marquardt & Wiedman (2004) found that discretionary accruals were significantly more positive in the year of the offering for this group than for firms where managers did not participate in a secondary offering.

5.5.2 Value relevance of balance statements

In this chapter, we will look to what degree the balance statement can describe movements in a company's market value. Value relevance research is often focusing on change, flow measures and stock returns. Book values from the balance sheet are normally quite stable, so one might say it's an inadequate estimate to describe shifts in the stock market. Still, a lot of existing value relevance research proves the opposite, documenting a high association

between movements in a company's market value and its book value of equity (Francis & Schipper 1999; Collins et. al. 1997; Barth, et al. 1996)

As already mentioned, Francis & Schipper (1999) performed tests to examine relations between market value measurements and accounting information. Even though they found evidence that the explanatory power of income statements on changes in stock returns has significantly decreased over time, they found, in contrast, no evidence of a decline in value relevance of book values of assets and liabilities for market equity values. Rather the opposite.

This supports the study by Collins et. al. (1997) claiming that the same factors contributing to a decline in the value relevance of earnings could cause an increase in the value relevance of book values. While earnings have decreasing importance when earnings are negative or contain non-recurring items (Basu, 1997; Hayn, 1995), other empirical studies suggest that book values take on increased importance (Collins et al., 1997). Collins et al. (1997) present two explanations to justify and give reason for these findings: (i) book values serve as a better proxy for future earnings when current earnings contain large temporary components, and (ii) book values serve as a proxy for the firm's abandonment option. In general, this research suggests that the value relevance of earnings and book values move inversely to one another, and if the value relevance of earnings has decreased over time then the value relevance of book values should have increased.

Barth, Beaver & Landsman (1996) examine the valuation roles of book equity and net income as a function of financial health. They describe the income statements and balance statement as two supplementary features of a firm's financial reporting, and that a distinctive role of the balance sheet is to determine loan decisions and control debt contracts. Because liquidation values from the balance affect equity values, Barth et.al. (1996) suggest that the balance sheet increases in importance and the income statement decreases in importance as financial health decreases. Hence, it is not surprising that the

balance sheet is more value relevant on distressed companies. This brings Barth et al. (1996) to the conclusion that the balance sheet and income statement fulfil different roles, and that which one of these two an investor classifies as the most value relevant is depending on the financial health of the respective firm. Some empirical studies, taking on the value relevance of balance sheet estimates, are also comparing fair value estimates to historical cost estimates. This will be discussed further in the next chapters.

5.5.3 Value relevance over time

Collins et. al. (1997) looks at three factors that are likely to contribute to change in the value relevance of earnings and book values over time:
i) the increased importance of service and technology-based firms that invests in intangibles, ii) more nonrecurring items and iii) frequency of negative earnings. One of the results in the accounting area is more adoption of fair value accounting into the accounting standards. The question is whether these changes are having an impact on the value relevance, going from historical cost accounting towards more of a dynamic fair value-based accounting system.

This question has been further analysed by numerous researchers in recent years. Collins et al. (1997) investigated the value relevance of earnings and book values of equity over time, using the valuation model presented by Ohlson (1995). His study showed that the incremental value relevance of earnings had declined over the last 40 years and replaced by an increased value relevance of book values. One explanation for this could be due to the growing adoption of the balance sheet approach by IASB. The overall conclusion from Collins et. al. (1997) was that the combined value relevance of both earnings and book values had increased slightly over the sample period. This conclusion is somewhat in contrast to the more “popular” view that the changes must have led to accounting measures becoming less relevant (Beisland 2008). Another study done by Francis & Schipper (1999) had similar findings to the ones by Collins et. al. (1997). In contrast, Brown et al. (1999) found that value

relevance measured by R^2, had declined significantly when controlling for scale effects.

5.5.4 Value relevance under fair value accounting

In this chapter, we will take on how of fair value accounting affect the value relevance. Several researchers conclude that fair value estimates are more value relevant than historical cost i.e. (Barth, Beaver, & Landsman, 1996; Carroll, Linsmeier, & Petroni, 2003; Khurana & Myung-Sun, 2003). Others argue against the reliability of including more fair value in financial statements, due to the increase of subjective measurements i.e. (Dichev, 2011; Penman 2012; Holthausen & Watts, 2001).

It could arguably be said that there is a trade-off between relevance and reliability of the financial statements when discussing fair value and historical cost. Where the increase of relevance in terms of increased use of fair value into financial statements could be at the expense of reliability, due to subjective valuation judgments. This is a widely discussed field, where i.e. Barth (2006) argues that the FASB adoption of more fair value accounting will result in more relevant financial statements. On the contrary, Dichev (2008) argues that the adoption of more fair value leads to less reliable financial statements, or more specific less persistent earnings.

Barth et.al. (2001) claims existing literature provides substantial evidence that fair value estimates are relevant to investors and reliable enough to be reflected in the market value of equity. This refer to those cases where there exists an observable market price for the asset that are measured at fair value (IFRS 13). The question further is whether the use of fair value on assets, where there are unclear market prices, leads to more or less relevant financial statements. The debate has been going on since the implementation in 2005, and the researchers are divided. Penman (2012) argues that the informativeness of fair value declines when subjective estimates are introduced. Barth et al. (1996) claims, on the other side, that the reliability and relevance increase with the use of fair value accounting. However, Barth et al. (1996) also states that there are

issues related to fair value accounting, due to subjective measurement. Still, they conclude that core earnings (earnings from core activities minus non-recurring income or expenses) and fair value accounting are unrelated.

Penman (2012) goes further and argues that fair value issues introduce errors not only to the balance sheet, but also the income statement (reports the adjustments in fair value). He argues that in extreme cases, fair value measured by non-observable market price could result in uninformative balance sheet and less uninformative income statement. Further he claims that the analyst would have difficulties carrying out a quality analysis on fair value accounting in cases where there exist no market values. Based on this claim, he question how estimation errors and biases would be discovered by the analyst. FASB statement 157 require a disclosure about the valuation methodology, which helps, but the analysis on earnings quality would however be unclear.

As proven, literature points out several disadvantages when discussing fair value accounting. Dichev (2008) also takes part in this debate, claiming recognized fair value changes in capital or in profit and loss are responsible for the higher volatility of reported results, thereby making the value creation process vague. In volatile markets, the value of an item can change quite frequently, which may lead to major fluctuations in companies' value and earnings. Dichev (2008) argues that the increase of fair value accounting leads to an increase in abnormal earnings and costs, due to more frequent "write-downs/up", and therefore leads to less persistent earnings. This is one of the reasons why we want to investigate how the adoption of fair value on biological assets may lead to less persistent earnings and unreliable book values, and thereby less value relevance. Some accountants may also find fair value measurements less reliable than historical cost. For example, accountants often look to the market when finding a value for new assets or investments. If there is no clear market price, accountants have to make subjective estimates when valuing the assets. Kinserdal (2015) states that humans are bad at making predictions, referring to the historical interest projections by Norges Bank as

an example. Further, he asks “What is the usefulness and relevance of having fair value measured assets, when the estimates are so unreliable”? He claims this subjectivity may lead to unreliable book-and market values. Sebastiana et al. (2014) also points out the fact that many blame fair value measurements in financial statements to be one or even the main driver of the financial crisis in 2008.

5.5.5 Fair value accounting of non-financial assets

The research discussed in this chapter report mixed results and opinions regarding the use of fair value accounting of non-financial assets. Little research has been carried out on the use of fair value accounting for the measurement of biological assets, and the scope of the studies conducted has been narrow. Generally, they focus on comparisons between historical cost and fair value, a subject of long-standing controversy among accounting academics and researchers.

Christensen & Nikolaev (2013) studied the choice between fair value and historical cost for non-financial assets when market forces determine the outcome of this choice. They collected and analysed data on accounting policies for intangible assets, investment property, and PPE for a sample of 1,539 companies. Their findings suggest that, for non-financial assets, the choice between the two valuation methods lies with historical cost accounting. Their evidence suggests that managers’ resistance to the use of fair value is likely to be driven by the costs of establishing reliable fair value estimates rather than a disagreement with standard setters on the potential benefits of fair value accounting. Christensen & Nikolaev (2013) therefore conclude that firm managers view fair value accounting for non-financial assets as costly.
In contrast to the previous academic discussion concerning asset measurement, focusing exclusively on fair value and historical cost, Huffman (2013) has examined whether asset measurement related to asset use assures more value-relevant information to investors. She concludes that accounting information is more value relevant when consumable biological assets are measured at fair value and bearer biological assets are measured at historical cost.

5.6 Value relevance of biological assets

Value relevance of assets at fair value has been a widely discussed field over the past decades. However, most of the academic literature addresses the fair value in context of financial assets. Topics related to value relevance of other fair valued assets are much less common. In these last two chapters, we will focus on the value relevance in context to fair value on biological assets after IAS 41, more specific the salmon farming industry. Past research suggests that the introduction of fair value on all biological assets in agriculture has led to more relevant information for the stakeholders (Argilés et. al., 2012; Misund, 2016; Gonçalves et. al. 2017). However, the main issue or disadvantage with fair value on some biological assets is the absence of active markets, which might result in subjective valuation models. Furthermore, past research mention that there are difficulties with the valuation of biological assets, because each asset has its own attributes and life cycle.

Gonçalves et. al. (2017) examined the value relevance of fair valuation in the context of IAS 41, looking to enhance knowledge on fair valuation issues in the context of agriculture. They analysed 389 listed firms across nine industry sectors, using the Ohlson price model. In general, the recognized amount of biological assets under fair value were considered value relevant. They further explored the difference in value relevance between bearer and consumable biological assets. Regarding consumable biological assets (such as farmed salmon), they found a slightly lower value relevance. Based on their results, they claim that investors value recognized biological assets, but they do so independently from the corresponding disclosure level. They state a probable explanation is that there typically is an available market price for consumable biological assets because they are usually sold in the short term.

Argiles et al. (2012) performed an empirical study, comparing the value relevance of fair value and historical cost estimates through its ability to assess future cash flows. For this analysis, they had a sample of Spanish farms valuing their biological assets at historical cost and a sample applying fair

valuation. They used a model, calculating subsequent errors, for samples of farms using HC and FV and also the mean absolute percentage error. As a result, they found no significant differences between the valuation methods in their ability to assess future cash flows. Still, their findings suggest that fair value is more reliable in the decision-making process for agents in the agriculture sector. Moreover, they conclude that fair value seems to be more suitable for accounting preparation than historical cost.

5.6.1 The salmon farming industry

After the implementation of fair value in the salmon farming industry, there seems to be limited confidence in reported fair value adjustments on biological assets. This was part of the motivation for the research done by Misund (2016), who is considered one of the first to examine the value relevance of reported biological assets in the salmon farming industry. He analysed the fair value adjustments on the biological assets and its value relevance. The study consisted of nine independent companies, listed on Oslo stock exchange, which resulted in a total of 215 observations. The accounting financials were manually extracted from the quarterly reports, and the stock prices were retrieved from Datastream. The analysis was done by using the Ohlson price model, where the fair value adjustments in both the balance sheet and income statement were extracted as own independent variables. He also used the return model to supplement his analysis. The overall conclusion in this study is that fair value adjustments on biological assets in the salmon farming industry is value relevant for the investor. He also finds book value of equity to be more value relevant than net income.

During the last decades, the adoption of fair value accounting has increased, even on assets where observable market prices are unclear. Stenheim (2008) argues that this adoption of fair value on areas, such as the salmon farming industry is controversial. The reason for this is the incentives an accounting producer may have to manipulate the income statement and balance sheet, especially when it is difficult to determine reliable fair value estimates on their assets.

Many companies in the salmon farming industry are using “future prices” from the global exchange platform Fish Pool, in order to estimate future salmon prices and further use it when determining the fair value on their biomass. However, the liquidity on Fish Pool is low compared to other commodity markets (Asche, Misund & Oglend, 2016), and the future-prices for salmon lack the important price discovery role. This role means that future-prices may tell something about future spot prices, like it does in the more liquid commodities markets, as oil and gas (Asche, Misund & Oglend, 2016). This low liquidity, on Fishpool, could potentially lead to price manipulation (Misund, 2016). The EU competition authority are currently investigating possible price manipulation in the industry (Bøe & Bach, 2019). The investigation has just started, but if the EU commission find guilt of price manipulation, it could support the view Misund et. al (2016) has on the possibility for manipulation in markets where the liquidity is low. This is relevant due to the fact that most of the companies are using future-prices in their fair value estimates on biological assets.

5.7 Hypotheses

This chapter marks the beginning of the second part of our master thesis. On the basis of the existing theory and empirical data presented in the first part, we have developed a set of hypotheses that will help answering our research question. We will first present our aim and the associated research question for our empirical study. Then, we are going to present our three hypotheses.

The aim of our empirical study is to analyse the value relevance of reported biological assets in the salmon farming industry. We want to give answer to whether reporting after IAS 41 gives value relevant information for the users of financial statements. Based on this, and presented existing research, we have formulated the following research question:
Are reported biological assets in the salmon farming industry value relevant at fair value, under IAS 41?

5.7.1 Motivation and development of hypothesis 1

The discussion on the relevance and reliability of accounting information has increased after the adoption of fair value accounting. The value adjustments that arise during the growth of a biological asset, are to be reflected in the financial statements (IAS 41). These adjustments consist of both growth and price fluctuations. The use of marked-based fair value accounting is therefore, according to IASB, presumed to give a more relevant picture of the value of a company, compared to traditional historical cost valuation. The argument against fair value is mainly that the use of IAS 41, in many cases, leads to less reliable valuation of biological assets. It is especially problematic when there is no active and available market price for every weight-class of salmon. This may lead to a substantial use of subjective judgments in the asset valuation. Therefore, it has been raised concern on whether these adjustments are value relevant when they are based on subjectivity and individual opinions. The degree to how these financial statements gives an accurate picture of a company's market value represent its *value relevance*. The primary purpose of this research is therefore to extend the knowledge regarding the relevance and reliability of accounting amounts on biomass as reflected in financial statements.

The requirement of fair value has created difficulties when determining reliable fair values for some biological assets, such as farmed salmon. This is claimed to be controversial, due to the incentives the accountant producer may have to manipulate the financial statements (Stenheim, 2008). It could as mentioned lead to a reality where users and producers of the financial statements tend to prepare their own subjective evaluation of these assets (Bernhoft & Fardal, 2007).

The discussion on how fair value brings relevant information is discussed widely by researchers, often comparing it to historical cost. Several researchers conclude that fair value is more value relevant than historical cost i.e (Barth, Beaver, & Landsman, 1996; Carroll, Linsmeier, & Petroni, 2003; Khurana &

Myung-Sun, 2003). Others argue against, questioning the reliability of fair value measurements, due to the increase of subjective valuation measurements (Dichev, 2008; Penman, 2012; Holthausen & Watts, 2001). Dichev (2008) claims recognized fair value changes in capital or in profit and loss are responsible for a higher volatility of reported results, thereby making the value creation process vague. He further argues that the increase of fair value accounting leads to an increase in abnormal earnings and costs, thereby less persistent earnings. Some accountants may also find fair value measurements less reliable than historical cost. For example, and as already mentioned, do accountants often look to the market when finding a value for new assets and investments. If there is no clear market price, accountants have to make subjective estimates when valuing the assets. This may lead to unreliable book- and market values, and declining value relevance.

In light of the ongoing debate, both by researchers and in the farming salmon industry, we find it highly relevant to also examine the value relevance of biological assets without fair value adjustments. By analysing historical cost estimates, the results will show how the absence of fair value and the current regulation affect the value relevance. It will also be an important basis of comparison for our next two hypotheses. With this foundation, we present the following alternative hypothesis:

Hypothesis 1: *Reporting biological assets at historical cost is value relevant.*

5.7.2 Motivation and development of hypothesis 2

Hypothesis 1 looks at the reported book values and earnings at historical cost, evaluating its value relevance. In extension to this, it is also interesting and highly relevant to address the fair value adjustments. The theoretical motivation presented for hypothesis 1 is a sound basis to build on for hypotheses 2A and 2B. We will in addition bring up research debating the difference in value relevance between balance sheet and income estimates.

The debate on whether fair valuation of biological assets in the salmon farming industry are relevant or not has been ongoing since the implementation of IFRS in 2005. The industry meant that salmon under 4kg was impossible to measure at fair value, while Finanstilsynet and the standard setters (IFRS) suggested that all biological asset should be valued at fair value. This debate is still ongoing. In the salmon farming industry, changes in biological assets from one period to another (due to fair value adjustments) is recognized in the income statement, and the sum of total biological assets are reflected in the balance sheet. The fair value adjustments on biological assets will therefore affect both the income and balance statement. For our next hypotheses, we therefore want to examine the value relevance in both statements, through its fair value estimates.

Prior research that have examined the value relevance of income statements concludes of a decline in value relevance over time (Lev 1989; Francis & Schipper 1999; Collins et. al. 1997). Collins et.al. (1997) also states that the value relevance of earnings and book values move inversely to one another, and that if the value relevance of earnings has decreased over time, then the value relevance of book values should have increased. Even though his study was done before the implementation of IFRS, this still looks to be the overall opinion. Beisland (2008) makes the same conclusion when evaluating the development of value relevance in Norway after implementation of IFRS. In general, the value relevance literature shows that estimates from the balance statement often are considered value relevant, but that is necessarily not the case regarding the income statement.

Based on the presented studies, we want to test if the fair value adjustments are value relevant and whether the overall value relevance has increased after the implementation of IAS 41. Our two last hypotheses are formulated as alternative hypotheses, claiming that fair value adjustments are value relevant.

Hypothesis 2A: *Fair value adjustments on biological assets in the balance statement are value relevant.*

Hypothesis 2B: *Fair value adjustments on biological assets in the income statement are value relevant.*

6.0 Empirical methods

Research design is defined as a framework of methods and techniques chosen by a researcher to combine various components of research in a reasonably logical manner, so the research problem is efficiently handled (Brown, 2004).

In this study, we will have a deductive and quantitative approach. Based on existing theories and studies, we have formulated a set of hypotheses to test our research question. This means that we use existing literature to create an empiric foundation for our study. In this chapter, we will present our chosen research methods, followed by describing our data sample in chapter seven. Based on the price model, we will use a price regression where the market price is the dependent variable, and the book value of equity and net income are the independent variables. We have further tested and processed our data to assume the needed assumptions are met in order to use the ordinary least squares method (OLS) in our regressions. This is an incremental association study (Holthausen & Watts, 2001) where we investigate whether accounting numbers associated to biological assets can be used in explaining the market value of equity, given other specified variables. The accounting numbers will be considered value relevant if its estimated regression coefficient is significantly different from zero. We will also use R^2 to express the explanatory power of the accounting numbers, where a higher R^2 indicates a higher value relevance. This will be explained further in the next chapters. We will also use additional tests to supplement our analysis.

6.1 Variable description

Table 1- Variable definitions

Variables *	**Definition**
MVE	market value of equity
BV	book value of equity
Earnings	net income after tax
BV(HC)	book value of equity minus fair value adjustments
Bio	total biological assets
AFV	fair value adjustment on biological assets
Earnings(HC)	earnings minus fair value adjustments
AdjBio	fair value adjustments in the income statement
HC	biological assets minus fair value adjustments
it	company *i* at time *t*

* all variables are scaled with total outstanding shares and "winsorized" at a 1% level

6.2 Price model 1 – traditional model

The traditional and most common approach to measure value relevance between the market value of equity and the reported financial statements is the price model, which has its foundation in the Ohlson model (Ohlson, 2005). Further, Ohlson & Penman (1992) reviews earnings and book value of equity as bottom line figures in the income statement and balance sheet, and together they serve as a primary indicator for the market value of equity. We therefore find it natural to use this model in our thesis, as we overall want to test if fair valued biological assets are value relevant for the investor. Our traditional price model is expressed as:

$$MVE_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 Earnings_{it} + \varepsilon_{it} \quad (1)$$

MVE_{it} = *market value of equity per share in company i at time t*

BV_{it} = *book value of equity in company i at time t*

$Earnings_{it}$ = *income after tax for company i at time t*

ε_{it} = *the residual*

To eliminate issues regarding scale effects in the variables between company size, we have used outstanding shares as our scale denominator. This is also in line with recommendations from Barth and Clinch (2009). To test our set of hypotheses, we are using the original price model with minor adjustments, which will be presented in the chapters below.

6.3 Price model 2 - Historical cost

First, we are going to test how the price model at historical cost will reflect movements in the market value of equity. This is because we want to test its value relevance and create a basis of comparison when we later include fair value adjustments in a new model. In order to do so, we extract biological assets (including biomass at historical cost and the fair value adjustments) from the book value of equity and set this as an own independent variable. Then we subtract the fair value adjustments, ending up with the reported biomass at historical cost as an own variable. Here, BIO_{it} is the total reported biomass (HC+AFV) for company i at time t, and HC_{it} is the biomass at historical cost for company i at time t.

$$BV(HC)_{it} = (BV_{it}\text{-}BIO_{it}) + (BIO_{it}\text{-}AFV_{it}) = (BV_{it}\text{-}BIO_{it}) + HC_{it} \quad (2)$$

To correct for fair value adjustments on biological assets incorporated in net income, we also subtract these adjustments (*AdjBio*) from reported earnings.

$$Earnings(HC)_{it} = (Earnings_{it} - AdjBio_{it}) \quad (3)$$

Further, we put equation (2) and (3) into equation (1), replacing them with the book value of equity, $BV_{it,}$ and $Earnings_{it}$. By doing so, we end up with equation (4), where the price model is at historical cost. This allow us to test each of the variable's significance, and examine to what degree the financials, free of fair value adjustments, are considered value relevant.

$$MVE_{it} = \beta_0 + \beta_1(BV_{it}\text{-}BIO_{it}) + \beta_2 HC_{it} + \beta_3(Earnings_{it}\text{-}AdjBio_{it}) + \varepsilon_{it} \quad (4)$$

The empirical model includes both one variable measured at time t and the change in the same variable from one period (t-1) to another (t). This may lead to multicollinearity issues due to the fact that the variables will be mutually correlated. This is shown in the correlation metrics (Table 3) in our analysis. To eliminate this multicollinearity issue, lagged observations of the variables are being used when the change in the variables is also included in the empirical model. After the adjustments for multicollinearity issues, the regression model will take the following form:

$$MVE_{it} = \beta_0 + \beta_1(BV_{it-1} - BIO_{it-1}) + \beta_2 HC_{it-1} + \beta_3 (Earnings_{it} - AdjBio_{it}) + \varepsilon_{it} \quad (5)$$

6.4 Price model 3 - Fair value adjustments

In our next model, we want to include the fair value adjustments in order to analyse the relation between fair value estimates and the market value of equity. The excluded variables are now included as own explanatory variables in the model. *AFV* is the fair value adjustment on biomass in the balance, and *AdjBio* is the corresponding fair value adjustment in the income statement.

$$BV_{it} = (BV_{it} - BIO_{it}) + HC_{it} + AFV_{it} \quad (6)$$

$$Earnings_{it} = (Earnings_{it} - AdjBio_{it}) + AdjBio_{it} \quad (7)$$

The next step is to replace the book value of equity and net income from equation 1), with equation 6) and 7). This model will have the same issues regarding multicollinearity as the one regarding historical cost, therefore we lag the observations.

$$MVE_{it} = \beta_0 + \beta_1(BV_{it-1} - BIO_{it-1}) + \beta_2 HC_{it-1} + \beta_3 AFV_{it-1} + \beta_4(Earnings_{it} - AdjBio_{it}) + \beta_5 AdjBio_{it} + \varepsilon_{it} \quad (8)$$

Our last two hypothesis will test the value relevance of the fair value adjustments in the balance sheet and income statement. We can test this by examine the statistical significance of the coefficients in equation (8). If β_3 is significant, one can conclude that fair value adjustment in the balance is value relevant, answering hypothesis H2A. If β_5 is significant, hypothesis H2B can be answered by considering value adjustments in the income statement as value relevant.

It will also be relevant to inspect how the included fair value adjustments will affect R^2 and the historical cost coefficients from equation (5). If the R^2 is higher from including the fair value estimates, this can also be evidence of that these value adjustments improve the value relevance and therefore work as a better model for explaining the market value of equity.

6.5 Panel data with fixed effects

As we will come back to in chapter seven, our data sample is defined as panel data, also known as cross-sectional time-series data (Torres-Reyna. 2007). This means that we have data describing individual behaviour across both time and individuals (Katchova, 2013).

The two most common techniques for analysing panel data are by using *fixed effects* and *random effects*, so-called individuals' specific effects models. By individual specific effects, we refer to the leftover variation in the dependent variable that cannot be explained by the regressors, and we assume there is unobserved heterogeneity across individuals. In order to know which technique to use, the main question is whether the individual specific effects are correlated with the independent variables. If they are correlated, the fixed effects model should be used, and if not, random effects are the suitable model.

The rationale idea behind the random effects model is that the variation across individuals is assumed to be random and uncorrelated with the dependent and independent variables included in the model. Considering our data sample, we believe the individual specific effects to be correlated with our variables,

making fixed effects the appropriate technique. After running a Hausman-test, it confirms that the use of fixed effects is the appropriate technique.

Fixed-effects (FE) is used whenever you are interested in analysing the impact of variables that vary over time and explore the relationship between the dependent and independent variables within an entity (country, person, company, etc.) (Torres-Reyna. 2007). In our case, each salmon company has its own individual characteristics that may or may not influence the predictor variables. When using FE, we assume that something within the company may bias or impact the independent and dependent variables, and we need to control for this. This technique therefore uses dummy variables to capture factors that are common for companies across time (time fixed effects) and effects on companies that do not change over time (firm fixed effects). Examples of "time fixed effects" in our study would be the influence of general market fluctuations on the valuation, such as the salmon spot price (Misund, 2016). This is relevant to consider because changes in reported biomass are influenced by developments in the salmon spot price. FE remove the effect of those time-invariant characteristics, so we can assess the net effect of the predictors on the outcome variable. An example of "firm fixed effects" would be the fact that some companies are valued higher than others because of intangible elements, such as goodwill or a good reputation (Misund, 2016).

6.6 The use of R^2

In a regression analysis, R^2 is the statistical measure representing the portion of variance for a dependent variable that is explained by an independent variable or variables (Stenheim, 2018). R^2 express how well the regression predictions approximate the real data points and is therefore often referred to as a measure of the *goodness of fit* of a model. If the R^2 of a model is 0.5 then approximately half of the model's variation can be explained by the model's input, and if R^2 is 1, it indicates that the regression predictions perfectly fit the data.

Studies frequently operationalize value relevance as the R^2 from regressions of stock prices on per share values of accounting earnings and book values of equity (Brown, Lo & Lys, 1999). If stock prices are regressed on accounting variables, R^2 is a measure of how much of the variation in stock price is explained by the accounting variables. Hence, the explanatory power in R^2 is a measure of value relevance.

R^2 from different samples are often used to compare and study if value relevance differs between the samples (Collins et al., 1997; Francis & Schipper, 1999). Brown et al. (1999) claims that R^2 is an unreliable statistic in the presence of scale, for example, samples drawn from different time periods, different stock exchange or across countries. Both Collins et al. (1997) and Francis & Schipper (1999) conclude that the value relevance of accounting has not declined, based on a pattern of increasing R^2´s. In contrast, Brown et al. present an analysis that finds, after controlling for scale effects, that the reported value relevance actually has declined. Gu (2007) also claims that R^2 can differ even though scale effects are not present, and warn the reader to use R^2 as a measure in scaled regressions.

The most common issue relating to the explanatory power of R^2 is that it increases when more independent variables are added to the model, even though the variables might not have a significant impact on the result. Taken this into account, we have chosen to use a modified R^2, also known as "adjusted R^2". The adjusted R^2 takes into account the loss of degrees of freedom associated when adding extra independent variables (Stenheim, 2018). Hence, it can be used as a decision-making tool for determining whether a variable should be included in a regression or not. Adjusted R^2 is a well-used indicator in value relevance research and is a measurement we will use as well. As a supplement, we will also look at regression coefficients in the Ohlson model.

6.7 The use of regression coefficients

Coefficients in a regression model measure the relation between the dependent and the independent variable, telling us something about the slope of the regression (Stenheim, 2018). With this, it also measures how sensitive the dependent variable is to changes in the independent variables. In our case, we test how sensitive the market value of equity is to changes in financial reported estimates. A higher regression coefficient implies that the market value has a higher sensitivity to this specific coefficient. There is, in addition, tested the significance of coefficients (Stenheim, 2018). The significance expresses to what extent the independent variable has a reliable relation to the dependent variable. The zero hypothesis that is tested claims that the coefficient is zero, meaning there is no relation. If the t-value from the test is higher than the critical test value, given a defined significance level, the zero hypothesis is rejected (Stenheim, 2018). If this is the case in our study, we can assume that the reported financials have a relation to the market value, making it value relevant. For our analysis, we will use the p-values 0.01 (strongly significant), 0.05 (significant) and 0,10 (weakly significant) to determine the significance of the coefficients.

6.8 Scale effects

The usefulness of R^2 in chapter 6.6, indicates that one must be careful in studies using the explanatory power as a measure of value relevance. When observing data with samples that differ in size, the explanatory power can become misleading and you may draw incorrect conclusions. This is referred to as scale effects and is a well-known concern in capital markets-based accounting research (Barth & Clinch, 2009). CMBAR studies typically focus on the relation between the market value of equity and book value of equity plus earnings, by using observations from a sample of firms in cross section over time. Doing so admits the possibility that differences in firm size might reflect scale differences that result in incorrect inferences. Accounting research frequently express concern about potential scale effects, and Barth & Clinch (2009) characterize five types of concern in relation to scale effects in the

Ohlson valuation model: multiplicative and additive correlated omitted scale variables, scale-varying valuation parameters, survivorship and scale-related heteroscedasticity.

They further point out that size-differences across firms are not necessarily evidence of scale effects causing incorrect conclusions but emphasize that one needs to look at any concluding results with some scepticism. In addition, they study various solutions dealing with scale effect, by adjusting the Ohlson model and examine how these adjustments deal with the mentioned issues. Here they conclude that dividing variables by the amount of the firm's outstanding shares is recommended. That's why we will use the respective firm's outstanding shares to scale our data.

6.9 Additional tests

In order to evaluate the robustness of our analysis and give supporting insight, we will run additional tests supplementing our findings. We are going to modify our price models to test if new modifications are having an impact on the overall statistical results. We will also use the return model to draw a more robust conclusions from the analysis on the value relevance of earnings.

6.9.1 Return model

The first additional test is related to hypothesis H2B, where we want to test if the results from the price model change when using the return model. This model is based on the original return model (Kothari, 1995) which is presented in chapter 5.4.4. If both β_5 from the price model 3 (including fair value adjustments) and β_2 from the return model are significant, we can draw a more robust conclusion on the value relevance of fair value adjustments in the income statement. This model will also be scaled on total outstanding shares, where the modified return model is expressed as the return per share:

$$R_{it} = \beta_0 + \beta_1 \frac{Earnings_{it} - AdjBio_{it}}{P_{t-1}} + \beta_2 \frac{AdjBio_{it}}{P_{t-1}} + \varepsilon_{it}$$

R_{it} is the return per share for company i at time t. β_1 consist of earnings minus fair value adjustments in company i divided by the share price in period t-1and β_2 is the fair value adjustments for company i divided by the share price in period t-1. All variables are divided on the stock price from the last period.

6.9.2 Including the spot price in price model 2 and 3

We want to test whether the results will differ when adding the historical salmon spot price as an own independent variable to our modified Ohlson price model at historical cost (price model 2).

$$MVE_{it} = \beta_0 + \beta_1(BV_{it-1} - BIO_{it-1}) + \beta_2 HC_{it-1} + \beta_3(Earnings_{it} - AdjBio_{it}) + \beta_4 Spot_{it} + \varepsilon_{it}$$

Further, we want to do the same in price model 3 to test if our original result on fair value adjustments (price model 3) is affected after adding the spot price as an own independent variable. The coefficients of interest are the fair value adjustments β_3 and β_5, where we want to see whether the significance is affected by introducing the new variable.

$$MVE_{it} = \beta_0 + \beta_1(BV_{it-1} - BIO_{it-1}) + \beta_2 HC_{it-1} + \beta_3 AFV_{it-1} + \beta_4(Earnings_{it} - AdjBio_{it}) + \beta_5 AdjBio_{it} + \beta_6 Spot + \varepsilon_{it}$$

The idea behind this approach is related to the findings by Asche, Misund & Oglend, (2016), where they analysed how well forward prices predict future spot price. The overall findings are that forward prices works well in predicting future spot prices. However, the lack of the important price discovery role makes the estimates more uncertain. This is interesting because forward prices are used by many companies in the industry to determine future spot prices, which further plays an important role when determining fair value adjustments. In addition to this, Bernhoft & Fardal (2007) stated that users of financial statements in the salmon farming industry might look away from the fair value

adjustments, which further was confirmed in 2019 by the seafood analyst in DNB Markets[1]. There seems to be a credibility issue, where some of the users find fair value estimates somewhat unreliable or uninformative, which cause them to make their own subjective valuation of the biomass in sea. Therefore, we find it interesting to compare the results from the model with fair value adjustments (price model 3) to the results from the historical cost model (price model 2), including a salmon spot price as an own independent variable. This will allow us to test whether fair value adjustment explain more of the market value of equity than other public available information outside the financial statements (here, represented through the salmon spot price).

7.0 Data

We have gathered the market value of equity from Bloomberg on six farming salmon companies, listed on the Norwegian Stock Exchange from the period 2008 to 2018. The Financial statement information is manually collected from quarterly reports. Here, the frequency on the data is on a quarterly basis, which is because the amount of listed Norwegian farming salmon companies is quite small. Hence, the quarterly reported data versus annually reported will give us more observations. The data sample comprises the following companies: SalMar ASA, Lerøy Seafood Group ASA, MOWI (Marine Harvest) ASA, Austevoll Seafood ASA, Norway Royal Salmon ASA and Bakkafrost ASA. We have disregarded companies that have been taken off the Norwegian Stock Exchange or acquired by other companies, such as Cermaq ASA and PanFish. This is because we wanted our study to reflect the current value relevance, by examining currently listed companies. The reason for limiting our sample to companies listed on the Oslo Stock Exchange is for consistency. Our selected companies report financial information according to the same international accounting standard IFRS, which is important because balance and income statement values for salmon companies are highly influenced by accounting regulations. Most of the salmon farming companies are either privately owned

[1] Seafood analyst at DNB Markets, Stein Alexander Aukner

or part of a conglomerates. This gives a total of 214 observation for our analysis. We have collected data on quarterly reported net income, total assets, biological assets, biological assets at historical cost and the value adjustment on the biological assets. We have also retrieved data on reported liabilities, equity and the market value of equity. MOWI ASA has from 2016 to 2019 reported financial statements in EUR, and Bakkafrost ASA are reporting in DKK. Therefore, we had to convert the numbers into NOK to get stock prices and reported financial statements in the same currency. The historical salmon spot prices are retrieved from Fish Pool, part of Oslo Børs ASA.

We have followed recommendations from Barth & Clinch (2009) and scaled our dependent and independent variables by dividing them by outstanding shares for the respective companies. When collecting the market value of equity, we chose the respective share prices two days after the quarterly results were published. We know that similar studies have chosen stock prices at a later time and we think there is no time-alternative that stands out as the clear correct one. The reason why we choose two days is because we think that this is enough time for the market to adjust and respond to the reported financials. Off course, one would be certain on including any adjustment by using stock prices at a later time. However, we think that the longer you wait, more factors (such as forward/spot-prices, harvest volumes, etc.) can contribute, influencing the market value of equity.

As mentioned in chapter six is our data sample categorized as panel data. Because the presented companies have become listed on the Norwegian Stock Exchange at different times, companies are not observed at all times. For example, Norwegian Royal Salmon (NRS) got listed in 2011, while Salmar became listed in 2008. This means that we have an unbalanced panel data (Katchova, 2013).

7.1 Cleaning the dataset

In regression analyses, there may in some cases be issues related to extreme observations in the data selection. This is especially important to be aware of in price regression models. We have tested the data for extreme observations by applying histograms and looking at the percentiles. The tests show a sign of a few outliers. Since our sample is limited with 214 observations, we want to avoid removing any observations. Therefore, we have applied the winsorizing function to clean our data set. This allow us to sort the data in ascending order, where the upper and bottom observations are replaced by the respective value of the 1% and 99% of the percentiles. Visual analysis was again tested for all variables, and the histogram and percentiles show no sign of extreme observations after the minor cleaning of the data.

8.0 Results and analysis

We will in the next chapters analyse our data through our empirical models and test our three hypotheses. First, we present the descriptive statistics. Then we will analyse the value relevance based on our reformulated price models. The results from our analysis will be the foundation for whether we find support for our set of hypotheses. At last, we will use our findings from the analysis to answer the research question and compare our results to similar research.

8.1 Descriptive statistics

In this chapter, we will present and discuss the descriptive statistics of our data set.

Table 2 - Descriptive statistics

	Mean	Standard deviation	Min	25 percentile	Median	75 percentile	Max
Price	100,67	103,13	8,05	34,20	59,63	130,60	468,4
BV	38,24	25,63	6,75	19,21	31,64	48,22	108,61
Bio	18,76	10,66	3,12	9,72	17,16	25,74	63,53
(BV-Bio)	19,48	18,15	1,96	7,01	14,17	20,43	77.31
AFV	4,81	4,40	-0,41	1,42	3,65	7,31	21,22
HC	13,96	6,75	2,76	6,95	14,42	18,89	28,01
Earnings	2,31	2,74	-1,45	0,41	1,62	3,42	10,39
AdjBio	0,40	2,43	-6,24	-0,52	0,17	1,37	8,06
(Earnings-AdjBio)	1,91	3,22	-5,75	0,18	1,05	3,29	11,74

Note. *Price* is the stock price, calculated as market value of equity. *BV* is the book value of equity, calculated by total assets minus total liabilities. *Bio* is reported biological assets, *AFV* is the fair value adjustment on biological assets, *HC* is biological assets at historical cost, *Earnings* is the reported net income, and *AdjBio* is the fair value adjustment in the income statement. All variables are expressed in per share.

The market value of equity (*Price*) is on average higher than the book value of equity with a factor on about 2,5, meaning the market value of equity is more than twice as high than the book value of equity. Book value of equity is on average, almost twice as high as the biological assets. This may support the fact that biomass is relevant when determining the market value of equity. The standard deviation and the mean are approximately the same on about half of the variables. In those cases, the data is normally distributed. Estimates regarding biological assets (*Bio, HC, AdjBio*) are the exceptions, where the variation coefficient is substantially higher. Further, we see that mean is higher than the median on all variables, with an exception of *HC*.

Some variables are skewed, which can be explained by some single observations dragging the mean to a higher level. For example, is the highest observation on *Price* 468,4 NOK, while the mean is 100,67. However, this is natural due to the differences in total outstanding shares and valuation between the different companies. The fair value adjustment in the income statement is on average positive, which can be explained by the increase in historical

salmon spot prices. The standard deviation tells us something about how far the observations, on average, are from the mean. It is therefore also a measure of variance in the variables. *AdjBio* has a standard deviation of 2,43, while its mean is 0,40. This represents the fact that these value adjustments also are negative in some periods.

8.2 Correlation analysis - Pearson Correlation

The Pearson correlation measures the covariance between two variables, also known as the linear relation (Stenheim, 2018). A correlation of 0 indicates zero correlation, and correlation of 1 or -1 indicates positive or negative full covariance between the variables.

Table 3 - Correlation matrix

	Price	*BV*	*Bio*	*(BV-Bio)*	*AFV*	*HC*	*Earnings*	*AdjBio*	*(Earnings-AdjBio)*
Price	1,00	0,73	0,83	0,51	0,82	0,79	0,65	0,08	0,48
BV	0,73	1,00	0,80	0,92	0,74	0,79	0,57	0,01	0,47
Bio	0,83	0,80	1,00	0,52	0,93	0,90	0,67	0,09	0,49
(BV-Bio)	0,52	0,92	0,52	1,00	0,48	0,54	0,41	-0,05	0,38
AFV	0,82	0,74	0,93	0,48	1,00	0,81	0,72	0,13	0,50
HC	0,79	0,79	0,90	0,54	0,81	1,00	0,60	0,07	0,44
Earnings	0,65	0,57	0,67	0,41	0,72	0,60	1,00	0,19	0,69
AdjBio	0,08	0,01	0,09	-0,05	0,13	0,07	0,19	1,00	-0,58
(Earnings-AdjBio)	0,48	0,47	0,49	0,38	0,50	0,44	0,69	-0,58	1,00

Note. The table gives an overview of the correlation between all variables used in the analysis. *Price* is the market value of equity per share. *BV* is the book value of equity. *HC* is the biological assets at historical cost and *AFV* is the adjusted fair value. Together, they make *Bio* which is the total reported biological assets. *Earnings* is the net income after tax and *AdjBio* is the fair value adjustment represented in the income statement.

Our matrix shows a positive correlation between almost all the variables. The two exceptions are the negative correlation between *(Earnings-AdjBio)* and *AdjBio*, and between *(BV-Bio)* and *AdjBio*. The first incident makes sense, considering *AdjBio* and *(Earnings-AdjBio)* should indeed have a negative relation. The second is considering a very small correlation.

The correlation between the dependent variable *Price* and the independent variables are all positive. This supports our three hypotheses which presume a positive relation between the market value of equity and the book value of equity and earnings. The variables with the highest correlation with the dependent variable are *Bio* (83%), *AFV* (82%) and *HC* (79%).
It also shows a considerable difference in correlation with the dependent variable when comparing fair value adjustments from the balance and adjustments in the income statement. The high correlation between fair value adjustments from the balance (*AFV*) and *Price* shows a strong linear relation, and support hypothesis H2A. The correlation between fair value adjustments in the income statement (*AdjBio)* and *Price* has a very low estimate at 0,08. This is not line with our hypothesis H2B. Overall, the variables retrieved from the balance has a higher correlation with *Price* than the variables from the income statement. This is in line with the general view from literature, describing book value of equity as more value relevant than earnings (Beisland, 2009).

The correlation between balance sheet estimates are also quite high. For example, is the correlation between *AFV* and *Bio* 93% ad *AFV* and *HC* is 81%. This is high correlation between explanatory variables and is a sign of multicollinearity. The variables present similar “constructs”, meaning one could remove two of them if it weren't for the fact that we want to examine this exact split. We are keeping the variables, and instead lagging the balance sheet coefficients in our regressions. However, this high correlation means one should be careful when interpreting the results from the price model.

8.3 Value Relevance

We are now going to analyse the price model with estimates at historical cost and estimates including fair value adjustments. Together, this may give answer to our research question regarding the value relevance of fair valued biological assets. We will start by analysing and discuss the result from our regression models. Then, we will review the results up against our set of hypotheses and

relevant theory to decide whether fair value on biological assets are value relevant for the financial statement user.

8.3.1 Traditional Price Model

We will start our analysis by introducing the traditional price model on our data without any adjustments. The results from this model will be used in further the analysis of *price model 2 (HC)* and *price model 3 (FV)*. Here, the share price is expressed as a function of book value of equity plus earnings for the period. This is the original Ohlson price model, and we find it natural to start with this model. Further we want to use the results as a benchmark when we further introduce minor adjustments to the model for measuring the value relevance of fair value on biological assets.

Table 4 - Price model 1

β_0	$\beta_1(BV_{it})$	$\beta_2(Earnings_{it})$	R^2	Total obs.
-74,89*** (-4,82)	4,34*** (24,95)	3,81*** (2,91)	82,65%	213

Note. *BV* is the book value of equity and *Earnings* is net income after tax. The variables are scaled with outstanding shares. This model is used to measure the overall value relevance of the reported financials. This significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

The regression coefficients β_1 and β_2 are strongly significant at the 1 % level. The t-value for β_1 is 24,95, making it highly relevant for explaining the dependent variable *Price*. β_2 has a t-value of 2,91, significantly lower than for β_1. The adjusted R^2 means that 82,65 % of the variance in the dependent variable *Price* is explained by the dependent variables *BV* and *Earnings*. The high adjusted R^2 of 82,65 % indicates the relevance of the Ohlson price model when measuring the value relevance between reported financial statements and the market value of equity.

8.3.2 Price model 2 - Historical cost

We will now present the results from the price model estimated at historical cost and start by describing the main findings. Then analyse the results, with a focus on our first hypothesis.

Table 5 - Price model 2

β_0	$\beta_1(BV\text{-}Bio_{it})$	$\beta_2(HC_{it})$	$\beta_3(Earnings\text{-}AdjBio_{it})$	R^2	Total obs.
-87,85*** (-4,05)	2,67 (1,42)	9,28*** (4,8)	4,66* (2,30)	66,1%	213

Note. (*BV-Bio)* is the book value of equity minus total reported biological assets and (*HC)* is biological assets at historical cost, meaning biological assets minus fair value adjustments. *(Earnings-AdjBio)* is net income after tax, less the fair value adjustments from biological assets. The variables are scaled with outstanding shares. The significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

The coefficient β_1 has a low significance after the extraction of biological assets, which is natural due to the significant portion of book value of equity which is extracted out as an independent coefficient in β_2. The regression coefficient β_2 is strongly significant at 1% and β_3 is weakly significant at the 10% level. The coefficient representing biological assets at historical cost (β_2) is 9,28. This means that an increase of one NOK in HC per share will lead to an increase of 9,28 NOK in market price, given that other variables are held constant. β_3 has the coefficient 4,66, meaning that market values are more sensitive to changes in biological assets without fair value adjustments than they are to changes in earnings without adjustments. The R^2 tells us that 66,1% of the variance in market price can be explained by changes in these three variables without fair value measurements. The explanatory power has dropped considerably (16,5%) compared with the traditional price model, including fair value adjustments.

With connection to this model, we presented the following hypothesis:

Hypothesis 1: *Reporting biological assets at historical cost is value relevant.*

Through this model, we found that biological assets at historical cost are highly significant and has a considerable impact on the market value of equity. Higher t-values for book value of equity than for earnings is in line with earlier studies, concluding that the book value of equity is more value relevant than earnings (Beisland, 2009).

Earnings without fair value adjustments (β_3) is now considered weakly significant and has a coefficient less than half of biological assets at historical cost (β_2). Despite a strong coefficient in β_2, we have a substantial drop in R^2 compared with the traditional price model. This shows that the explanatory power of the model is weaken when excluding fair value adjustments.

β_3, which represents earnings without adjustments, has now a low significance, and a t-value less than half of β_2. This means that we cannot characterize this variable as value relevant. An explanation of this is that fair value adjustments related to the income statement tends to be high and sometimes larger when comparing it to total earnings for the period. When excluding a large part like this from *Earnings,* the results shows that it will affect its influence on price and its significance. Still, the output tells us that biological assets without fair value adjustments in the balance statement are to be considered as value relevant, because of its high coefficient and significance. This gives support to our first hypothesis, H1.

The nature of farming makes historical cost valuation of biological assets inherently difficult, because they are affected by procreation, growth, death, as well as joint-cost situations (Argiles et al., 2012). Our findings show a value relevance in historical cost measures, but the weaken R^2 makes indications of the fact that historical cost cannot be expected to be more value relevant than fair value. This is in resemblance to the findings by Argiles et al. (2012) and their study comparing historical cost to fair value measurements on biological assets in general.

8.3.3 Price model 3 - Fair value adjustments

Here we will present the results from the price model with fair value adjustments. We will start by present the main findings, and further analyse and discuss the hypotheses.

Table 6 - Price model 3

β_0	$\beta_1(BV_{it}$-$Bio_{it})$	$\beta_2(HC_{it})$	β_3(AFV$_{it}$)	$\beta_4(Earnings_{it}$-$AdjBio_{it})$	$\beta_5(AdjBio_{it})$	R^2	Total obs.
-46,40 (-1,89)	2,51 (1,50)	2,37 (1,36)	8,35** (2,77)	11,21*** (4,16)	14,22** (3,66)	75,33%	213

Note. (*BV-Bio)* is the book value of equity minus total reported biological assets, *HC* is biological assets at historical cost, meaning biological assets minus fair value adjustments and *AFV* is the adjusted fair value measurement on biological assets in the balance sheet. *(Earnings-AdjBio)* is net income after tax, free of fair value adjustments from biological assets and *AdjBio* is the fair value adjustment related to biological assets in the income statement. The variables are scaled with outstanding shares. The significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

The regression coefficient β_1 $(BV_{it}$-$Bio_{it})$ is not significant due to the same reason as in price model 2. The coefficient β_2 (HC_{it}) has now changed from significant to weakly significant when including the fair value adjustments. This is an unexpected and notable change. Biological assets at historical cost are still a substantial part of the book value of equity, so the drop in the coefficient and significance is strange. We fall short in being able to describe this shift and could be a subject for additional research. Further β_3 (AFV_{it}) and β_5 $(AdjBio_{it})$ are significant at a 5% level and $\beta_4(Earnings_{it}$-$AdjBio_{it})$ is highly significant at the 1% level. The coefficient representing the fair value adjustment (*AFV*) in the balance sheet is 8,35, which means that an increase of one NOK in AFV per share will lead to an increase of 8,35 in the market price, given all other variable held constant. β_4 which is representing the coefficient earnings minus fair value adjustments in the income statement is 11,21 and β_5 that represent the fair value adjustments in the income statement is 14,22. This means that market value of equity also is sensitive to changes in fair value adjustments in earnings and to changes in earnings itself. R^2 is now 0,753,

which tells us that 75,3% of the variation in *Price* can be described by changes in the explanatory variables.
We presented the following hypothesis in connection to price model 3:

Hypothesis 2A: *Fair value adjustments on biological assets in the balance statement are value relevant.*

The results from our analysis shows a significant and positive coefficient representing the fair value adjustments made on biological assets in the balance statement. These findings are in support to our hypothesis 2A, and we conclude that fair value adjustments in the balance statement are considered value relevant. The R^2 is higher, compared with price model 2, indicating that fair value adjustments give additional explanatory power for explaining the market value of equity.

The coefficients and the associated t-values related to variables from the income statement are significantly higher than the balance sheet coefficients. This implies that the market value of equity is less sensitive to changes in fair value adjustments in the balance, than it is to changes in fair value adjustments in the income statement. Balance sheet numbers are often higher than the one retrieved from the income statement. For example, is the mean of *AFV* 4,81, while the mean of *Earnings* and *AdjBio* is 2,31 and 0,40 (Table 2). This results in higher coefficients on variables from the income statement. We will therefore not interpret these higher coefficients as a sign of higher value relevance in the income statement, compared to the balance statement.

The R^2 has increased from 66,1 % (HC-model) to 75,3% when including fair value adjustments in both balance sheet and income statement. The interpretation of this is when fair value adjustments are included in the price model, we now explain more of the variation in the market value of equity (9,2%). This also supports our conclusion, supporting hypothesis 2A.

Hypothesis 2B: *Fair value adjustments on biological assets in the income statement are value relevant.*

The results from price model 3 also brings a sound basis to answer our last hypothesis. We find that the explanatory variable for fair value adjustments in the income statement (*AdjBio*) has a positive and strong effect on *Price*. This variable has the highest coefficient in the regression (Table 6) and is significant at the 5% level. It therefore has a considerably impact on the book value of equity. All these findings support the hypothesis 2B, and we conclude that fair value adjustments on biological assets in the income statement are value relevant. After including fair value adjustments, we achieve a higher R^2, compared with price model 2. The fact that the fair value adjustments gives additional explanatory power to the price model will also support H2A and H2B.

8.4 The research question

In this chapter we will compare our results on the value relevance of fair value related to biological assets in the salmon farming industry with results from existing research. We will start by summarize the results from our hypotheses and how they answer our research question:
Are reported biological assets in the salmon farming industry value relevant at fair value under IAS 41?

When we reformulate the traditional price model by abstracting the effect of fair value adjustments, the result is value relevant adjustments in both the balance and income statement (Table 6). The fact that both variables are significant gives support to our hypotheses 2A and 2B. Our intermediate conclusion is therefore that fair value adjustments on biological assets are useful information for an investor and is therefore value relevant.
The price model 2 also makes proof of value relevant estimates (Table 5). Because the coefficient in this model, representing reported biological assets at historical cost, is significant, it supports hypothesis 1. As previously stated, biological assets consist of an historical cost measurement and a fair value adjustment. These two components have therefore been tested in three hypotheses, in order to answer our research question. Because historical cost

measurements and the fair value adjustments are value relevant, our conclusion is that reported biological assets in the salmon farming industry is value relevant at fair value, under IAS 41.

We will now compare the results against past research on the wide field of value relevance. Further, we will compare our results with research examining fair value on biological assets after IAS 41. There may be issues related to comparing overseas research, due to differences in accounting policies and purpose (King & Langli, 1998). We will therefore be careful when comparing our results to research done overseas.

We get strong and significant coefficients, which are the basis for answering our hypotheses. However, the R^2 differ when our price model includes fair value adjustments and when it does not. In fact, the R^2 increase from 66,1% to 75,3% when including fair value adjustments. This means that fair value adjustments give additional explanation to the variation in the market value of equity. This gives support to Barth et. al. (2001) and Landsman (2007), claiming extant research provides an overall conclusion that FV-based information is more relevant than historical cost (HC)-based information. However, this is not in line with Holthausen & Watts (2001) and Dichev (2008). They believe fair value adjustments are responsible for higher volatility, resulting in a vague value creation process. Holthausen & Watts also argues that fair valuation is a poorer measure of worth and performance than historical cost. Our results argue against this, and places our results in line with Barth (1994), Barth et al. (1996), Carrol et al. (2003) and Barth & Clinch (1998) claiming fair value to be more value relevant than historical cost.
In our study, both book value of equity and earnings have a significant impact on predicting the market value of equity, indicated by the significance and R^2. Earlier research on the field of value relevance conclude that book value of equity is more value relevant than earnings (Beisland, 2009). When we included fair value adjustments in price model 3, we got higher t-values on variables from the income statement compared with variables from the

balance. Statistically this could be a sign of higher value relevance for earnings than for book values. This differ from the results by Misund (2016), concluding that the book value of equity is more value relevant than earnings due to higher t-values in his price model. However, Barth et al. (1996) conclude that which of the these two an investor classifies as the most value relevant depends on the financial health of the company. They argue that book value of equity (net income) will be higher (lower) for firms classified as being less financially healthy than other firms. This may explain some of the reason for higher t-values for the income statement coefficient, due to the overall strong financial health in the salmon farming companies. Our overall finding is that both fair value adjustments in the balance sheet and the income statement are value relevant for the investor, and we find it difficult to determine which is more value relevant than the other. This is in line with earlier research done by Barth et al (1996).

Our results have no major breakouts from existing research taking on value relevance on reported biological assets. Gonçalvesa et. al. (2017) examined the agricultural sector as a whole and found that the recognized amount for biological assets under the fair value model is value relevant. Misund (2016) looked at the isolated value relevance of fair value adjustments, for salmon farming companies. He drew the same conclusion as we did for our hypothesis H2A and H2B, claiming that these adjustments are value relevant for investors. Argilés et. al. (2012) compared the value relevance of biological assets at historical cost and fair value in the agriculture sector. They found both methods value relevant but concluded that fair valuation on biological assets gives additional predictive power to future earnings and price fluctuation.

8.5 Additional tests

We are in this chapter presenting the results from our additional tests. The aim is to provide additional insight, supplementing our primary analysis.

8.5.1 Return model

In our first additional test, we will use the return model, to evaluate the robustness of our results answering hypothesis H2B.

Table 7 – Return Model

β_0	$\beta_1(Earnings_{it}$-$AdjBio_{it})$	$\beta_2(AdjBio_{it})$	R^2	Total obs.
0,005 (0,36)	2,27*** (4,90)	3,46*** (4,56)	16%	214

Note. ($Earnings_{it}$-$AdjBio_{it}$) are total earnings minus fair value adjustments on biological assets related to the income statement and *AdjBio* is fair value adjustments on biological assets related to the income statement. The variables are divided by the share price in period t-1.
The significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

With the regression from the return model, we find that the estimated coefficient to net income free of fair value adjustments is 2,27, with a t-value of 4,90 and strong significance at the 1%-level. This tells us that net income has a strong positive relation to the stock return. Considering fair value adjustments, this also has a positive relation to the stock return with a coefficient of 3,46 and is strongly significant. The explanatory power of this return model is quite low. It is however not relevant to compare the R^2 from this model to the price model, because we use different variables. Based on the positive and significant relation between fair value adjustments in the income statement and stock return, the results from our return model support our conclusion on H2B.

8.5.2 Including the spot price in price model 2

For our next test, we are going to modify price model 2 by including the historical spot price of salmon.

Table 8 – Spot price in price model 2

β_0	$\beta_1(BV_{it}$-$Bio_{it})$	$\beta_2(HC_{it})$	$\beta_1((Earnings_{it}$-$AdjBio_{it})$	$\beta_4(Spot_{it})$	R^2	Total obs.
-131,43** (-5,31)	2,44 (1,45)	6,34** (3,44)	4,29** (2,82)	1,98*** (7,25)	72,30%	213

Note. (*BV-Bio)* is the book value of equity minus total reported biological assets and *HC* is biological assets at historical cost, meaning biological assets minus fair value adjustments. *(Earnings-AdjBio)* is net income after tax, less the fair value adjustments from biological assets. *Spot* is the historical spot price on salmon, retrieved from Fish Pool. The variables except spot are scaled with outstanding shares. The significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

When historical spot prices are included in the historical cost model (price model 2), R^2 increased from 66,1 - to 72,3%. The significance of the independent variables remains stable, β_2 *(HC)* and β_3 (*Earn-AdjBio*) is significant at the 5% level with respectively t-values of 3,44 and 2,82. The new variable β_4 (*Spot*) is strongly significant at the 1% level with a t-value of 7,25. This means that historical spot price of salmon has a significant and positive relation for determining the market value of equity. When comparing the adjusted-R^2 between this model and the price model (3) including fair value we find minor differences, for instance respectively 72,56% and 75,33% (Fair value). The significance of the independent variables are almost identical compared with the results from the price model (3). The overall conclusion is that fair value of biological asset is value relevant. However, by adding salmon spot price (publicly available information) as a new independent variable to the price model including historical cost, the statistical results are almost the same. The similar explanatory power and significance of the coefficients may reflect the ongoing debate on why users of financial statements might use other publicly available information instead of the reported adjustments (Bernhoft & Fardal, 2007). Still, because this additional test gives no higher indication of value relevance, compared to price model 3, fair value adjustments are still to be considered value relevant. This supports our conclusions for H2A and H2B.

8.5.3 Including the spot price in price model 3

In the last additional test, the historical spot price for salmon is included as an own independent variable in price model 3. The reason for this approach is to see to what degree the spot price will change our conclusion on value relevance.

Table 9 – Spot price in price model 3

β_0	$\beta_1(BV_{it}$-$Bio_{it})$	$\beta_2(HC_{it})$	$\beta_3(\text{AFV}_{it})$	$\beta_4(Earnings_{it}$ -$AdjBio_{it})$	$\beta_5(AdjBio_{it})$	$\beta_6 Spot$	R^2	Total obs.
-80,19* (-2,38)	2,41 (1,51)	2,10 (1,25)	6,70 (1,88)	9,71** (3,28)	11,44 * (2,36)	1,13* (2,53)	77,1 %	213

Note. (*BV-Bio)* is the book value of equity minus total reported biological assets, *HC* is biological assets at historical cost, meaning biological assets minus fair value adjustments and *AFV* is the adjusted fair value measurement on biological assets in the balance sheet. *(Earnings-AdjBio)* is net income after tax, free of fair value adjustments from biological assets and *AdjBio* is the fair value adjustment related to biological assets in the income statement. *Spot* is the historical spot price on salmon retrieved from Fish Pool., The variables are scaled with outstanding shares. The significance levels are expressed with a 10% (*), 5% (**) and 1% (***) two-tailed test. T-values of the coefficients are in the parenthesis.

Our results show a drastic change when including spot prices in price model 3. With β_4 as an exception, all other variables have low significance. β_3 are no longer significant and β_5 is weakly significant. Further, β_6 is weakly significant, compared to the result from the historical price model including spot price (Table 8). One possible explanation for this could be due to the fact that β_3 and β_5 are explaining some of the same variation as the spot price. We have seen that the fair value adjustments and spot price have significant coefficients, when comparing the results from Table 6 and Table 8. When they are included in the same model, explaining similar effects on the market value of equity, it could decrease the significance of the variables.

These findings weaken our conclusion on the value relevance of fair value estimates. Still, it should be mentioned that this is an additional test to supplement our primary analysis. We originally found that fair value estimates are to be considered value relevant, based on reported financials. However, the

additional tests show that it is no longer obvious that fair value estimates are value relevant when additional publicly available information like salmon spot prices is included in our models. The R^2 from the additional tests on price model 2 and 3 also shows that an investor would be approximately just as good off, using historical cost measures with salmon spot price, as they would be using fair value estimates.

The findings in our last two additional tests are in line with our original concern regarding how analysts and investors are using the reported biological assets at fair value in the salmon farming industry. We previously stated a potential credibility issue, where users of financial statements could find the reported fair value estimates somewhat unreliable. This could potentially make the user disregarding the reported valuation, and instead making their own subjective valuation with the use of other available information. Spot prices are a good example of a measure an investor and analysist use in their potential, own evaluation. Our results indicate low value relevance on fair value estimates, when they are analysed and regressed together with spot price.

9.0 Conclusion

In this chapter, we will end and conclude our study. We are also going to give suggestions for further research on this field.

9.1 Concluding remarks

In this thesis, we conducted a study with the following research question:
Are reported biological assets in the salmon farming industry value relevant at fair value under IAS 41?

After the implementation of IFRS in 2005, the salmon farming industry were imposed to account biological assets at fair value, reflected in both the income and balance statement. Fair value accounting has been widely discussed, both by researchers and practitioners, questioning whether this type of accounting is useful or not for the user of the financial statement. The fact that users of

financial statements in the salmon industry might look away from the fair value adjustments on biological assets (Bernhoft & Fardal, 2007), illustrates the ongoing debate. There seems to be a difference in opinion on whether reported biological assets at fair value gives a reliable estimate that will be reflected in a company's market value of equity. In our thesis, we have examined this empirically, using value relevance methodology.

Based on the empirical results from our study, we can conclude that reported biological assets in the salmon farming industry are value relevant at fair value. This implies that fair value of living salmon gives a better understanding for the investor than only historical cost when determining a company's market value of equity. By using Ohlson price model, we find that reported biological assets have a positive relation to the market value of equity, and that fair value adjustments strengthen the accounting information´s ability to explain price fluctuations. Biological assets in the balance sheet consist of an historical cost measurement and a fair value adjustment. We have therefore tested the value relevance of these two components. Our results support the claim that both these elements are to be considered sufficient estimates for describing the market value of equity. However, our results do not support Misund (2016), claiming fair value adjustment in the balance sheet to be more value relevant than adjustments related to the in the income statement. But the overall results are the same. Reported biological assets in the salmon farming industry are value relevant at fair value.

The additional tests support our original answer to the research question regarding the value relevance of reported biological assets at fair value, when only considering the reported financials. *However*, the last two additional tests show that it is no longer obvious that fair value estimates are value relevant when additional publicly available information like salmon spot prices is included in the model.

9.2 Suggestion for further research

In this thesis, we have analysed the value relevance of biological assets in the salmon farming industry. This has not been done by many, so the opportunities for further research are many. In our dataset, we experienced issues with scale effects, heteroskedasticity and serial correlation. Looking at additional methods to eliminate these issues, could be interesting. One could also develop the analysis further to include more explanatory variables beyond balance and income measures. This would most likely strengthen the explanatory power and give additional information to what's causing price changes. As mentioned, the biological assets at historical cost became weakly significant when including fair value adjustments in price model 3. We were not able to give a thoroughly explanation of this and is a shift that should be analysed further.

Even though we got significant results indicating value relevance on fair value reported biological assets, there is still some uncertainty how these estimates are used by an investor. We showed through our last two additional tests that there is a positive relation between the market value of equity and the spot price from Fish Pool. The results also indicate a weaken value relevance of fair value estimates when other publicly available information is considered. A suggestion for additional research is therefore to further examine the relation between the market value of equity and other publicly available information, and how this may decrease the value relevance of reported fair value estimates. This might help to describe a possible current situation where analysts use their own valuation, free from the company and auditor`s subjective estimates. Even though we concluded that fair value adjustments and biological assets in general are considered value relevant, further research could also examine this with a different empirical approach, such as qualitative interviews.

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