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Master Degree Project in Accounting

The Valuation of Forest before and after the Financial Crisis in 2008

A descriptive study of forest valuation under IAS 41

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Abstract

Following the financial crisis in 2008, many studies suggested that the use of fair value measurement contributed to the crisis. Further they showed how the value relevance of level 3 inputs especially was affected by the increased doubt in fair value measurement. The crisis also involved large reductions in interest rates. Consequently, the application of IAS 41 - *Agriculture* in the forestry industry could be affected by the recent crisis. This connection is based on the fact that IAS 41 requires fair valuation of biological assets, that most of the forestry firms use level 3 inputs in their valuation and that the volatility in interest rates are affecting the valuations made by forestry firms through the discount rate which is used to value their forest by the use of a discounted cash flow model. Accordingly, the present study, applying a qualitative approach, investigates the valuation of forests before and after the financial crisis to capture the developments and changes in the used valuation methods. The study covers a period of 10 years between 2005 and 2014 to track changes over a period of time. Annual reports are our focus area for data collection and they are used in order to investigate factors that affect the valuation of forest in firms. The main finding of this study is that most of the companies do not make any significant changes in the valuation methods after the crisis. However, we found that some companies strive for more reliability in their valuation of forests after the crisis compared to before. Finally, some suggestions for follow-up research are presented at the end of this study.

Key Words: IAS 41, Forest, Biological asset, Fair Value Measurement, Financial Crisis

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1. Introduction

1.1 Background

One of the main objectives of the financial reporting is to provide information that transparently reflect the real situation of the reported entity, which would be useful for both present and potential investors, lenders and creditors (Picker et al., 2013). Initiating from this fact, entities' assets and liabilities should be fairly presented for outsiders based on its real value. Furthermore, in order to focus on the valuation of assets and liabilities within the scope of International Financial Reporting Standards (IFRS), the International Accounting Standard Board (IASB) identifies two different methods. One of these methods is the Historical Cost Measurement (HCM) and the other one is the Fair Value Measurement (FVM). While measuring the Fair Value (FV) of assets or liabilities, entities need either to capture the prices from the market or to make many assumptions. These assumptions are made in correspondence to the ones that market participants make when they are evaluating the price of an asset or a liability during the current market conditions at the time of evaluation (IFRS, 2013). Later on in 2011, IASB issued IFRS 13, which is a standard that illustrates how the FV of assets and liabilities should be based on the market prices in which FV is identified 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 Foundation, 2015, IFRS 13, Paragraph 9). IFRS 13 includes the FV hierarchy that is supposed to increase the comparability and thereby reduce differences in FVMs. This is achieved by categorizing the measurements into three different levels. Level 1 consists of inputs that are quoted prices from active markets. This level has the most reliable FVM since the quoted price comes directly from the market, and therefore it can be used without any adjustments. Level 2 consists of inputs other than the market prices that are included in level 1 that can be observed for an asset or liability. In other words, markets that are similar to the market of interest are used instead. Finally, level 3 consists of inputs that are unobservable for the asset or the liability. Thus, when measuring level 3 inputs it is hard to find any activity related to these inputs in the market, which means that the measurement needs to be made by using the best available information and a lot of assumptions need to be made (Deloitte, 2016, 13).

One standard that is affected by the use of FVM is the International Accounting Standard (IAS) 41 - Agriculture. In general, the accountancy of biological assets and agricultural activities are covered by this standard. The standard requires the biological asset to be measured at FV after deducting costs to sell, all the way from the initial recognition up until the point of sale. Additionally, IAS 41 defines the agricultural activities as those who transform biological assets into additional biological assets or into produce that have been harvested from the company's biological assets. The transformation of biological assets can be achieved by growth, production or procreation, which lead to a change in the biological asset. Additionally, a biological asset is defined as a plant or animal that is alive. The life process of the biological asset is ended when

the asset becomes harvested. IAS 41 revolves around the treatment of biological assets accounting-wise (IFRS, 2014). The standard itself was first issued in December 2000 and was firstly applied in January 2003. Since then, there have been a few changes with the latest being the exclusion of bearer plants in IAS 41, which instead was incorporated into IAS 16. IAS 41 is today applicable for biological assets except for bearer plants (Deloitte, 2016, 41). IAS 41 is applicable all the way up to the point of harvest, after that, another standard, such as IAS 2-*Inventories*, becomes applicable instead. This means that IAS 41 does not handle anything that has to do with the transformation of the produce (IFRS, 2014).

One of the assets that are recognized under IAS 41 as a biological asset is the forest. Accordingly, companies within the forestry industry that apply IFRS should evaluate its forests under IAS 41. The forestry industry in Europe is considered to be an important industry since its production accounts for approximately 12 percent of the total manufacturing in Europe and it employs at least 2.4 million people (Swedish Forest Industries Federation, 2000). Further, some European countries are in the top exporters in the world regarding forestry products (Skogsindustrierna, 2011), and hence Europe has an important role within the industry worldwide.

1.2 Problem Discussion

In the most recent financial crisis in 2008, many studies criticized the use of FVM for being a contributing factor (Laux and Leuz, 2009; Magnan, 2009; Whalen, 2008). This criticism has highlighted some concerns about the use of FVM in accounting and how appropriate it is in the financial reporting around the world and under the scope of IFRS. This criticism insisted IASB to make some changes in the aim of improving the financial reporting, such as establishing an expert advisory panel to facilitate the fair valuation in illiquid markets (Mala and Chand, 2012). Further, as a result of the financial crisis, some studies mentioned how the value relevance of the three level inputs was perceived differently after the crisis (Goh et al., 2015; Kolev, 2008; Song et al., 2010; Tama-Sweet and Zhang, 2015). More specifically, the level 3 inputs became less value relevant in comparison to the other two levels of inputs. Thus, investors discount level 3 inputs since it is based on many assumptions from managers that they do not trust as much as they did before the crisis. Furthermore, after the financial crisis there has been an increased volatility in the interest rate, which resulted in the reduction of the interest rate (Tokle et al., 2015) and the increased interbank interest (Angelini et al., 2011). Even though the main effect of the financial crisis was within the banking industry, it was not limited to only this industry but the crisis also affected other industries in other countries as well. For instance, Alber (2013) found that the crisis affected different sectors “Insurance, real estate and banks” in different countries with various degrees.

In relation to IAS 41 and more specifically to forests as a long-term biological asset that companies own, the standard requires the use of FVM to evaluate it. Further, many companies

that own forests, such as Holmen, UPM, SCA, Sveaskog, Bergvik Skog and Stora Enso, disclose that there is no active market for their forests, which means that their valuation is based on FV level 3 inputs. Thus, their use of level 3 inputs could be affected by the financial crisis by being less value relevant. Additionally, these companies use the Discounted Cash Flows (DCF) model as a measurement method in which the discount rate represents an important factor for the valuation. Therefore, since the interest market has experienced an impact from the crisis, it is likely that the forestry industry also has been affected by the crisis since they use the interest rate when measuring the value of forest.

Based on the aforementioned discussion we want to identify a potential problem in the valuation of forests under the scope of IAS 41 after the financial crisis. This problem, first of all, is generally related to the use of FV in the valuation method. We could see the increased doubt regarding FVM in the banking industry after the financial crisis and this could also affect IAS 41 since it requires FVM for biological assets as well. Second, the problem is linked to the use of a DCF model in which the discount rate is part of it. We argue that the increased volatility in the interest market after the financial crisis might have had an impact on the forest value under IAS 41 and the DCF model. That is based on the importance of discount rates in calculating the value of the long-term asset. Third, since most companies that apply IAS 41 evaluate their forests under FV level 3 inputs, which has been criticized after the crisis by previous studies, we argue that IAS 41 might also be affected by the crisis. Even though this issue is linked directly to the banking industry, but it might has an impact on the level 3 inputs in general.

1.3 The Aim and the Research Question

After highlighting the research problem, the main purpose of this study is to detect if there has been an impact of the financial crisis in 2008 on IAS 41 and more specifically on the biological assets. We accomplish this purpose, first of all, by looking at the valuation method of forest and by covering the changes that have happened in the period after the financial crisis between 2009 and 2014. Secondly, by checking if the level 3 inputs under IAS 41 has faced less value relevance after the financial crisis. Finally, by investigating how the volatility in the interest markets after the crisis has affected the measurement of forests under the DCF model. Based on the aforementioned purpose, we state the following research question:
Has the financial crisis in 2008 affected the valuation of forest under IAS 41?

By answering our research question, this study contributes to the literature in several aspects. First of all, by adding knowledge about how the forest has been evaluated under IAS 41 in the very recent years (until 2014). Second, this study adds knowledge to the accounting literature of how IAS 41 is affected by the recent financial crisis since it requires FVM for biological asset and there was an increased doubt toward this measurement after the crisis. In more details, we add knowledge about the FVM under the scope of IAS 41 and shed light on how companies

perceived the FV of forests after the financial crisis by tracking the changes that they made in the followed valuation method. Additionally, we cover the impact of the volatility in interest markets on forestry industry and the use of DCF model. Third, the findings of this study could be used by standard-setters in relation to any future amendments regarding IAS 41 to increase its quality or to increase the reliability of level 3 inputs. Finally, our findings could be important for regulators that are interested in the financial crisis and its effect on different industries worldwide.

The remainder of this report is structured according to the following; Chapter two describes the literature review with relevant research regarding IAS 41, fair value measurement, and the financial crisis in relation to fair value. In chapter three the methodology of the study is described and also the variables used when looking at the annual reports are presented. In chapter four the results are presented for all the variables with tables where it would increase the understandability of the results. A discussion of the results is made in chapter five and finally, in chapter six the conclusions and suggestions for future research are presented.

2. Literature Review

To answer our research question, we cover prior studies and literature regarding the following sections. First of all, since this study is mainly about IAS 41 we cover previous research in relation to this standard. By doing so, we are able to understand different implications of this standard. At the same time, these studies enable us to know the different opinions toward this standard and more specifically toward the movement from the use of Historical Cost Measurement (HCM) to FVM, as HCM was the followed method to value biological assets before issuing this standard. Second, based on the fact that IAS 41 requires FVM, we want to cover prior studies of how this method has been perceived in the accounting literature. These studies support our analysis by giving evidence of how other researchers have interpreted the FVM method so that we can relate their findings to our results. Finally, based on both the fact that our research question is about the effect of the financial crisis on IAS 41 and that IAS 41 requires FVM, we want to explore prior research regarding the financial crisis in relation to FVM. Further, we want to highlight why the crisis might affect IAS 41 and what reasons that could be behind it. Even though these studies are not in regards of IAS 41, we see a strong relation between these studies and IAS 41. This relation is initiated from, first of all, the fact that FVM has been criticized for contributing to the financial crisis in 2008 and it is the followed valuation method under IAS 41. Second, the value relevance of the level 3 inputs has been affected by the financial crisis, and most of the companies that apply IAS 41 disclose that their assets are categorized with this level of inputs. Thus, we argue that the recent crisis also might have an impact on FVM and level 3 inputs under the scope of IAS 41.

2.1 IAS 41 - Agriculture

There have been some discussed issues in the accounting research regarding IAS 41. These issues are categorized under two groups, which will be covered in the following section. The first group consists of issues regarding the implementation of IAS 41. The second group consists of issues that are linked to the FV valuation of biological assets regarding both the absence of active markets, and the recognition of changes in FV of biological assets in the Profit and Loss statement (P&L).

To begin with, after IAS 41 had been issued, Argiles and Slof (2001) observed a high possibility that the use of this standard in combination with the European Farm Accountancy Database Network (FADN) could diminish the identified gap that they found. This gap was mainly between the importance of accounting in the agriculture industry and the actual level of accounting practices that they assessed to be at a low level. Basically, Argiles and Slof (2001) reviewed the accounting techniques in both of the approaches, FADN and IAS 41. Hence, they were able to make a comparison of the used accounting principles in agriculture between FADN and IAS 41. They also made a summary of the main contributions of IAS 41 that has been taking place to enhance the bookkeeping at that time, which in their point of view could diminish the identified gap since the quality of bookkeeping level is increased. Further, they argued that IAS 41 could face some issues regarding the implementation phase because one can see the standard on a conceptual level more than a practical level. This in turn could lead to less reliability in the valuation of the biological assets. Accordingly, there is a need for some explanation tools to help organizations in the implementation phase. Hence, FADN could develop a useful tool in that concern since it has been focusing on this field for a long time before. Furthermore, they concluded that IAS 41 would significantly enhance the farm accounting based on the fact that before issuing this standard the agriculture sector was kind of ignored by accounting standard setters. On the other hand, as a weakness of IAS 41, Argiles and Slof (2001) highlighted a lagging in setting the standard since it is not taking into account the significant experiences that FADN or similar organizations might have. For instance, FADN finds it very complicated to value the agricultural harvest produce at FV while IAS 41 requires it to be evaluated under the scope of FVM. As a result this means that companies applying this standard need to interpret how to apply it totally by themselves, and in some cases without sufficient knowledge, which could affect the reliability of their valuations.

To expand the findings of Argiles and Slof (2001) to a wider international context, Elad (2004) performed a study with that aim. By discussing the usage of FVM in IAS 41, this study mentioned that it is more beneficial to use this method rather than HCM when there is an active market for the inputs. For instance, in situations where the HCM is very costly, the use of FV could be much easier and more efficient. Thus, that could address efficiency in setting IAS 41. But however Elad (2004) mentioned some issues regarding IAS 41. One issue is the assumption that the FV of the asset is measured reliably in which the word reliably is characterized by a high

degree of doubt. Another issue is regarding the annual FV valuation that firms should do, which is considered to be costly, especially when the firm operates in a low developed country. Thus, companies within the forestry industry might not conduct an annual test for their forests and still state that their valuation is reliable. This shows that there are arguments speaking for both methods but the important aspect for the FVM is that it can be measured reliably. If the forestry companies do not make an annual FV valuation due to the high costs, the assets might be presented in a way that is not accurate. This would in turn portray a picture of the assets that is incorrect, which would mislead the information users.

In 2005, after the new regulation regarding implementing IFRS in all listed European firms had taken place, Herbohn and Herbohn (2006) found this as an incentive to investigate in IAS 41. Thus, they examined the application of this standard in a European organization context. Further, their study was based on a previous study that had investigated the Australian market. In their study, they wanted to cover the impact of using the FVM on firm's financial reports. Mainly, they discussed two issues about the application of IAS 41 in European firms. The first is the appropriate measurement of biological assets at FV, which is really problematic when there is no active market and in contrast, it is reflecting the reality of biological assets in the existence of active markets. However, it is very difficult to find an active market for biological assets (Herbohn and Harrison, 2004). The second discussed issue is the recognition of the changes in the assets' FV, which might lead to unrealistic gains or losses. Hence, according to Herbohn and Herbohn (2006), some companies had an increase in the FV of biological assets more than the other total reported profit, which in that sense could be problematic.

In the aim of examining the application of HCM versus FVM in the Spanish market, Argiles et al. (2011) performed a study with a sample that was based on two main categories. The first category consisted of firms that were still applying HCM on the biological assets. Where this category represented the majority of the studied sample with about 96 percent, in accordance with the Spanish accounting standards number 3 and 13. While the other category consisted of firms that had shifted to the FVM where these firms have not followed the Spanish standards in their preparation of financial statements. Further, they found that the total assets value is significantly higher in firms that are following the FVM in comparison to the ones that are following HCM. However, this did not affect earnings, revenues or cash flows from operations. Hence, there are no significant differences in earnings between companies that apply HCM and companies that apply FVM. In regards to the valuation of the biological asset this is an interesting finding since the biological assets are likely to be higher when using FVM comparing to the use of HCM. Another finding by Argiles et al. (2011) is that applying the FVM on biological assets generates at least equal or sometimes higher earnings predictability than HCM. Furthermore, there is not high volatility in earnings in applying neither the HCM nor the FVM. On the other hand, Herbohn, and Herbohn, (2006) found that IAS 41 is more seen as an academic standard, which in practice is not very efficient for reporting the biological assets. In the same vein, Penttinen et al. (2004) stated that IAS 41 requires a FVM for forests, which might

be problematic since that is affecting both the balance sheet 'the asset value' and the P&L statement 'the recognized changes'. Further, to investigate more in the implication of IAS 41, they examined several farms and found that the major proportion of the total operating profit is from changes in stock value and felling income. Thus, applying IAS 41 could cause unrealistic gains or losses in these farms.

When it comes to the valuation process of the biological asset, Lorentzon (2011) made a study that focused on the valuation of assets within the forest and real estate industries in the Swedish market. For the forest companies, he looked at the three biggest actors on the Swedish market, which is SCA, Holmen, and Sveaskog. He found that the valuation of forest according to FV was disregarded by the biggest forest companies in Sweden (Holmen, SCA, and Sveaskog). The reason behind this was that they argue that the amount of forest that they own is so large in which there is no active market can rightfully reflect it. Therefore, they all decided together to use a DCF model instead. The DCF model was developed by all the companies together including auditors and a consultant. The consultant is the main reason behind the discount rate that all the companies settled upon and the reasoning behind the specific discount rate is unknown according to Lorentzon (2011). He stated that during his interviews with the respondents from the companies the reasoning behind the specific discount rate has not been discussed. The companies argue that the reason behind them all coming together to decide upon how to interpret IAS 41 is partly due to the fact that it is unclear how it should be applied in the forestry industry. Thus, there is a big chance that the accounting will not be fairly represented if the companies try to interpret it all by themselves. In other words, the ability to be able to compare the companies with each other would be harder. This can either be seen as a way for the companies to achieve comparability or as a way for them to make the valuations in their own way and being portrayed in the way that they want to.

2.2 Fair Value Measurement

The use of FV within the scope of IFRS is not as extensive as many researchers imply. Hence, to support this idea Cairns (2006) argued that the use of FV is still limited under the scope of IFRS. Further, Ronen (2008) discussed the reliability of FVM and the inputs that are needed. He stated that the level 3 inputs are not reliable since they can cause significant distortions in the financial statements due to its characteristics, which leaves managers with a subjective potential to determine these inputs by themselves. Cairns (2006) further expressed concerns in regard to the fact that for level 3 inputs there are no active market that can be used to attain information for the valuation of assets and liabilities. Landsman (2007) discussed the level 3 inputs and that since there is no active market for these inputs, managers have to take decisions regarding the valuation of assets and liabilities based on their own judgment, which leads to information asymmetry and hence opens up for the risk of manipulation. Penman (2007) stated that a positive approach regarding the level 3 inputs is that it allows for market prices that are hypothetical. A downside to this, however, is the subjectiveness when there is a need to make own judgments

due to the fact that there are no active markets. According to these studies and in relation to the forestry industry, one could argue the great critics regarding the level 3 inputs and how it is based on many managerial judgments, which is impacting the trustworthiness of the managerial choices in forestry firms in linkage to the application of IAS 41. However, this level of inputs still enable forestry companies to identify FV prices even if there are no such prices existing in any active markets.

Another problem that Landsman (2007) pointed out regarding the FVM is the big chance of errors within these measurements. Additionally, Penman (2007) agreed that there is a big risk for errors in the measurements, which in turn will lead to errors in the financial statements. However, Landsman (2007) stated that it is important to be aware of the fact that HCM is also likely to contain errors when it comes to measuring the value. Thus, the important question that needs to be asked is whether or not the information provided to investors by having a FVM is better in relation to the information that would be provided with a HCM instead. In regards to these studies, there is a chance of errors in both HCM and FVM, which means that this is not an issue concerning the specific method.

The use of FV accounting is positive on a conceptual level, but however when it comes to the implementation, it is complicated (Penman, 2007). Ronen (2008) said that when the measures are quantified with the exit prices of a liability or an asset, the investors are not receiving information that is valuable. Further, Penman (2007) noted in his study that when the exit price is defined by FV the negative aspects piles up. One of these problems he stated is that it is hard to match assets and liabilities. The exit price can, however, inform the investors to some extent concerning the risks of the surroundings (Ronen, 2008). Furthermore, the exit values for the measures that are using level 3 inputs have a low reliability and can be heavily biased. Ronen (2008) stated that one of the reasons for this is that managers and directors today do not get any penalties or consequences that would deter them from altering the books. Based on that, different stakeholders could not trust managers since they can do what they want without any form of punishment or limitation. In the same vein, another problem regarding the informativeness is that it is affected by errors in the estimates and the influence managers have had regarding manipulation (Landsman, 2007).

2.3 The Financial Crisis in Relation to Fair Value

In the discussion of the financial crisis, one could not ignore the amount of research that has been done with the aim of figuring out any relation of FV to the crisis. Whalen (2008) mentioned the FV as one of the main factors that caused the financial crisis in 2008. He explained how the use of FVM resulted in the significant collapse of the market, in addition to the increased doubt about the financial institutions' solvency. Further, he discussed the unavailability of a market for banks' structured assets that should be valued on the FV, and how it lead to nearly total losses because of the significant write-down of assets, which at the end caused the crisis. Thus, mainly

the absence of active markets resulted in writing down the assets since there was no demand for it at all in which the demand is considered an essential factor when deciding upon market prices in the FVM. Accordingly, the use of this method might result in the same issue in other industries and not only in the banking industry. For instance, many forestry firms claim the absence of active markets for their forests, which is problematic in crises situations since it leads to a significant write down of assets as mentioned before.

In relation to the three levels of inputs of FV, investors found that inputs from level 1 and level 2 were relevant at market value with a very low doubt regarding any possible manipulation. However, concerning level 3 inputs, they perceived it to be measured less reliably, and they had a concern regarding manipulation when it comes to this level of inputs. Accordingly, during the financial crisis in the late summer of 2008, investors discounted the level 3 values significantly, which is based on the idea that they did not trust managers' measurement anymore because of the high discretion in their decisions (Goh et al., 2015; Kolev, 2008; Song et al., 2010). Furthermore, Tama-Sweet and Zhang (2015) investigated the value relevance of the three levels of inputs and made a comparison between the recession period in 2008-2009 and the normal economic period in 2012-2013. They found less value relevance in both periods for the level 3 inputs of financial assets in comparison to level 1 and 2, which is in accordance with a greater discretion when managers use this level of inputs. Additionally, Goh et al. (2015) made a study to examine the investor's opinion towards the valuation of assets in banks under the scope of FV. They found that investors have some concerns regarding the estimations of level 3 inputs after the financial crisis in comparison to inputs from level 1 and level 2. Thus, investors discount the FV level 3 inputs higher than level 1 and level 2 inputs. However, the lower reliability of level 3 inputs was diminishing over time after the market was stabilized but remained to some extent. Based on these studies, one could argue how the level 3 inputs has been mostly affected from the financial crisis, and hence investors and other financial statement users do not find this level as reliable as it was before the crisis. This less value relevance can not be limited to the level 3 inputs in only banking industry, but also in other industries that use it, such as the forestry industry, since these inputs have the same characteristics regardless of which industry that it belongs to.

According to Shleifer and Vishny (1997), the market prices can distort from its essential value in cases such as the limitation of arbitrage and a lack of liquidity. This has been explained in many studies that if the deviation of market value in one bank resulted in writing down and selling their asset at fire-sale, and then accordingly this can affect other banks as well when fire-sale prices become relevant to their assets. Hence, this requires them to write down their assets value and adopt it to the new prices. Consequently, here we can say that FVM has caused the writing down of assets in other banks (Allen and Carletti, 2008; Heaton et al., 2010). By applying the same conditions to any other assets in any industry that require a FVM for this asset, almost the same issue of writing down the assets would be the result. Further, Allen and Carletti (2008) discussed how the use of FV accounting during illiquidity crisis would reflect in deviation from

the essential and fundamental value of assets. As a result many people blame the FV accounting to have a significant role in the financial crisis where a former chair of U.S. Federal Deposit Insurance Corporation, William Isaac, said "mark-to-market accounting has been extremely and needlessly destructive of bank capital in the past year and is a major cause of the current credit crisis and economic downturn" (Jeffrey, 2008: 27). Further, in a study by Fang et al. (2013) the value relevance regarding FV for financial instruments is investigated in regards to the financial crisis. They found that the financial instruments, and thereby the FV accounting, are value-relevant when the economy is stable, which means that the relevance of financial instruments is affected by major changes in the financial environment. In the same approach, Jaggi et al. (2010) defended the use of FV because in their point of view the FV valuation during stable conditions in the market reflect reliable situations while in the case where the market was volatile and unstable, using a FV method would be questionable and not so efficient. Here one could criticize the use of FVM in accounting since it results in less value relevance in the unstable markets, which is not only limited to the financial instruments but also could cover all other assets that are evaluated under FVM, for instance, the FVM of biological assets under IAS 41.

On the other hand, Magnan (2009) discussed the importance and relevance of FV accounting to investors, which means that we could not only blame FV when it comes to the financial crisis. However, he mentioned that FV accounting contributed in accelerating the crisis. Thus, without the use of FVM the crisis would be delayed but not canceled, meaning it was only a matter of time and not the followed valuation method itself. At the same time, Laux and Leuz (2009) argued that the FV accounting could not be the major reason for the financial crisis, but however they still found some factors that supported FV accounting to be contributing when it comes to assets' fire-sale and the significant write-down of assets in the banking sector. Further, Wallace (2008) supported the use of FV accounting by stating that it is not the reason for the financial crisis but it was the messenger that gave feedback on the current market situation. She also discussed how the absence of FV accounting would affect the financial market negatively and even generate a worse situation than the occurred one in the crisis. This is mainly based on the fact that FV accounting contributed of reflecting the real situation of the current market, which at the same time helped in discovering the crisis before its effect became even worse than it was.

In addition to the increased doubt of the FVM, some studies (Angelini et al., 2011; Tokle et al., 2015) discussed an increased volatility in the interest rate after the financial crisis in 2008. This volatility could be seen in the interest market in general and was presented in different aspects. Angelini et al., (2011), discussed the sharp increase in the interbank interest rates globally. They found that interbank interest rates are affected from the financial crisis by being reactive to the creditworthiness of borrowers instead of only been insensitive to their characteristics. Thus, other factors are affecting the interest rates that might increase its volatility. Furthermore, in a study by Tokle et al. (2015), one consequence of the financial crisis was the large reduction of interest rates. A monetary policy that was very reserved lead to short-term interest rates being close to zero at this time. Further, this indicates that there has been a large volatility for the interest rate

over the years. Thus, one could argue how the interest market has been affected from the crisis in different ways, which at the end represented volatility in the rates that impact its different users. One potential using of these rates could be under the measurement of DCF model in which some of the forestry firms use to valuate their forests under IAS 41. Hence, the volatility in these rates could impact the DCF model in forestry industry.

3. Methodology

3.1 Research Design

In this study, we chose to implement a qualitative method that is mainly based on empirical data. Further, our study is focused on an event, the financial crisis in 2008, meaning that this is the breaking point where we based our differentiation between the years before and after it. The collected data is both numerical and textual in which the annual reports were our resources. Our aim was to observe any useful information regarding the FV valuation of forest and thereby biological assets. We chose to observe information by looking at annual reports since conducting beneficial interviews will be unmanageable. This is based on the fact that our sample study is spread geographically and not located in one country, and additionally our study period covered several years, which means that finding employees that have worked during this period is very unlikely.

Derived from our research purpose and questions, formulating a qualitative methodology is the most efficient choice. This is based on the fact that we are planning to come up with a descriptive conclusion in which looking deeply on the disclosed information in annual reports would facilitate this mission. According to Bryman and Bell (2015), a qualitative approach gives the researcher the opportunity to be closer to the study's respondents, which enable them to get a better understanding of the studied context in reality. However, they mentioned that generalizing the results of a qualitative study on the whole population would almost be impossible. Hence, drawing up a statistically generalizable result is not one of our aims in this study.

3.2 Sample Selection

The selection of our sample is based on a previous thesis study made by Bierfreund and Pichalo (2012) with some modifications to fit our research purpose. The reason why we chose this study's sample as a basis for our search criteria is because they conducted a study that looked into the valuation of standing trees under IAS 41 with consideration of the amendment in 2009. Hence, they identified a sample that consisted of companies that own trees and value it under IAS 41. To determine this sample they first used Orbis as a database source, and selected the industry based on the codes as shown below:

NACE Rev. 2:

16 - Manufacture of wood and of product of wood and cork, except furniture;

manufacture of articles of straw and plaiting materials
161 - Sawmilling and planning of wood
162 - Manufacture of product of wood, cork, straw and plaiting materials
17 - Manufacture of paper and paper product
171 - Manufacture of pulp, paper and paperboard
172 - Manufacture of articles of paper and paperboard

Second, they looked more deeply into the firm's annual reports, and then selected the companies that own forest and apply IFRS. Third, after the previous step in the selection process, they found just a few companies that fit their criteria, and hence in order to maximize the sample they added some companies that based on a global survey of the forest, paper and packaging industry made by PriceWaterhouseCoopers in 2011 (PwC, 2012). As a final result, they got a sample of 30 companies, which have trees and value it under IAS 41, but however their sample is located in different countries regardless of any considerations to geographical or political borders. Additionally, the ownership form of their selected companies was both listed and private-owned companies.

According to that, the study of Bierfreund and Pichalo (2012) had a purpose of search criteria that is similar to ours since we want to identify companies that both own forest and follow IFRS to value it. Hence, to select our sample we chose these 30 companies as a primary selection and then modified it to our research purpose. First of all, we focused on the European Union countries where they follow many common regulations. Basically, in 2002 the European Union reached a decision to enforce all firms that are listed in any European stock market to adopt IFRS from the beginning of 2005. Hence, in the beginning, we had the main focus to base our selection on listed companies in the European Union, which also allowed us to access their annual reports easily since it should be publicly published. Later, we decided to maximize the sample size and therefore we decided to include the private-owned companies that are located in the European Union that also apply IFRS, which gave us a few more companies. In addition, we added two more companies that are located in Switzerland and Norway and at the same time were part of the primary sample. The reason behind this is that we believe that Switzerland and Norway have many things in common with other countries since they are geographically part of Europe. Further, all the companies needed to own forest at least between 2007-2010. This in order for us to be able to have some years before and after the crisis that is our breaking point. Later, we looked into the primary sample and selected the companies that are still active throughout our study period. Additionally, we looked at an updated version of the survey made by PriceWaterhouseCoopers in 2014 to see whether there are any new companies in the list that could be of interest to our study (PwC, 2014), but however none of these companies were added to our study. Finally, we had a sample that consists of 17 companies that have forest and apply IFRS. 12 of these companies are listed in one of the European stock markets and five companies are privately owned. Further, in accordance with the purpose of making a comparison within firms in the same country, we identified three clusters based on the region in Finland, Portugal,

and Sweden. However, we were not able to have a cluster for any other country since the rest of the countries have only one selected firm. Our sample distribution is presented in Table 1 and the companies are presented separately in Table 2.

Table 1 - Sample Distribution

Country	*Frequency*	*Percentage*	*Country*	*Frequency*	*Percentage*
Finland	**3**	**17,65%**	**Portugal**	**3**	**17,65%**
Germany	**1**	**5,88%**	**Spain**	**1**	**5,88%**
Great Britain	**1**	**5,88%**	**Sweden**	**5**	**29,41%**
Ireland	**1**	**5,88%**	**Switzerland**	**1**	**5,88%**
Norway	**1**	**5,88%**	*Total*	*17*	*100,00%*

Table 2 - List of Companies

Company	*Country*	*Company*	*Country*
Stora Enso	**Finland**	***The Navigator Company**	**Portugal**
***Tornator**	**Finland**	**Ence Energia & Celulosa**	**Spain**
UPM-Kymmene	**Finland**	**Bergs Timber**	**Sweden**
Asian Bamboo	**Germany**	***Bergvik Skog**	**Sweden**
Mondi group	**Great Britain**	**Holmen**	**Sweden**
Smurfit Kappa Group	**Ireland**	**SCA**	**Sweden**
Norske skog	**Norway**	***Sveaskog**	**Sweden**
Altri SGPS	**Portugal**	***Precious Woods**	**Switzerland**
Semapa	**Portugal**	*Total*	*17*

*** Privately owned companies**

3.3 Data Collection

After the selection of our sample and based on the identified breaking point, we determined a study period of 10 years. Officially, we wanted to cover two main periods, one before and until the financial crisis and the other one from the crisis and after it. Thus, as a starting point, we chose the year 2005 in which we believe all listed companies at least applied IFRS from this date. This guaranteed for us that the majority of companies in our sample have been applying IFRS from our starting point of the study. As an ending point, we chose 2014 to be the last year in our study since that guaranteed for us the availability of information. Further, since the financial crisis effect was mainly in 2009, we had a period of four years before the crisis and a period of six years after the crisis. By covering a period of ten years, we were able to track all changes in the valuation of forest and all development in the method that companies followed. Even more, we were able to detect changes in the disclosure throughout our study period.

As mentioned before, financial reports were our main resource for this study, and thus, we collected it manually from the companies' websites. In the case of missing data, we tried to contact the companies directly in order to ask them to provide us with the material that we were lacking. However, the amount of annual reports that we did not get access to were few, which in our case was not material in comparison to the total available annual reports. The annual report that we looked at needed to be available in Swedish or English in order for us to include that year. Finally, we made an annual observation through accessing the financial annual report, which means for each company we made a maximum of 10 observations in the case of availability of annual reports for our whole study period, and hence we made 154 observations.

When we investigated the annual reports, not only the notes were looked at when looking for relevant information but also the rest of the annual report. To make sure that areas where relevant information might be available the annual reports were scanned by searching for the words: IAS 41, IFRS 13, Biological assets, Forestry assets, Fair value, Forest, Trees, and Discount rate. After that, the information that we needed was collected in accordance with the variables that we determined by looking at the annual reports. These variables are presented in the following sections of the methodology chapter.

3.4 Variables in the Annual Reports

In our investigation, we looked into several variables in the annual reports of the companies to conduct this study. First of all, we identified the biological asset ratio from total asset, which we believe supported our discussion considerably when it comes to the discussions that are related to the effect of IAS 41 on the financial statements. Second, we looked into the valuation model that companies use to evaluate forest. And based on the fact that the majority used the DCF model, we identified three other variables that are directly related to this model, which are the discount rate, the harvesting cycle and the calculation of future cash flows. Further, we looked into the changes in forests FV as a percentage from operating result to see how stable these changes are.

In the same vein, we calculated the value per hectare of forests to see how stable the changes in value were. Further, a Mann-Whitney U-test is conducted for the averages of both biological asset ratio and changes of FV in P&L statement. We used this test in order to see if there is a statistical significance between the period before and after the crisis for the averages. Finally, we examined the disclosure quality of IAS 41 and also from 2013 we examined the disclosure quality of IFRS 13 since it is affecting the fair valuation in IAS 41. In summary, we tried to cover all factors that could affect the valuation of forest and identified it as a base for our investigation. In the following sections, we are going through all mentioned variables deeply.

3.4.1 Biological Asset Ratio

We calculated the biological assets ratio by taking the amount of biological assets and dividing it by the total assets of the company. This ratio made it possible for us to identify the significance of biological asset for each company. This also made it easier to compare companies with each other, which facilitated our analysis. Additionally, it helped us draw up a conclusion since the effect of the biological asset for example in companies that own it as 80 percent of total assets is very different compared to companies who own it as five percent of total assets.

3.4.2 Valuation Model of Forest

One variable that we used for investigating the annual reports is concerned with which model the companies are using when they are valuing their forest and thereby their biological assets. These models can be various in different ways; firstly it can be valued in relation to the historical cost of the asset plus all expenses for maintaining it. Secondly, forests can be valued by the use of an active market price. Thirdly, the use of similar markets could be efficient to establish the price and thereby the value. Finally, in the case of absence in the active market, companies value their forest based on judgments and assumptions since there is no active market or similar market to help. Such an example is presented in a dissertation by Lorentzon (2011), where he stated how three of the Swedish forest companies got together in order to come up with a DCF model to value their forests.

In our investigation, we identified this model that companies use to value their forest. We also tried to cover all related information concerning this topic. Hence, comments regarding why this model was decided are looked at, and the amount of presented information regarding the model itself and the decisions behind the use of that model are discussed. The different factors that are used to calculate the future cash flow are also investigated and these are presented further in the following sections.

3.4.2.1 Discount Rate

In the DCF model, companies use a particular discount rate to calculate the present value of the predicted future cash flows. However, this would generate different results depending on which discount rate the company decides upon to use. In the dissertation by Lorentzon (2011), he

concluded after his interviews with respondents that one consultant set the discount rate for the three big Swedish companies (SCA, Holmen and Sveaskog). This consultant was solely deciding upon an appropriate discount rate and afterward the companies adopted it.

In the annual reports, we investigated the information disclosed in regards to the discount rate. Furthermore, we also looked at the development of the discount rate throughout the whole study period. Discussions concerning if there has been a change in the discount rate and additionally we tried to cover the reason behind any potential change.

3.4.2.2 Harvesting Cycle

Another factor that is taken into account when using the DCF model is the harvesting cycle. It is the expected life cycle of the forest up until harvest. In other words, it is the expected annual harvesting till the end of the asset's life. While investigating the annual reports we identified the different harvesting cycles in all companies if it was applicable since not all companies disclosed information regarding it. We also examined how well companies support the chosen harvesting cycle. Finally, we made a discussion revolving differences between companies and the possible reason behind it.

3.4.2.3 Calculation of Future Cash Flows

As a final factor in the DCF model, it is the prediction of future cash flows from the biological assets. Thus, in our study, we collected all possible information regarding how companies predict and account for the future cash flow from their biological assets. This discussion is significantly important for us since there have been many discussions about how IAS 41 leaves management with a high possibility to make many judgments (Elad and Herbohn, 2011). Covering this term was interested for us to detect and track differences of the disclosed information regarding the calculation of future cash flows before and after the crisis, and to see if companies have made any adjustments.

3.4.3 Value of Changes in Biological Assets, Operating Result and Total Assets

Initiating from the direct effect of IAS 41 and FVM on annual reports, we wanted to cover some important items from the balance sheet and income statement that helped us in conducting this study in many senses. First, we collected data regarding the value of biological assets and total assets that companies have. This data gave us an overview of how material the biological asset is for each company in which we used it to calculate the biological asset ratio and that, as explained before, helped us in the analysis process.

Other important items were the changes in FV of the biological assets and the operating result, which we collected from the companies' income statements. These variables were important since we wanted to measure the percentage of changes in biological assets from operating result. Thus, it allowed us to check the stability of these changes in both periods before and after the

crisis to detect any changes. And also this enabled us to make comparisons between different companies within the same country.

3.4.4 Value per Hectare of Forests

An additional area that we wanted to look at is the recognition of the percentage of changes in forest values. By covering a study of ten years we were, first of all, able to track the stability of changes in the value of forests. Second, we were able to notice the differences in changes of percentage before the financial crisis and after it, which helped us to draw a conclusion concerning this event. Moreover, by doing so we reached a good comparison between firms that were located in the same countries, and at the same time, we were able to compare countries between each other.

Further, to get a sufficient form of comparison we connected the forest values to the surface area that it covers, which gave us the value per hectare. This value facilitated our purpose since many activities might occur during a period study of 10 years, such as new acquisitions and sales of forests. Finally, while looking at the surface area that forest covers, we had in mind that some factors are strongly recommended to affect the value of hectare. For instance, the density of trees could be very different from hectare of forest A to hectare in forest B, and in the same perspective, the diversity of species is essential as well.

To detect the value per hectare of forests, we either found information disclosed in the annual reports presenting clearly the value per hectare of forests that the company owns, or we gathered information regarding the area size of forests. Here we have to highlight that some companies disclosed the number of hectares of productive forest and others only disclosed the total number of hectares. However, we did not find this problematic for both reasons. First, most of the companies disclose the total hectares that they own, and second the companies that disclose their number of productive hectares of forest always have the majority of hectares as productive, and the percentage of the non-productive forest is very low and not material at all.

3.4.5 Disclosure Quality

We used a checklist to investigate the disclosure quality and whether the companies disclose all the information that they are required and recommended to or not. In the first column of the checklist, the standard is presented, which is about IAS 41. In the second column, we added the information that is required and recommended by the standard. Finally, we presented the score in the third column of the table. We included this checklist in Appendix B.

The checklist itself contains information about what is stated in the standard. The information presented from the standard is then used to compare with what the companies disclose in their annual reports. If the disclosures match the information that is required and recommended by the standard the company will receive a score of 1. If the information does not match what is

required and recommended or if the information is not disclosed at all, the company will receive a score of 0. If the information is not applicable for that item in the company a notification N/A is made, showing that the information is not present in the annual report.

The classification score that the companies received on the amount of disclosures that they have in relation to what is required or recommended by the standard results in a disclosure index. This index shows a ratio of the items that are disclosed in linkage to the maximum possible score for that company. In the extreme situation that the disclosures match exactly the information that is required and recommended by the standard the company would receive a score of 1. While on the other hand, if the information is not disclosed at all, the company would get a score of 0. The paragraphs in the checklist for IAS 41 consisted of both the required and the recommended information that companies should disclose. The scoring is accordingly divided between the required and recommended information stated in the standard. The reason for this division is that the required and recommended scores generate two different numbers. A discussion revolving around these is made to see how much information the companies are disclosing because they have to disclose and how much information the companies wants to disclose to increase transparency (Mazzi et al., 2016). In the study made by Mazzi et al. (2016) they found a significant positive trend when it comes to the scores for disclosures in relation to the standard for the period 2008 to 2011. They state that the disclosures that they looked at changed over time, meaning that they were not consistent throughout the period.

When we were looking at the annual reports to investigate whether or not they disclose the information required or recommended in the standard key points within each paragraph in the standard were deducted. These keywords were then used when looking at the annual reports. If the majority of the key points within the paragraph were found in the annual report, they received a score of 1. If there were none of to only a few key points existing the company received a score of 0.

3.5 Data Analysis

In this study, we gathered all the relevant data from the annual reports and then it was portrayed in tables. These tables were outlined to include the data that is of interest and that later would be analyzed. The tables are presented in the text as aggregated as possible in order to make it easier for the reader to take in the information that is relevant. For some tables, we found it necessary to include all the years in order for the reader to track the changes that occurred over time. However, for most of the tables only the averages before and after the crisis are included, since this was enough information to understand what happened for the variable presented in that table. The time period of ten years makes it possible to analyze differences and trends throughout the years. The effects however might not be a result of the crisis and further the effect of the crisis might happen several years after the actual event of the crisis. Therefore the analysis of the data is likely to contain effects that are not solely results of the crisis.

The tables that are presented contain the variables that were investigated in this study. The variables are categorized under four main sections, namely; the valuation model, changes in P&L statement, value per hectare of forest, and disclosures for IAS 41. Under each of these sections, the data is analyzed in accordance with the previous literature. To analyze the gathered data, first of all, we tracked the valuation that companies followed during the whole study period to identify all possible changes. We trucked and highlighted the changes that were out of the ordinary either by means of being large changes from one period to another or by showing volatility throughout the time periods. These changes were then analyzed by trying to identify if they were a result of the crisis or part of the business environment and the regular operations of the different companies in our sample. If a connection to the crisis could be found, the changes were then analyzed from the perspective of previous literature. A connection to the crisis was established if a difference in any of the variables was found between the period before the crisis compared to the period after the crisis and that this change was not explained in the annual reports. The literature was used to find similarities and differences with the changes we found in our research. These were then discussed in order to see if a trend within the research could be found or if our result was in conflict with what other researchers has found. Second, we analyzed all information that could be of interest in regards to the valuation method of forests with the main focus on the financial crisis in 2008. Here we looked at the different measures that are used when valuing forests. One of the connections investigated here concerns the interest rates and whether it can be clearly seen if this has had a severe impact on discount rates used for DCF models or not. Finally, this process in linkage to the covered literature helped us draw up our conclusion and to make it possible to answer our research question.

3.6 Limitations

While we were conducting this study we faced several factors that might limit our findings, and hence the reader should take it into account. To begin with, in our sample selection, we were limited to the primary sample that is based on a prior study. Further, IAS 41 accounts for the valuation of biological asset regardless of the industry. Thus, some other industries might still have forests that are evaluated under IAS 41, which we did not take into account since it was extremely difficult to cover it. In the data collection process, we were limited to the information that is disclosed in the annual reports. Hence, some other information could still be important for us but we could not get access to it since we did not use any other methods of data collection other than text observations from annual reports. Furthermore, the data that was collected and that was later analyzed in accordance with the crisis in 2008 might show results that are not accurate. This is due to the fact that the effects that are analyzed might not be the effects of the crisis alone, since this is hard to establish. Therefore there is a risk that the results are a bit skewed. Additionally, while collecting the data regarding the investigation of disclosure quality, our process of the collection in regards to the checklists can be subjective since the researcher needs to make a judgment regarding if the disclosed information is enough to receive a score of 1

or not. In the same vein, we investigated the valuation of forest under IAS 41 in a very limited number of firms in which there is a possibility that our results could be different if the sample size were to be larger.

4. Empirical Data

4.1 Biological Asset Ratio

In Table 3 we presented the averages of the biological asset ratios for both the period before and the period after the crisis for all the companies. However, we included the detailed results for all years from 2005-2014 in Appendix A. In general, the biological asset ratio is very different from one company to another. In some companies, forests represent the majority of the total asset such as Tornator and Bergvik Skog. In other companies, forests represent a fairly high percentage ranging from 20 to 50 percent of total assets such as Holmen and Precious Woods. While in some other companies the forests represent a low percentage of the total assets such as Stora Enso and Mondi Group. Finally, what was obviously noticeable is that most of the companies had a stable ratio of the biological asset throughout the study period. By conducting a Mann-Whitney U-test based on the values in Appendix A, the results indicated an approximately normal distribution for the biological assets ratios, which means that the z-value can be used. This result is based on the U-value of 554. The z-score of -0,2882 and the p-value of 0,77182 shows that the result is not significant with a significance level of 0,5. Thus, the averages of biological asset ratio before and after the crisis are not significantly different from each other.

Table 3 - Biological Asset Ratios

Company	*Country*	*Average before*	*Average after*
Stora Enso	**Finland**	**0,70%**	**2,40%**
Tornator	**Finland**	**90,90%**	**89,00%**
UPM-Kymmene	**Finland**	**7,70%**	**10,20%**
Asian Bamboo	**Germany**	**53,50%**	**31,30%**
Mondi Group	**Great Britain**	**3,30%**	**4,40%**
Smurfit Kappa Group	**Ireland**	**1,00%**	**1,40%**
Norske Skog	**Norway**	**0,50%**	**1,00%**

Altri SGPS	**Portugal**	**6,80%**	**8,50%**
Semapa	**Portugal**	**3,70%**	**2,90%**
The Navigator Company	**Portugal**	**5,40%**	**4,10%**
Ence Energia & Celulosa	**Spain**	**17,50%**	**12,70%**
Bergs Timber	**Sweden**	**6,90%**	**7,40%**
Bergvik Skog	**Sweden**	**93,00%**	**92,90%**
Holmen	**Sweden**	**30,00%**	**41,40%**
SCA	**Sweden**	**14,70%**	**19,10%**
Sveaskog	**Sweden**	**78,60%**	**81,20%**
Precious Woods	**Switzerland**	**20,20%**	**24,30%**
Total average		***25,55%***	***25,54%***

4.2 Valuation Model of Forest

When it comes to the valuation model of the forests, there are several methods that companies followed and more precisely disclosed in their annual reports. Where each firm identifies the used model based on specific criteria that they have and in relation to their judgments. In Appendix B we presented a summary of the used model by companies in each year of our study period.

The most common model that is used is the DCF model. Companies using this model stated that the reason why they are using it is due to the unavailability of market prices or any comparable valuations to their asset. Further, in this model, companies calculate the expected future cash flows that their biological asset will generate in the future, and then they discount it to reflect a reliable present value. However, there are many assumptions that are related to this model, which we will discuss in later sections separately. Briefly, their assumptions are: the volume of harvesting timber and linking it to the future selling prices. The harvesting cost and all other expenses that are directly related to the sale of this asset, for example transportations, fertilizing and workers' cost. The inflation rate for the prices is also taken into account, but still companies might either reject accounting for it or just not disclosing any information regarding inflation. For instance, Precious Wood disclosed in their annual reports that they are not taking inflation

into account since a two percentage rate of inflation would increase the valuation of plantations significantly by 20 percent. The discount rate is another assumption, which companies use to reflect the present value of their future cash flows. But however, on the first hand many firms did not disclose all information regarding the use of this model and limited their disclosure to only mentioning that their forest is based on the FV less the expected costs at the point of sale such as Norske Skog. While on the other hand, some companies disclose precisely how they calculate the future cash flows, which is based on the expected selling prices of their forest and also disclosed the estimated cost of harvesting and all other expenses that are directly related to the sale in the future such as Asian Bamboo.

As a second method that companies follow to evaluate their biological asset, they use a model that is the same as the DCF model except that an external party conducted it. Firms that followed this model disclosed that an external expert has set up their DCF model and in that sense the assumptions are made externally by experts within the forestry area.

The third method is the HCM. Companies stated that there are no active markets for their forests and it's impossible for them to collect the future cash flows. Thus, they value their forest based on its historical cost less accumulated depreciation cost or any impairment losses. In other words, they still run evaluation tests for any possible impairment and deduct it from the asset's value. Furthermore, Altri SGPS stated in their annual reports that their historical cost of the biological asset is very close to its FV, which is based on managerial decisions and indicators that are not mentioned in their annual reports. Additionally, they said that all expenses that are related to this asset are taken into account, and they add to the historical cost. These expenses could be new plantations, development, and maintenance of current forest.

The fourth approach to value forests is the market price method. In this model companies identified the market prices that corresponded to their forests and were located in the same geographical area. Hence, by looking at the current market prices and collecting the expected future expenses at the point of sale, they could set up the FV of forests. However, while using this model, Asian Bamboo disclosed very detailed prices, and on the other hand Norske Skog only disclosed that the value is set based on the selling price.

The fifth and sixth approaches that companies follow are mixed ones. In the fifth, they stated in their annual reports that the valuation is either based on the market prices or, in the absence of it, they use the DCF model. In the sixth approach, they stated that if the market prices do not exist they refer their biological asset to the historical cost less any accumulated depreciation cost or accumulated impairment losses. However, in both approaches companies did not state the method that they use and only provide general information regarding these two potential methods that they might use when valuing their forest.

As a final approach that companies follow is the fair valuation approach. In this method companies only stated that their forest is based on the fair valuation and no further information is disclosed. Accordingly, their fair valuation might be built on market prices, DCF model, or even HCM if they found it close to the FV. However, this method was very limited and only adopted by Tornator in 2007 and 2008 and Norske Skog in 2005. And no other companies from our sample used it at all.

4.2.1 Discount Rate

One of the variables that companies use in the DCF model is the discount rate. Based on management assumptions a specific rate is identified and used. In Appendix C we collected the discount rate that all companies disclosed in their annual reports. However, at the first glance we excluded the firms that did not use the DCF model, but in the later stages, we also excluded some companies that use the discount rate but did not disclose it in their annual reports. Further, some values in this table are missing since some companies did not disclose the discount rate that they have used in every year of our study period.

Most of the companies have various discount rates in comparison to each other, but however most of them used the same rate or at least a similar rate for a long period. Even though companies are located and operates in the same country, there is still a possibility that they do not use the same rate. For example, Holmen is located in Sweden and used a discount rate of 5.5 percent between the years 2007 to 2014, while at the same period, other firms that are also located in Sweden used a different rate to discount the expected future cash flows from their forests. Moreover, some companies used various discount rates during our study period (Asian Bamboo), while others remained either using the same rate, such as Sveaskog and SCA, or a very similar rate for a long period, such as Semapa and Holmen. When it comes to companies that own forest in different countries, UPM-Kymmene, being one of them, used discount rates from 2009 in relation to the location of the forest. From the same approach, in 2013 Asian Bamboo used two different rates based on the type of forest that they own in which they believe that many factors concerning the potential risk could be related to the nature of the species.

In the aim of transparency and to give a clear view for the readers of the annual reports, companies sometimes disclosed information of the effect of changes in the discount rate. They state that a decrease or increase in the discount rate would result in specific changes of the forest's value. For instance, UPM-Kymmene (2007) stated that a one percent change in the discount rate would affect the FV of their biological asset directly with 130 million EUR. Another example, SCA (2005) mentioned that a very low difference of the discount rate such as 0.5 percent would increase or decrease the FV of their forest by 950 Million SEK. Hence, most of the companies disclose this information to make the reader illustrate the significant effect of discount rate on their asset.

Finally, few companies disclosed detailed information of how they reached their discount rate and which factors lead to it. Holmen showed how they calculated their discount rate, which is linked to all these rates, the debt/equity ratio, nominal risk-free return, risk premium for borrowed capital and for equity, and a tax rate. While on the contrary many other firms only disclosed their discount rate without any further motivation or identification for it, such as Norske Skog.

4.2.2 Harvesting Cycle and Future Cash Flows

When it comes to the harvesting cycle, not all companies disclosed information regarding it. In general, most of the firms that disclosed information about their harvesting cycle mentioned the importance of taking into account the potential growth of forest and the environmental restrictions. Where in some countries the government limits companies with a maximum felling size, which affects their annual allowable cut and limit it (Mondi Group, 2007-2014).

In the most detailed approach, companies stated the exact harvesting cycle length. Some of them stated the same harvesting cycle throughout the whole period, for example, Bergs Timber 85 years, Bergvik Skog 100 years, SCA 100 years, and Asian Bamboo 20 years based on the expiration date of their land lease rights since their forests are on a leased land. Other stated within the study period more than one harvesting cycle according to the following: Sveaskog 80-110 years in 2006 then 60-120 years from 2007-2014. Precious Wood between 2005 and 2008 they had a harvesting cycle of 30 years and from 2009 they switched to a harvesting cycle of 20 years. UPM-Kymmene stated in 2013 and 2014 two different harvesting cycle based on the country that the forest is located in, the first is 100 years for forests in Finland and US, and the second is ten years for forests in Uruguay. Finally, Holmen stated a harvesting plan each ten years, which in the period between 2000 and 2009 they had a harvesting cycle of two and a half million cubic meter every year, and they estimated that the harvesting is predicted to increase in the next 40 years to reach three million cubic meters annually. Later on in their new harvesting plan from 2010 to 2019 they stated an annual harvesting of three million and three hundred cubic meters. Hence, there was a clear growth in their harvesting cycle plan.

In the calculation of future cash flows companies based their assumption on the harvesting cycle and the expected selling prices of the harvested product, in addition to many different expenses that is directly attributable to the selling of their harvested products and to the replantation that is considered as a prerequisite for the felling. One more additional factor taken into account while calculating the future cash flows is the inflation rate

4.3 Effect of Changes in Fair Value of Biological Asset on Profit and Loss Statement

In Appendix D we presented the percentage of changes in FV from the operating result for each year. However, in relation to the purpose of this study, we calculated, in Table 4, the averages of this rate before and after the financial crisis. Additionally, we calculated the difference between the highest and the lowest value during the studied period for each company to have a view of how much this percentage might differ. Here we tried to focus on the companies that are using the FVM, and since some of them disclosed that they kept using the HCM (Ence Energia and Celulosa, and Altri SGPS), we excluded them from this table. This decision is based on the fact that impairment loss, as these companies use this method to depreciate their biological asset, is not one of our interests in this study, and hence excluding them was the appropriate choice. Further, in the situations where we could not access the annual reports we stated in the table a not applicable value. Another comment on this table is that the values are presented regardless of the natural effects of these changes, which in some situations resulted in an increase of the operating result, while on the other hand in other situations it decreased the operating result.

To begin with, changes in FV of biological assets had various effects based on different companies and years. In some cases, companies had changes in FV of biological asset almost the same as the disclosed operating result, as it is in both Sveaskog and Bergvik Skog in the whole of our study period. In other cases, companies such as Smurfit Kappa Group and Semapa, had very low changes in value in relation to their operating result during our study period. However, other companies had very different values from year to years such as UPM-Kymmene and Asian Bamboo. Therefore, as presented in Appendix D the volatility of changes in FV of the biological asset as a percentage of operating profit or loss are categorized into three groups.

A very high volatility characterized the first group wherein the extreme situation one could notice that UPM-Kymmene had a percentage of changes in biological asset's FV from the operating results in 2008 of 575 percent, while there were changes of only four percent in 2006. Thus, in this group, the percentage change is very volatile and not constant or consistent at all. Further, in the aim of identification, we decided that the companies with differences of more than 100 percent between the highest and the lowest value during our study period belong to this group. Accordingly, Stora Enso, UPM-Kymmene, Asian Bamboo, Sveaskog and Precious Woods are the companies that belong to group one.

Group two still presents volatility in changes of biological asset's FV but not as significant as group one. As in the most extreme situation Holmen had a 111,2 percent of change in biological asset's FV in 2010 while on the other hand they had 23,4 percent in 2005. Furthermore, in this group we chose to include the companies that have differences in the top and bottom values from 20 percent to 100 percent. And consequently, Tornator, Mondi Group, Bergvik Skog, Holmen, and SCA belong to group two.

The final group is group three, which consists of companies we considered had a constant change in the percentage of biological asset's FV from operating result. This result was based on the fact that there is no significant difference between their highest and lowest value. As the best situation, Semapa had 4,7 percent as the highest rate of changes of biological asset's FV on operating result in 2006, while they had no changes at all in 2008. Accordingly, companies in the third group had constant percentages throughout our study period. Smurfit Kappa Group, Norske Skog, Semapa, The Navigator Company and Bergs Timber belong to this group.

The results of a Mann-Whitney U-test for changes in P&L statement (Table 6) indicates based on a U-value of 102 that the result is not significant since the critical U-value at p<_0.05 is 64. The z-score of 0,4148 and the p-value of 0,6818 also shows that the result is not significant with a significance level of 0.05, which means that the averages of changes in P&L statement before and after the crisis are not significantly different from each other. However, there is no support for the fact that they are totally the same either.

Table 4 - Percentage of Changes in FV of Biological Asset from Operating Result

Company	*Country*	*Average before*	*Average after*	**Absolute Change*
Stora Enso	**Finland**	**4%**	**63%**	**358,00%**
Tornator	**Finland**	**50%**	**26%**	**73,70%**
UPM- Kymmene	**Finland**	**161%**	**31%**	**571,00%**
Asian Bamboo	**Germany**	**52%**	**98%**	**298,40%**
Mondi Group	**Great Britain**	**25%**	**8%**	**52,60%**
Smurfit Kappa Group	**Ireland**	**2%**	**2%**	**4,80%**
Norske Skog	**Norway**	**5%**	**4%**	**13,90%**
Semapa	**Portugal**	**1%**	**1%**	**4,70%**
The Navigator Company	**Portugal**	**2%**	**2%**	**6,10%**
Bergs Timber	**Sweden**	**7%**	**-4%**	**14,90%**

Bergvik Skog	**Sweden**	**113%**	**108%**	**40,00%**
Holmen	**Sweden**	**51%**	**71%**	**87,80%**
SCA	**Sweden**	**21%**	**11%**	**52,10%**
Sveaskog	**Sweden**	**118%**	**101%**	**110,80%**
Precious Woods	**Switzerland**	**81%**	**42%**	**102,90%**
Total average		***46,20%***	***37,60%***	***119,45%***

*** The difference between the highest and the lowest value during the whole study period**

4.4 Value per Hectare of Forests

One factor that we collected data about is the value of forests. In Appendix E we presented the value of forests per hectare that is based on two different options. First, we collected data that companies stated to be the value of productive forest per hectare. Second, in the absence of value per hectare of productive forest, they might disclose information regarding the size of forest that they own. Hence, we divided the forest asset value on the total disclosed number of hectares, which gave us the value per hectare. However, in other situations, where companies either did not disclose any information regarding their forest size or were we could not get access to their annual reports, we were not able to calculate the value per hectare, which left us with a not applicable value for that specified year. Additionally, some of the companies did not disclose any information at all regarding their forests size during our whole study period, and hence we could not get any results regarding this variable.

In Table 5 the average values of the percentage of changes in value per hectare from the period before and the period after the crisis is presented. To see the values for all of the years it can be found in Appendix F. On the first hand, some companies had fairly stable changes in the value throughout the whole study period such as SCA. While on the other hand, the rest of the companies had varying changes in percentage of their hectare value. For instance, Asian Bamboo faced changes in the value per hectare of forests in 2008 by an increase of 29.3 percent, while directly in the next year they faced a 7.67 percent decrease in value per hectare of forests. Further, in some situations, the changes were very low and near zero, while in other situations, the changes were relatively high both as a decrease in value (Asian Bamboo, 2010) and as an increase in value (Smurfit Kappa Group, 2011). While looking at the total averages before and after the crisis, there is a clear difference from 7,99 percent to 1,08 percent. This difference could highly be attributable to the significant changes in some of the companies, namely in Asian Bamboo and Bergs Timber.

Table 5 - Changes in Percentage of Value per Hectare

Company	*Country*	*Average Before*	*Average After*
Tornator	**Finland**	**3,17%**	**3,38%**
UPM- Kymmene	**Finland**	**-0,87%**	**3,50%**
Asian Bamboo	**Germany**	**29,31%**	**-22,89%**
Smurfit Kappa Group	**Ireland**	**-1,54%**	**9,38%**
Semapa	**Portugal**	**-0,69%**	**-1,48%**
The Navigator Company	**Portugal**	**-0,69%**	**-1,48%**
Bergs Timber	**Sweden**	**33,61%**	**6,48%**
Bergvik Skog	**Sweden**	**6,35%**	**3,05%**
Holmen	**Sweden**	**9,03%**	**7,55%**
SCA	**Sweden**	**2,24%**	**3,29%**
Total average		***7,99%***	***1,08%***

4.5 Disclosure Quality

We investigated the disclosure quality by comparing the checklist for IAS 41 with what the companies disclose in their annual reports. The checklist for IAS 41 is divided between before and after the crisis, which means that the period before consists of the years 2005-2008 and the period after consists of the years 2009-2014. In measuring the disclosure quality, we argued that the higher the score presented the higher the quality of the disclosures. Further, it is divided between the total score, which includes both required and recommended information from the standard and the required score, which only includes the information that is required by the standard. The scores that the companies achieved in each year were then combined with the other scores within the same period and then an average was calculated. The average scores before and after the crisis for IAS 41 are presented in Table 6 and Table 7.

Table 6 - IAS 41 Total Score

Company	*Country*	*Average Before*	*Average After*
Stora Enso	**Finland**	**0,39**	**0,44**
Tornator	**Finland**	**0,28**	**0,44**
UPM-Kymmene	**Finland**	**0,56**	**0,56**
Asian Bamboo	**Germany**	**0,67**	**0,72**
Mondi Group	**Great Britain**	**0,56**	**0,61**
Smurfit Kappa Group	**Ireland**	**0,56**	**0,56**
Norske Skog	**Norway**	**0,44**	**0,22**
Altri SGPS	**Portugal**	**0,5**	**0,56**
Semapa	**Portugal**	**0,5**	**0,61**
The Navigator Company	**Portugal**	**0,56**	**0,56**
Ence Energia & Celulosa	**Spain**	**0,44**	**0,44**
Bergs Timber	**Sweden**	**0,56**	**0,56**
Bergvik Skog	**Sweden**	**0,56**	**0,56**
Holmen	**Sweden**	**0,56**	**0,56**
SCA	**Sweden**	**0,56**	**0,56**
Sveaskog	**Sweden**	**0,56**	**0,56**
Precious Woods	**Switzerland**	**0,5**	**0,56**
Total average		***0,52***	***0,53***

Table 7 - IAS 41 Required Score

Company	*Country*	*Before the crisis*	*After the crisis*
Stora Enso	**Finland**	**0,5**	**0,7**
Tornator	**Finland**	**0,4**	**0,6**
UPM-Kymmene	**Finland**	**0,8**	**0,8**
Asian Bamboo	**Germany**	**0,8**	**0,8**
Mondi Group	**Great Britain**	**0,8**	**0,8**
Smurfit Kappa Group	**Ireland**	**0,8**	**0,8**
Norske Skog	**Norway**	**0,8**	**0,4**
Altri SGPS	**Portugal**	**0,8**	**0,8**
Semapa	**Portugal**	**0,7**	**0,9**
The Navigator Company	**Portugal**	**0,8**	**0,8**
Ence Energia & Celulosa	**Spain**	**0,6**	**0,6**
Bergs Timber	**Sweden**	**0,8**	**0,8**
Bergvik Skog	**Sweden**	**0,8**	**0,8**
Holmen	**Sweden**	**0,8**	**0,8**
SCA	**Sweden**	**0,8**	**0,8**
Sveaskog	**Sweden**	**0,8**	**0,8**
Precious Woods	**Switzerland**	**0,8**	**0,8**
Total average		***0,74***	***0,75***

By looking at the total scores for all the companies, it can be seen that for all companies the score has either stayed the same after the crisis or increased, except for Norske Skog. Norske Skog had a decrease in their score from 0.44 to 0.22 before and after the crisis. Seven of the companies had an increase in their score after the crisis compared to before, and the remaining nine companies had the same score both before and after the crisis. For the required score, 13 of the companies had the same score before and after the crisis, three companies had an increase in the score after the crisis and only one had a decrease in the score. Generally, when it comes to the total averages before and after the crisis for both the required and the total scores, the numbers indicate a slight increase in the period after. By comparing the required score with the total score we can notice that the required score is higher compared to the total score for all of the companies. Accordingly the companies did not disclose as much information that is recommended compared to what is required. Further, the total and the required score for both before and after the crisis is exactly the same for all Swedish companies. They have the same score for both periods both in the total score (0,56) and in the required score (0,8). One of the Finnish companies has the same numbers as the Swedish companies have as well.

5. Discussion

5.1 Valuation Model

To begin with, we would like to mention that our discussions concerning the discount rate, harvesting cycle, and future cash flows are limited to the companies that follow the DCF model. Consequently, Norske Skog, Altri SGPS, and Ence Energia & Celulosa are excluded since they did not apply this valuation model in any of the years during our study period. However, we included them in our discussion regarding the valuation model that companies use and how their models have changed after the financial crisis.

In general, we clearly notice how most of the companies disclosed more information regarding their valuation model of forests after the financial crisis in comparison to the period before it. However, this is not linked directly to 2009, which means that some changes have taken place one or two years after the crisis, but we still think that the crisis might be the reason for these changes. When it comes to the used model, most of the companies remained using the same model after the crisis in which a reason for that could be that they perceive their model to be the most efficient and appropriate one, and in addition they have not perceived any need to change it after the financial crisis. Thus, even if these companies evaluate their forests under the FVM, they have not perceived any threats by using this method, which is linked to some prior research about not blaming FVM for being the cause of the financial crisis (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008). The attitude of making no changes in the used model supports the use of FVM even after the increased discussion of its reliability in which no clear action is taking place in the aim of finding a new method that is characterized of a greater reliability. However, there is a potential that these companies ignored updating their model, which is

problematic since in few companies (Bergvik Skog and Sveaskog) forests have a very high biological asset ratio of more than 80 percent of their total asset. Thus, ignoring and not updating the valuation method of an asset that presents the majority of a company's assets is a clear issue. On the other hand, in many companies (Stora Enso, UPM-Kymmene, Mondi Group, Smurfit Kappa Group, Norske Skog, Altri SGPS, Semapa, The Navigator Company and Bergs Timber) the ratio of forests from their total assets presents a very low percentage, and then the impact of not updating the valuation method of this asset is not as problematic. In practice, the discussion of the impact of updating the used model or not is significantly related to the biological asset ratio in the addressed firm since the value of biological asset in the balance sheet is directly linked to the operating results of the companies. This is based on the fact that any changes in the value of this asset are reflected in the P&L statement. Hence, the impact of following methods that are not reflecting the FV of forests reliably in companies where this asset constitutes a majority of their total assets is totally different than the impact in companies that have forests as a minor and very low percentage of their total assets. Furthermore, a few companies made some changes that we recognize in the period after the financial crisis. These changes were represented by a new valuation method for forests, which is the same old used one, the DCF model, but developed by a third party. This switch has happened since 2012 in both Asian Bamboo and Tornator, which is more than two years after the crisis. Hence, we could not argue that the crisis is the main reason for these companies to apply a new model to evaluate their forests, but however this model presents a greater reliability in comparison to the previous one since an independent party and at the same time experts in this area has developed it. Additionally, based on the fact that forests' FV is based on level 3 inputs, changing the valuation model in the aim of a greater reliability is linked to many studies (Goh et al., 2015; Kolev, 2008; Song et al., 2010) when they mentioned that investors find level 3 inputs has less reliability than level 1 and 2 inputs. Even though these studies are mainly addressed to the banking industry, we argue that FV and level 3 inputs are affected in the forestry industry as well since as mentioned by Alber (2013) the crisis also affected other industries. This switch in Asian Bamboo and Tornator in their used valuation model could also be linked to the high importance of forests in these companies, which presents an average of biological asset ratio about 90 percent in Tornator and approximately 40 percent in Asian Bamboo. Accordingly, they have a special interest to increase the efficiency in their chosen model. However, we couldn't notice a common trend in that sense, because some other companies that have a high percentage of biological asset ratio still use the same valuation model after the crisis.. The striving for a greater reliability in these companies is adding an evidence to the research of how the forestry companies is affected from the crisis, which encouraged some of them to switch to more reliable methods to valuate their forests that based on FVM. Another noticeable change that happened after the crisis is that one of the companies, namely Norske Skog, evaluated their forest based on the market price in the period before the crisis while they started, after the crisis, to disclose that their forests are based on either the market price or the historical cost in the absence of such a price. This change could be linked to the argument about the use of FV to be the reason for the financial crisis (Allen and

Carletti, 2008; Whalen, 2008). In which we notice how Norske Skog by basing their valuation model on either market price or historical cost, they are keeping the historical cost as a safeguard for them that they could use in crises to avoid the depreciation of their asset significantly as it happened in 2009 in the financial institutions. In practice, Even though these few companies (Asian Bamboo, Tornator and Norske Skog) made noticeable changes in their followed FVM in correspondence to the financial crisis, these changes could still be related to other reasons such as finding a more efficient method to evaluate asset in these companies. Further, the number of the companies that made recognized and clear changes is very limited to our small sample in which if we would have had a larger sample these type of companies might be greater and represent a higher percentage of total number of firms. Hence, the evidence of how forestry companies are affected from the crisis would be stronger and clearer.

In the discussion of the calculation method of future cash flows and harvesting cycle, very few companies disclosed information regarding them. Even more, these companies disclosed kind of similar information before and after the crisis, and consequently there aren't any noticeable changes that could be attributable to the crisis. Concerning the discount rate, most of the companies had a constant discount rate, which means that they believe that their discount rate is efficient enough in representing the market, and hence they did not change it during the ten years of our study. In relation to the increased volatility in interest markets we argue that these companies that kept having the same discount rate are not affected from the crisis as much as the ones that made changes in it. From a practical aspect, forestry companies might perceive the interest rate irrelevant when it comes to the chosen discount rate. Hence, some different factors might be behind their decisions that gave them the possibility of not being affected from the increased volatility in the interest markets. However, this is hypothetically predicted and not based on clear and touchable facts. Furthermore, few other companies, namely Holmen, Precious Woods and Stora Enso, had a constant discount rate with one or two changes during our study period, which shows adaptability for these companies in correspondence to some specific situations that they might face. On the other hand, Asian Bamboo and both of Semapa and The Navigator Company had volatile discount rates. This volatility could be attributable to the reliability of FV level 3 inputs and the use of DCF model to determine the asset value, which Ronen (2008) stated as an issue in regards to reliability when it comes to level 3 inputs. Further in relation to the financial crisis, Asian Bamboo lowered the discount rate significantly in 2010 to remain constant in the following years. Semapa and The Navigator Company had a higher discount rate from the beginning of 2011, which means more risk has been taken into account. UPM-Kymmene in 2009 started to distinguish between the forests that they own in Finland and Uruguay. All these changes in discount rate, firstly, could be attributable to the financial crisis since companies have started to take into account more details to show more reliability in their FV valuation of forests. Secondly, this volatility could be a reflection of the volatility in the interest markets after the financial crisis as Tokle et al. (2015) argued how the interest rate became more volatile as a result of the crisis. Here one could notice how the forestry firms is affected from the crisis since the volatility in discount rate has a great impact on both companies'

balance sheet and P&L statement. This impact comes from the use of DCF model to calculate the value of forests in which the discount rate is one essential factor of it.

By making a comparison between companies in the same country where we have three clusters Sweden, Finland and Portugal. First, in Sweden, the five companies followed the same valuation model with a very high similarity with almost everything, which is attributable to the fact that three of these companies set their model together (Lorentzon, 2011). Their model remained the same after the crisis as well as the discount rate, which means that the Swedish firms did not make any changes regarding the valuation model due to the crisis, but however this finding is very limited to our sample size and could not be generalized. Second, in Finland, all the three companies used almost the same valuation model during the ten years, except Tornator in 2005-2008 (where information in 2005 and 2006 was missing) and in 2012-2014 they used the same model but by the development of a third party. Accordingly, we could not recognize a common trend after the financial crisis in Finland since the three companies in our sample have not followed the exact same model. Third, in Portugal, two companies were using the DCF model while the third one stated that there is no possibility to measure the FV of forests, and hence the board of directors decided to use the HCM, which they refer to be representative of the FV of the asset. These companies used the same model even after the financial crisis. Consequently, there is no common trend in Portugal, but we find differences between the firms since some apply DCF model and the other apply HCM.

5.2 Effect of Changes in Fair Value of Biological Asset on Profit and Loss Statement

As presented in Appendix D, we notice that in some companies, namely in Bergvik Skog and Sveaskog, the percentage of biological asset's FV changes from the operating result is relatively high and almost equal to 100 percent of the disclosed profit or loss. Also, this was kept constant during the whole study period, which means that both before and after the financial crisis these companies still reported a high percentage of changes in FV from their operating result. Thus, their use of FVM and the reported changes in value has not been affected from the increased doubt of FVM to be the cause of the crisis as many studies claim (Allen and Carletti, 2008; Whalen, 2008). Further, it is concluded by different studies that companies disclose very high changes in FV of the biological asset from their operating profit or loss, which raise queries about the operating result when they apply IAS 41 (Herbohn and Herbohn, 2006; Penttinen et al., 2004). However, by looking at the biological asset ratio in especially Tornator, Bergvik skog and Sveaskog we could argue that it is a relatively high percentage of the total assets. Thus, the high rate of changes in FV of forests from operating result could be attributable to the companies in our sample who has a high biological asset ratio (Tornator, Bergvik and Sveaskog).

On the other hand, Smurfit Kappa Group, Norske Skog, Semapa, The Navigator Company and Bergs Timber reported very constant and low changes in FV of forest in relation to their

operating result. Even though they have high stability in changes in FV of forests, one should keep in mind the low importance of forests in these companies that is presented by a very low ratio of forest from total assets. This low ratio could be the reason of why the changes in FV have a low effect on them. Moreover, in line with prior studies (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008), these companies did not perceive any threat to the reliability of FVM after the financial crisis, which left them without any clear changes in the recognized changes of FV in P&L statement. Generally, this threat could be either related to the low importance of forests in these companies, or they found the increased doubt in the FV accounting irrelivent to forestry industry, and hence they didn't make noticeable changes after the crisis.

Many other companies, such as Stora Enso, UPM-Kymmene and Asian Bamboo reported various values of changes. In some years, they did not disclose any changes at all or very small changes in the biological asset value and in other years they disclosed changes with more than 100 percent in comparison to their reported profit or loss. Consequently, implementing IAS 41 has resulted in a high volatility when it comes to the reported changes in FV of the biological asset. This finding is similar to what has been found by Herbohn and Herbohn (2006) when they stated a high volatility in gains or loss in relation to the use of FV to evaluate biological assets. Further, for these companies we find the volatility even in the period after the financial crisis, which means there are no clear patterns that these companies followed to make the changes more constant. However, this volatility affects the reliability of FVM, which was also a discussed issue by Elad (2004) when he highlighted that the complexity of FV valuation is presented by assuming it to be reliably measured. The differences of reported changes in FV could also be related to the risk of errors in the FVM that has been stated by Landsman (2007).

In general, the Mann-Whitney U-test that we conducted for this variable did not state a significant difference between the averages of changes before the financial crisis and after it. Thus, we argue that the FVM has not been affected in the companies that did not have any significant differences, which is in relation to the studies that defended the FVM from causing the crisis (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008). However, this result is more on a general level for the whole sample, and then there are still some companies that have noticeable differences in the averages before the crisis compared to the period after. Hence, in relation to the studies that blame the use of FVM (Allen and Carletti, 2008; Whalen, 2008), we see that for example Mondi Group and Norske Skog reported less changes in FV in P&L statement, which could be seen as way to increase the reliability of this measurement since it has been questioned after the crisis in 2009. Finally, when we are looking at the three identified clusters Finland, Sweden and Portugal, we could not identify any specific trends that the companies follow based on any clusters, and hence we are not able to recognize any result.

5.3 Value per Hectare of Forests

Looking at the value per hectare of forests it can be seen that none of the companies have the same percentage of changes throughout the entire study period, which is an expected outcome. The reason behind this expectation is related to what Herbohn and Herbohn (2006) said regarding the implementation of IAS 41, that it has lead to a higher volatility. However, some of the companies showed higher changes over the years compared to other companies who were relatively stable. For example, Asian Bamboo and Smurfit Kappa Group had unstable changes in the value per hectare for all the years of our study. Bergvik Skog and Holmen on the other hand had a single year that stood out from the rest but after that they had fairly stable changes for the rest of the years. For the rest of the companies, the changes before and after the crisis are small.

The changes from before the crisis to after the crisis were the biggest for Asian Bamboo. The reason behind these changes could be either that the quantities of the productive forests are changing or that the FV of their forests is changing significantly. By looking at the quantity of forests in Asian bamboo it has changed from 14 649 hectare in 2007, before the crisis, to 54 511 hectare in 2013, after the crisis. This large increase in the quantity of forests leads to a decrease of the value per hectare of forests as long as the quantity increases more than the value of forests. In the case of Asian Bamboo the average percentage before the crisis was 29,31% and after the crisis it was -22,89%. This means that the value per hectare of forests went through a large decrease from the period before to the period after the crisis. The other aspect behind why the value per hectare could be changing regards the value of the forest. If the value decreases, the percentage for value per hectare will also decrease as long as the decrease in value is bigger than a potential decrease in the quantity. For Asian Bamboo the average was negative in the period after the crisis and the reason for this is that the value of forest decreased in this period. A reason for this decrease could be in line with what Goh et al. (2015) discussed regarding the low value relevance of level 3 inputs when valuing the forests and how this was met with concerns. This could in practice indicates that companies try to make improvements in their valuations in order to be more reliable, which in turn could lead to volatility in the valuations. Accordingly, the revaluation of forest could be the reason behind the changes in value per hectare of forests as well and not only the amount of forest. However, since the level 3 inputs are used for valuing the forests there could be an issue with how fair the representation of the value is. An issue that Ronen (2008) discussed regarding the level 3 inputs and how they can cause distortions in the financial statements, which leads to the wrong picture being portrayed and hence the changes in percentage can also be misleading. However, looking at the biological asset ratio for Asian Bamboo it is fairly high. This however means that the impact of changes in value per hectare might not be as significant for Asian Bamboo in comparison to companies who have a higher biological asset ratios, such as Tornator, Bergvik Skog and Sveaskog. But since the biological asset ratio is fairly high for Asian Bamboo the large changes in value per hectare will have an impact on the balance sheet.

When looking at our different clusters before and after the financial crisis, we can see for the Swedish companies that the value per hectare of forests are similar for all the companies except one. Looking at the averages before and after the crisis, Bergs Timber goes through a large reduction in average from 33,61% to 6,48%. The average that Bergs Timber has after the crisis is similar to what all the Swedish companies have both before and after the crisis. This might be due to the fact that Bergs Timber overstated the value of the forest in the period before the crisis and needed to make adjustments for the period after, which is in line with the issue discussed by Ronen (2008) regarding how the use of level 3 inputs can cause distortions in the financial statements. In the Finnish and Portuguese companies, the value per hectare of forests is similar both for the period before and after the crisis. By looking at the averages for the different clusters no trend can be clearly seen, except for the two companies in Portugal who have the same averages before and after. However, no conclusion can be drawn from this and no trend can be talked about either. Further, no country specific effects can be determined either but rather the changes in value per hectare of forests for the companies seem to be independent of each other.

5.4 Disclosure Quality

In Table 8 and Table 9 it can be seen that the total scores and the required scores for IAS 41 either remain the same or increase after the financial crisis compared to the period before it except for Norske Skog. Accordingly, the level of disclosures that corresponds to what is stated in the standard is higher. In agreement with Mazzi et al. (2016), the increase in the score for disclosures in relation to the standard from the period before the crisis to the period after it is in line with what they found in their study where the disclosure score increased from 2008 to 2011. When the checklists are compared to the annual reports from the companies in our sample an increase of the disclosure scores can be seen as a general result. This means that compared to the period before the crisis the companies with an increase has added information in their annual reports that are in accordance with what is stated in the checklist for the standard IAS 41. For example, Stora Enso started to disclose about mature and immature biological assets, which means that they meet the requirements in point 43 in the checklist (Appendix G). Semapa on the other hand started to disclose about biological assets that were pledged for securities, which lead to them meeting point 49 in the checklist (Appendix G). This meant for both of these companies that their score increased from the period before the crisis to the period after. The fact that they started disclosing more in accordance with the standard in the period after the crisis might not have been a direct effect of the crisis. It could be due to changes that were made in the companies that were a part of their regular business and operations. This would then mean that the increase in disclosure scores was not made as a reaction of the crisis but rather due to natural changes in the company.

Looking at the scores in Table 8 and Table 9 on a country level, for our three different clusters (Finland, Portugal, and Sweden), it shows varying degrees of similarities between the companies in each cluster. For the companies situated in Finland and Portugal, they all show various scores.

Some have the same score in one period such as Altri SGPS and The Navigator Company in the total scores after the crisis, but none of the companies in these two countries have the same scores for both periods. Therefore we could not distinguish any trend or country specific effects in these two clusters. However, by looking at the companies in Sweden, one could notice completely different results. All five companies have the exact same scores before and after the crisis for both the total and the required scores. This result is in line with what Lorentzon (2011) found when he looked at the biggest companies in the forestry industry in Sweden. Furthermore, in line with previous studies that defend the FVM from being the main reason of the crisis (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008), this result in Sweden shows that companies are not striving for higher disclosure quality after the financial crisis in 2008. Hence, we argue from this perspective that these companies have not tried to increase the reliability of its FVM by increasing their disclosure quality of IAS 41.

The consultant's part of the process is according to Lorentzon (2011) to decide the discount rate. In the annual reports from the Swedish companies over the years, it is not stated how the discount rate was decided. Since there is no clear motivation behind these discount rates and the fact that Lorentzon (2011) found that the discount rate was set mainly by the advice from the consultant, the reliability of the valuation from these companies could be questioned. This finding is also relevant for other companies in our study since many companies did not state how the discount rate was decided. Further, the disclosures about the decision of the discount rate were not mentioned in most of the companies in both periods before and after the financial crisis, which is an indicator that these companies did not strive for a higher disclosure quality regarding the discount rate in their FVM. Accordingly, we argue that if these companies found FVM problematic after the crisis then they would disclose more information regarding their decision of the chosen discount rate. Thus, in that sense this is in line with previous studies that do not see the FV as an issue that caused the crisis (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008). However, many companies are disclosing more information regarding what is required and recommended by the standard after the crisis in 2008 in comparison to the period before the crisis. Thus, the disclosure quality increased, which could be seen as an attempt to achieve a higher reliability. Further, since many companies use level 3 inputs, the increase in disclosures quality could be reflected as an attempt to increase the value relevance of these inputs, since it has been characterized with less value relevance as an effect from the crisis (Goh et al., 2015; Kolev, 2008; Song et al., 2010).

6. Conclusion

This study aims to explore if the financial crisis in 2008 has affected the valuation of forest under IAS 41. By studying European forestry firms during the period of 2005-2014 we are able to give an answer to our research question based on our sample. We focus on how firms evaluate their forest in a period before the financial crisis (from 2005-2008) and which changes they have

made regarding the followed valuation method in the period after the crisis (from 2009-2014). Our interest areas are directly related to IAS 41 and the used valuation method of forests.

The main finding of this paper is that there is no fundamental effect of the financial crisis on the valuation method of forests under IAS 41. This result is in relation to the fact that most of the companies have not changed any essential factors in their valuation, and hence they have not had a significant effect as a result of the financial crisis regarding the FVM of forests. Generally, the impact of the volatility in the interest markets has no obvious effect on the majority of the firms (except Asian Bamboo, Semapa and The Navigator Company). Practically on the first hand, forestry firms might find this volatility irrelevant when it comes to deciding upon their discount rates. On the other hand, the importance of forests might vary from one company to another, which means companies that are not sensitive enough to the changes in the interest market might not have a significant amount of forests, which means it will not have a large impact on them. Our finding of the absence of obvious changes in the followed FVM methods as reflections from the financial crisis is in line with prior studies (Laux and Leuz, 2009; Magnan, 2009; Wallace, 2008), however our paper adds evidence from the forestry industry and also how the use of FVM in this industry has been affected by the increased criticism of this method. We add evidence of the reaction of the forestry industry toward the increased volatility in the interest markets. Furthermore, as a minor finding after the financial crisis in some of the companies (Asian Bamboo, Norske Skog, Semapa, The Navigator Company, Tornator and UPM-Kymmene) this paper highlights, first, a stronger strive for value relevance and reliability of level 3 inputs under IAS 41, which is in line with previous studies (Goh et al., 2015; Kolev, 2008; Song et al., 2010). Second, an increased volatility in the chosen discount rate that could be a reflection of the volatility in interest markets. Third, there were some changes in the followed FVM that could be related to the increased doubt of FV after the crisis, which is in line with some studies (Allen and Carletti, 2008; Whalen, 2008). Thus, we add evidence to the literature of how some companies in the forestry industry reacted toward the high volatility in the interest markets, the increased blame of FVM and the less value relevance of level 3 inputs under IAS 41 after the financial crisis in 2008. This minor finding is based on different factors that some companies made in the period after the financial crisis. These factors are; first, some companies used a DCF model that was conducted by a third party, which is a way to achieve higher reliability. Second, they started to take into account more factors while deciding upon their discount rate. Third, they were affected from the changes in the interest markets that presents higher volatility in their discount rates. Fourth, they had a lower percentage of changes in FV from operating result. Finally, they had a higher disclosure quality in linkage to what IAS 41 requires and recommends.

The findings of this study could be important for standard-setters and other regulators that are interested in capturing the financial crisis effect on different industries and economies. Further, to extend our research, first of all, we suggest a research that investigates the valuation methods of forest under US GAAP before and after the financial crisis to check if there have been any changes in the followed methods. Thus, the findings of the study could be compared to ours to

give an overview of how US GAAP and IFRS have been affected by the crisis. Second, we suggest a research that follows the same approach of this study but however covering another industry that owns forest and evaluates it under IAS 41. Finally, we suggest a future research that investigates the valuation of another biological asset than forest, such as living animals, and then investigates if there have been any changes after the financial crisis in 2008.

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Appendices

Appendix A: Biological Asset Ratios

Company	*Country*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Stora Enso	**Finland**	**0,4%**	**0,6%**	**0,6%**	**1,1%**	**1,3%**	**1,5%**	**1,6%**	**1,6%**	**3,1%**	**5,0%**
Tornator	**Finland**	**N/A**	**91,5%**	**91,9%**	**89,2%**	**87,8%**	**88,6%**	**89,6%**	**87,7%**	**89,0%**	**91,6%**
UPM-Kymmene	**Finland**	**7,6%**	**7,2%**	**7,9%**	**8,2%**	**9,5%**	**10,4%**	**9,8%**	**11,5%**	**10,0%**	**10,4%**
Asian Bamboo	**Germany**	**N/A**	**N/A**	**38,8%**	**68,2%**	**57,6%**	**28,8%**	**26,3%**	**24,1%**	**19,8%**	**N/A**
Mondi Group	**Great Britain**	**N/A**	**3,2%**	**3,3%**	**3,4%**	**4,0%**	**4,9%**	**5,3%**	**4,7%**	**3,7%**	**3,7%**
Smurfit Kappa Group	**Ireland**	**N/A**	**0,9%**	**0,9%**	**1,1%**	**1,2%**	**1,2%**	**1,5%**	**1,6%**	**1,4%**	**1,6%**
Norske Skog	**Norway**	**0,4%**	**0,5%**	**0,6%**	**0,6%**	**1,0%**	**1,1%**	**0,8%**	**0,9%**	**1,1%**	**1,2%**
Altri SGPS	**Portugal**	**7,5%**	**7,2%**	**5,9%**	**6,8%**	**7,2%**	**7,9%**	**9,2%**	**9,6%**	**8,8%**	**8,5%**
Semapa	**Portugal**	**3,9%**	**3,5%**	**3,8%**	**3,7%**	**3,5%**	**3,1%**	**2,9%**	**2,6%**	**2,6%**	**2,8%**
The Navigator Company	**Portugal**	**6,2%**	**5,4%**	**5,0%**	**5,0%**	**4,6%**	**4,1%**	**3,9%**	**4,0%**	**4,0%**	**4,2%**
Ence Energia & Celulosa	**Spain**	**15,4%**	**18,4%**	**18,8%**	**17,5%**	**12,7%**	**12,5%**	**13,2%**	**12,4%**	**N/A**	**N/A**
Bergs Timber	**Sweden**	**N/A**	**9,2%**	**4,7%**	**6,7%**	**8,0%**	**7,5%**	**6,6%**	**7,5%**	**N/A**	**N/A**
Bergvik Skog	**Sweden**	**91,0%**	**93,1%**	**94,6%**	**93,3%**	**93,2%**	**92,4%**	**93,0%**	**92,4%**	**93,1%**	**93,4%**
Holmen	**Sweden**	**27,1%**	**27,5%**	**33,3%**	**32,0%**	**34,5%**	**36,4%**	**42,4%**	**43,8%**	**44,9%**	**46,3%**
SCA	**Sweden**	**13,1%**	**13,5%**	**16,5%**	**15,5%**	**17,0%**	**18,2%**	**19,2%**	**20,9%**	**20,2%**	**19,2%**
Sveaskog	**Sweden**	**70,9%**	**81,4%**	**81,4%**	**80,7%**	**81,9%**	**78,6%**	**81,5%**	**81,8%**	**82,0%**	**81,6%**
Precious Woods	**Switzerland**	**22,2%**	**23,4%**	**15,4%**	**19,6%**	**20,3%**	**28,4%**	**N/A**	**N/A**	**N/A**	**N/A**

Appendix B: Valuation Model

Year	*Country*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Stora Enso	**Finland**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Tornator	**Finland**	**N/A**	**N/A**	**FV**	**FV**	**DCF**	**DCF**	**DCF**	**DCF by third party**	**DCF by third party**	**DCF by third party**
UPM-Kymmene	**Finland**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Asian Bamboo	**Germany**	**N/A**	**N/A**	**MP**	**MP**	**MP**	**MP**	**MP**	**DCF by third party**	**DCF by third party**	**N/A**
Mondi Group	**Great Britain**	**N/A**	**N/A**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Smurfit Kappa Group	**Ireland**	**N/A**	**N/A**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**	**MP/ DCF**
Norske Skog	**Norway**	**FV**	**MP**	**MP**	**MP**	**MP/ HC**	**MP/ HC**	**MP/ HC**	**MP/ HC**	**MP/ HC**	**MP/ HC**
Altri SGPS	**Portugal**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**
Semapa	**Portugal**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
The Navigator Company	**Portugal**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Ence Energia & Celulosa	**Spain**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**HC**	**N/A**	**N/A**
Bergs Timber	**Sweden**	**N/A**	**N/A**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**N/A**	**N/A**
Bergvik Skog	**Sweden**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Holmen	**Sweden**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
SCA	**Sweden**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**

Sveaskog	**Sweden**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**
Precious Woods	**Switzerland**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**DCF**	**N/A**	**N/A**	**N/A**	**N/A**

Where:
DCF: ***Discounted*** ***Cash*** ***Flows*** ***model***
MP: ***Market*** ***Prices***
HC: Historical Cost
FV: ***Fair*** ***Value***
N/A: Not Available

Appendix C: Discount Rate

Year	*Country*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Stora Enso	**Finland**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**10%**	**10%**
UPM-Kymmene	**Finland**	**7%**	**7,50%**	**7,50%**	**7,50%**	**7,50% Finland 10% uruguay**	**7,50% Finland 10% uruguay**	**7,50% Finland 10% uruguay**	**7,50% Finland 10% uruguay**	**7,50% Finland 10% uruguay**	**7,50% Finland 10% uruguay**
Asian Bamboo	**Germany**	**N/A**	**N/A**	**Pre tax 27%**	**Pre tax 30%**	**Pre tax 27%**	**12,7%**	**13%**	**13%**	**13,28% trees 12,99% shoots**	**N/A**
Mondi Group	**Great Britain**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**11,40%**	**10,60%**
Semapa	**Portugal**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**6,60%**	**7%**	**8%**	**8%**
The Navigator Company	**Portugal**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**6,60%**	**7%**	**8%**	**8%**
Bergs Timber	**Sweden**	**N/A**	**N/A**	**6,26%**	**6,26%**	**6,26%**	**6,26%**	**6,26%**	**6,26%**	**N/A**	**N/A**
Bergvik Skog	**Sweden**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**
Holmen	**Sweden**	**6,25%**	**6,25%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**	**5,50%**

SCA	**Sweden**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**
Sveaskog	**Sweden**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**	**6,25%**
Precious Woods	**Switzerland**	**10,80%**	**10,80%**	**10,87%**	**10,75%**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Appendix D: Percentage of Changes in FV of Biological Asset from Operating Result

Year	*Country*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Stora Enso	**Finland**	**3%**	**1%**	**11%**	**1%**	**0%**	**0%**	**0%**	**0%**	**358%**	**18%**
Tornator	**Finland**	**N/A**	**26%**	**77%**	**47%**	**28%**	**N/A**	**28%**	**12%**	**43%**	**4%**
UPM- Kymmene	**Finland**	**24%**	**4%**	**40%**	**575%**	**73%**	**33%**	**36%**	**7%**	**20%**	**18%**
Asian Bamboo	**Germany**	**N/A**	**N/A**	**60%**	**44%**	**15%**	**47%**	**103%**	**311%**	**13%**	**N/A**
Mondi Group	**Great Britain**	**N/A**	**12%**	**8%**	**55%**	**5%**	**22%**	**9%**	**7%**	**3%**	**5%**
Smurfit Kappa Group	**Ireland**	**N/A**	**4%**	**1%**	**0%**	**0%**	**2%**	**3%**	**0%**	**0%**	**5%**
Norske Skog	**Norway**	**11%**	**0%**	**4%**	**4%**	**4%**	**1%**	**1%**	**0%**	**1%**	**14%**
Semapa	**Portugal**	**0%**	**5%**	**0%**	**0%**	**3%**	**3%**	**0%**	**1%**	**1%**	**1%**
The Navigator Company	**Portugal**	**2%**	**6%**	**0%**	**0%**	**3%**	**3%**	**0%**	**1%**	**1%**	**1%**
Bergs Timber	**Sweden**	**N/A**	**4%**	**1%**	**16%**	**-9%**	**5%**	**-7%**	**-6%**	**N/A**	**N/A**
Bergvik Skog	**Sweden**	**106%**	**115%**	**104%**	**128%**	**115%**	**110%**	**104%**	**117%**	**112%**	**88%**
Holmen	**Sweden**	**23%**	**27%**	**96%**	**58%**	**35%**	**111%**	**77%**	**61%**	**81%**	**59%**
SCA	**Sweden**	**15%**	**4%**	**56%**	**8%**	**8%**	**7%**	**27%**	**11%**	**7%**	**6%**
Sveaskog	**Sweden**	**185%**	**98%**	**74%**	**115%**	**99%**	**86%**	**85%**	**125%**	**106%**	**106%**

Precious Woods	**Switzerland**	**57%**	**139%**	**63%**	**67%**	**36%**	**49%**	**N/A**	**N/A**	**N/A**	**N/A**

Appendix E: Value per Hectare

Company	*Country*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Tornator*	**Finland**	***N/A***	***N/A***	***1387***	***1431***	***1461***	***1528***	***1585***	***1615***	***1705***	***1746***
UPM- Kymmene*	**Finland**	***1174***	***1037***	***1095***	***1133***	***1293***	***1430***	***1513***	***1476***	***1325***	***1367***
Asian Bamboo*	**Germany**	***N/A***	***N/A***	***3378***	***4368***	***4033***	***2087***	***1890***	***1540***	***1069***	***N/A***
Smurfit Kappa Group*	**Ireland**	***N/A***	***N/A***	***843***	***830***	***945***	***905***	***1192***	***1279***	***1136***	***1350***
Semapa*	**Portugal**	***1048***	***986***	***1024***	***1024***	***986***	***921***	***923***	***909***	***928***	***934***
The Navigator Company*	**Portugal**	***1048***	***986***	***1024***	***1024***	***986***	***921***	***923***	***909***	***928***	***934***
Bergs Timber**	**Sweden**	***N/A***	***N/A***	***18605***	***24859***	***26023***	***26608***	***31421***	***31700***	***N/A***	***N/A***
Bergvik Skog**	**Sweden**	**12827**	**13094**	**15143**	**15342**	**15684**	**15972**	**17039**	**17521**	**17758**	**18351**
Holmen**	**Sweden**	***8410***	***8515***	***10678***	***10726***	***10765***	***11784***	***15282***	***15709***	***15974***	***16187***
SCA**	**Sweden**	***N/A***	***N/A***	***11964***	***12232***	***12711***	***13047***	***13177***	***13765***	***14397***	***14843***
Sveaskog**	**Sweden**	***6005***	***N/A***	***N/A***	***6233***	***6518***	***6667***	***6828***	***6933***	***7344***	***7511***

**In Euro*
***In Swedish Crowns*

Appendix F: Changes in Percentage of Value per Hectare

Company	*Country*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Tornator	**Finland**	**N/A**	**N/A**	**3,17%**	**2,10%**	**4,59%**	**3,73%**	**1,89%**	**5,57%**	**2,40%**
UPM- Kymmene	**Finland**	**-11,67%**	**5,59%**	**3,47%**	**14,12%**	**10,60%**	**5,80%**	**-2,45%**	**-10,23%**	**3,17%**

Asian Bamboo	**Germany**	**N/A**	**N/A**	**29,31 %**	**-7,67%**	**-48,25%**	**-9,44%**	**-18,52%**	**-30,58%**	**N/A**
Smurfit Kappa Group	**Ireland**	**N/A**	**N/A**	**-1,54%**	**13,86 %**	**-4,23%**	**31,71 %**	**7,30%**	**-11,18%**	**18,84 %**
Semapa	**Portugal**	**-5,92%**	**3,85%**	**0,00%**	**-3,71%**	**-6,59%**	**0,22%**	**-1,52%**	**2,09%**	**0,65%**
The Navigator Company	**Portugal**	**-5,92%**	**3,85%**	**0,00%**	**-3,71%**	**-6,59%**	**0,22%**	**-1,52%**	**2,09%**	**0,65%**
Bergs Timber	**Sweden**	**N/A**	**N/A**	**33,61 %**	**4,68%**	**2,25%**	**18,09 %**	**0,89%**	**N/A**	**N/A**
Bergvik Skog	**Sweden**	**2,08%**	**15,65 %**	**1,31%**	**2,23%**	**1,84%**	**6,68%**	**2,83%**	**1,35%**	**3,34%**
Holmen	**Sweden**	**1,25%**	**25,40 %**	**0,45%**	**0,36%**	**9,47%**	**29,68 %**	**2,79%**	**1,69%**	**1,33%**
SCA	**Sweden**	**N/A**	**N/A**	**2,24%**	**3,92%**	**2,64%**	**1,00%**	**4,46%**	**4,59%**	**3,10%**
Sveaskog	**Sweden**	**N/A**	**N/A**	**N/A**	**4,57%**	**2,29%**	**2,41%**	**1,54%**	**5,93%**	**2,27%**

Appendix G: Disclosure items in IAS 41 (Quoted from the standard)

Standard and paragraph	*Text*	*Score (N/A-0-1)*
IAS 41 - p.40	**An entity shall disclose the aggregate gain or loss arising during the current period on initial recognition of biological assets and agricultural produce and from the change in fair value less cost to sell of biological assets**	
IAS 41 - p.41	**An entity shall provide a description of each group of biological assets**	
IAS 41 - p.42	**The disclosure required by paragraph 41 may take the form of narrative or quantified description**	
IAS 41 - p.43	**An entity is encouraged to provide a quantified description of each group of biological assets, distinguishing between consumable and bearer biological assets or between mature and immature biological assets, as appropriate. For example, an entity may disclose the carrying amounts of consumable biological assets and bearer biological assets by group. An entity may further divide those carrying amounts between mature and immature assets. These distinctions provide**	

	information that may be helpful in assessing the timing of future cash flows. An entity discloses the basis for making any such distinctions.	
IAS 41 - p.44	**Consumable biological assets are those that are to be harvested as agricultural produce or sold as biological assets. Examples of consumable biological assets are livestock intended for the production of meat, livestock held for sale, fish in farms, crops such as maize and wheat, produce on a bearer plant and trees being grown for lumber. Bearer biological assets are those other than consumable biological assets; for example, livestock from which milk is produced and fruit trees from which fruit is harvested. Bearer biological assets are not agricultural produce but, rather, are held to bear produce**	
IAS 41 - p.45	**Biological assets may be classified either as mature biological assets or immature biological assets. Mature biological assets are those that have attained harvestable specifications (for consumable biological assets) or are able to sustain regular harvests (for bearer biological assets)**	
IAS 41 - p.46	**If not disclosed elsewhere in information published with the financial statements, an entity shall describe: (a) the nature of its activities involving each group of biological assets; and (b) non-financial measures or estimates of the physical quantities of: (i) each group of the entity's biological assets at the end of the period; and (ii) output of agriculture produce during the period**	
IAS 41 - p.47	**-**	
IAS 41 - p.48	**-**	
IAS 41 - p.49	**An entity shall disclose: (a) the existence and carrying amounts of biological assets whose title is restricted, and the carrying amounts of biological assets pledged as security for liabilities; (b) the amount of commitments for the development or acquisition of biological assets; and (c) financial risk management strategies related to agricultural activity**	
IAS 41 - p.50	**An entity shall present a reconciliation of changes in the carrying amount of biological assets between the beginning and the end of the current period. The reconciliation shall include: (a) the gain or loss arising from changes in fair value less costs to sell; (b) increases due to purchases (c) decreases attributable to sales and biological assets classified as held for sale (or included in a disposal group that is classified as held for sale) in accordance with IFRS 5; (d) decreases due to harvest; (e) increases resulting from business combinations; (f) Net exchange differences arising on the translation of financial statements into a different presentation currency, and on the translation of a foreign operation into the presentation currency of the reporting entity; and (g) other changes**	
IAS 41 - p.51	**The fair value less costs to sell of a biological asset can change due to both physical changes and price changes in the market. Separate disclosure of physical and price changes is useful in appraising current period performance and future prospects, particularly when there is a production cycle of more than one year. In such cases, an entity is encouraged to disclose, by group or otherwise, the amount of change in fair value less costs to sell included in profit or loss due to physical changes and due to price changes. This information is generally less useful when the production cycle is less than one year (for example, when raising chickens or growing cereal crops)**	
IAS 41 - p.52	**Biological transformation results in a number of types of physical change-growth, degeneration, production, and procreation, each of which is observable and measurable. Each of those physical changes has a direct relationship to future economic benefits. A change in fair value of a biological asset due to harvesting is also a physical change**	

IAS 41 - p.53	**Agricultural activity is often exposed to climatic, disease and other natural risks. If an event occurs that gives rise to a material item of income or expense, the nature and amount of that item are disclosed in accordance with IAS 1 Presentation of Financial Statements. Examples of such an event include an outbreak of a virulent disease, a flood, a severe drought or frost, and a plague of insect**	