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Goodwill and the Prediction of Bankruptcy

A study on the impact of the IFRS transition to goodwill impairment on bankruptcy prediction models based on accounting ratios

Authors:

Lau Skovgaard Jørgensen (22208) & Johannes Mofors (22322)

Thesis supervisor:

Stina Skogsvik

Abstract

This study investigates whether the transition to IFRS in Sweden with regards to goodwill impairment testing has affected bankruptcy prediction models based on accounting ratios. We compare data from reported IFRS financial statements with simulated Swedish GAAP data to determine the effect on the Skogsvik and Ohlson bankruptcy prediction models. The study shows that there has been a significant change in the level of risk generated from prediction models. The estimates of bankruptcy risk are lower under IFRS accounting than under Swedish GAAP accounting with regards to goodwill accounting. Using default risk from credit ratings as a proxy of actual bankruptcy risk to evaluate the bankruptcy models, we are not able to identify a significant decrease in the predictive ability after the transition to IFRS.

Key words: Bankruptcy prediction, goodwill, IFRS, Sweden

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List of abbreviations

CCA	Current Cost Accounting
CDS	Credit Default Swap
CGU	Cash Generating Unit
Fitch	Fitch IBCA
HCA	Historical Cost Accounting
IAS	International Accounting Standards
IAS 36	IAS 36 Impairment of Assets
IAS 38	IAS 38 Intangible Assets
IFRS	International Financial Reporting Standards
MDA	Multivariate Discriminant Analysis
Moody's	Moody's Investor Service
NASDAQ OMX	NASDAQ OMX Group, Inc.
OHL	Ohlson bankruptcy prediction model
OLS	Ordinary Least Squares
RR	"Redovisningsrådets Rekommendationer" (Swedish GAAP)
S&P	Standard & Poor's
SKOG	Skogsvik bankruptcy prediction model
Swedish GAAP	Swedish Generally Accepted Accounting Principles
ÅRL	Årsredovisningslagen

1 Introduction

Bankruptcy probabilities constitute important parameters in many decision contexts such as in discounted cash flow valuation of financial instruments. In order to be able to make more correct decisions in financial markets and other business-contexts, it is then important that estimations of bankruptcy risk are reliable.

Models predicting bankruptcy are often based on accounting ratios, but researchers are becoming increasingly aware that earlier models may no longer provide relevant estimates of bankruptcy. Beaver, McNichols & Rhie (2005) examine how the ability to predict bankruptcy from financial statements in the US has been affected by three major trends: (1) the development of new accounting standards, (2) an increase in the relative importance of intangible assets and financial derivatives and (3) a perceived degree of discretion entering financial statements.

Inspired by Beaver, McNichols & Rhie (2005), we identified the transition to IFRS (International Financial Reporting Standards) in Sweden as an important change in accounting standard. We choose to focus on the accounting for goodwill as this intangible asset is gaining importance in the modern economy and is widely discussed in the academic literature. This study contributes to the current debate by evaluating the impact of the change for goodwill accounting from a bankruptcy prediction standpoint.

1.1 Background

Sweden has recently gone through a significant change in accounting standards. As of 2005, all companies listed on the Swedish stock exchange are to report in accordance with IFRS, previously reporting according to Swedish GAAP (Generally Accepted Accounting Principles). Financial reporting according to IFRS is believed to better reflect the companies' profitability and financial situation, thus giving investors more value-relevant information. One of the most important differences between IFRS and Swedish GAAP is the treatment of intangible assets and specifically goodwill (Bild, Schuster 2006).

Goodwill arises as an acquiring company pays more for a target company than the fair value of its net assets. Goodwill may be considered the amount an acquirer has paid for the expected excess profits arising from the acquisition. Prior to 2005 under Swedish GAAP, goodwill was amortized linearly, reflecting its assumed decreasing value. IFRS however, abandons goodwill amortizations in favor of impairment tests. In this process, the carrying

value of goodwill is compared with its fair value, often calculated as the net present value of future expected cash flows.

The impairment-approach to goodwill is suggested to make managers convey private information on future expected cash flows, thereby generating corporate reporting that better reflects the underlying economics of firms. The concept of goodwill impairment gives management discretion regarding estimates and assumptions that are hard for investors to verify. It is therefore possible that managers may opportunistically exploit this accounting discretion to their own benefit, overstating performance by avoiding impairment charges to goodwill. This would reduce the claimed benefits of the impairment approach, making financial statements less informative. It is then unclear how the impairment-only practice of goodwill affects the quality of company reporting (Hamberg, Paananen & Novak 2011).

Research investigating the transition to IFRS reporting in Sweden has found that goodwill impairments after the transition to IFRS have been smaller than goodwill amortizations prior to 2005. Over the transition period, the amount of capitalized goodwill has increased substantially, with the average amount of goodwill as a percentage of total assets growing by more than 27 % from the period 2002 – 2004 to 2005 – 2007 (Sahut, Boulerne & Teulon 2011). At the end of 2008, the total goodwill in relation to total assets for companies on the Swedish stock exchange amounted to approximately 30 % (Gauffin, Thörnsten 2010). The transition to IFRS has consequently had a significant effect on the consolidated financial statements for companies in Sweden.

1.2 Purpose of study

Bankruptcy prediction models based on accounting ratios are not isolated from the change in accounting standards for goodwill. Some of the most widely known bankruptcy models based on accounting ratios were developed in a different time and setting. As many of these models are still being applied today, it is important to understand how the subsequent accounting changes described above have affected their predictive ability. In our thesis, we seek to investigate the effect of the new accounting for goodwill under IFRS, compared to the previous reporting in accordance with Swedish GAAP. We investigate:

Has the impairment-only approach to goodwill under IFRS reporting affected the ability to predict bankruptcy using prediction models based on accounting ratios?

We approach this problem using two accounting-based bankruptcy models: The Ohlson model developed in 1980 and the Skogsvik model, introduced 1987. To investigate the effect from the new goodwill accounting, we compare reported IFRS figures to a fictional data-set simulating goodwill amortizations according to Swedish GAAP. By using the bankruptcy models on these two data-sets, we are able to measure the effect on bankruptcy prediction from the new goodwill accounting. Through this approach, other factors affecting the consolidated financial statements from the transition to IFRS are held constant. We then use the implied default risk from credit ratings as a proxy for actual risk of bankruptcy. By comparing the bankruptcy model estimates with this proxy, we are able to examine whether the predictive ability has decreased.

The motivation for choosing the Skogsvik and Ohlson models are as follows. The Ohlson model is a widely known bankruptcy prediction model, frequently used in academic studies. The Skogsvik model was developed on Swedish companies, making it relevant in this study as we investigate bankruptcy prediction in a Swedish context. The Skogsvik and Ohlson models were developed using probit and logit analysis respectively, which are the predominant methods for developing prediction models (Jones, Hensher 2004). It is important to note that we do not directly compare the Skogsvik and Ohlson models, but rather seek to use them as representatives to identify general trends in how bankruptcy models behave in this context. Another frequently used bankruptcy prediction model is the Z-score model published by Altman in 1968. This model is based on Multivariate Discriminant Analysis (MDA), why its output cannot be transposed into a percentage risk of bankruptcy (Ohlson 1980). This ability is important to allow comparison with estimates of default from credit ratings. This is possible with both the Skogsvik and Ohlson models.

1.3 Thesis research boundaries

We do not evaluate the prediction of the two models with actual outcomes (i.e. bankrupt or non-bankrupt) or seek to expand or improve the predictive ability of the accounting based bankruptcy models. This would not be feasible at present due to the small number of bankruptcies post-2005 in Sweden.

The study is limited to include companies listed on the Swedish stock exchange, examining bankruptcy risk during 2012. In addition, due to the method of comparing model estimates with credit ratings, the sample has been limited to companies rated by credit institutions (Please see section 4.1 Sample).

The study leaves out other possible market estimates of bankruptcy risk, such as those obtained from credit default swaps (CDS) and bond prices.

Although managerial discretion is part of the theoretical background as to why goodwill impairment might not give a transparent picture of a company's financial situation, we do not evaluate the presence of opportunism in goodwill reporting.

1.4 Outline

The outline of this thesis is as follows. In chapter 2, we present theory and previous research on goodwill accounting, the bankruptcy models used in the study as well as credit ratings. Chapter 3 describes the development of our test logic and general hypothesis. In chapter 4, we present the method used in our study as well as our sample. In chapter 5, we analyze our results followed by part 6 with a discussion including robustness checks. Part 7 concludes the thesis.

2 Theory and previous research

2.1 Goodwill accounting

2.1.1 Goodwill and the impairment process under IFRS

As of 2005, all companies listed on the Swedish stock exchange are to report in accordance with IFRS, previously reporting according to Swedish GAAP. One of the most significant and debated differences between IFRS and Swedish GAAP is the treatment of goodwill and intangible assets (Bild, Schuster 2006).

Under IFRS, goodwill is classified as an intangible fixed asset recognized on the consolidated balance sheet arising from acquisitions. Goodwill is mainly governed by IFRS3 Business combinations and IAS 36 Impairment testing.

When performing a purchase analysis in connection with an acquisition, companies are required to use the acquisition method, where unidentifiable intangible assets are classified as goodwill. More generally, goodwill is the residual between the value of acquired net assets and the purchase price. Thus, goodwill may be viewed as the premium a company has paid for future economic benefits that are not capable of being identified individually such as reputation, synergies, brand and/or market share. The acquired goodwill is allocated to each of the acquirers' cash generating units (CGU) that are expected to benefit from the synergies of the business combination.

In contrast to intangible assets, goodwill is not amortized but instead tested for impairments. In this process, governed by IAS 36, the current account of goodwill is compared with its recoverable amount. The recoverable amount is the higher of the fair value less costs to sell and the value in use. Value in use is calculated as the net present value of future generated cash flows from the asset. Companies are to estimate future cash flows and determine an appropriate discount factor based on market estimates to determine the net present value. IAS 36 requires that assets should be carried at no more than their recoverable amount. If the carrying amount of the unit exceeds the recoverable amount, an impairment loss must be recognized immediately as an expense in the income statement. Instead, if the recoverable amount exceeds the current account, goodwill is not impaired. It is not possible to reverse the impairment of goodwill.

Impairment tests for goodwill should be carried out at least on an annual basis or if events or changes in circumstances suggest that the asset may be impaired. Indications of impairment

should consider both external and internal sources and look for e.g. technological obsoletion or change in market environment.

2.1.2 Transition to IFRS from Swedish GAAP

Prior to 2002, the accounting standard RR 1:96 required goodwill to be amortized over five years unless a longer useful life could be estimated with reasonable certainty (as required by Swedish law: ÅRL 4:2-4). Since 2002, RR 1:00 allowed an economic life of 20 years, although many firms continued to report more conservatively. In 2003, RR 1:00 was altered, to a presumption that the useful life of acquired goodwill will not exceed 20 years unless rebutted. Annual impairment testing was then required for goodwill with useful lives exceeding 20 years. (Hamberg, Paananen & Novak 2011)

IFRS1 First-Time Adoption, states that companies when adopting IFRS should test all goodwill carried in the balance sheet for impairment at the date of transition. This should be done regardless of whether there are any indications of impairment, unless the business combinations occurring prior to transition have been retrospectively restated.

The impairment rules of IFRS mirrors the development in the US, where there has also been a transition from amortization to impairment testing following the issuance of SFAS 142 in 2001 (White, Sondhi & Fried 2003).

2.1.3 Effects from amortization to impairment

The change from Swedish GAAP to IFRS with regards to goodwill accounting does not have a cash flow effect and only affects the consolidated income statement and balance sheet. Bild & Schuster (2006) analyses the effect on net profit related to goodwill amortization versus impairment, stating three main effects when looking at profitability over time:

1) Net profit increases or is constant. In the long run, net profit is constant if total amortizations and impairments are the same. If the company has internally generated goodwill and assigns this to the same CGU as acquired goodwill has been assigned to, it is possible that no impairment will be recognized even though the goodwill from the acquisition has decreased in value. Total impairment will then be lower than total amortization in the long run, and total net profit will be higher.

2) Net profit is reported earlier. This statement rests upon that write-downs were required previously as a complement to amortization if necessary. This implies that the carrying value

of goodwill with the impairment-only approach can never be lower than the carrying value with amortizations and write-downs. This effect is showed in Exhibit 1, depicted as the blue line always above or equal to the green line.

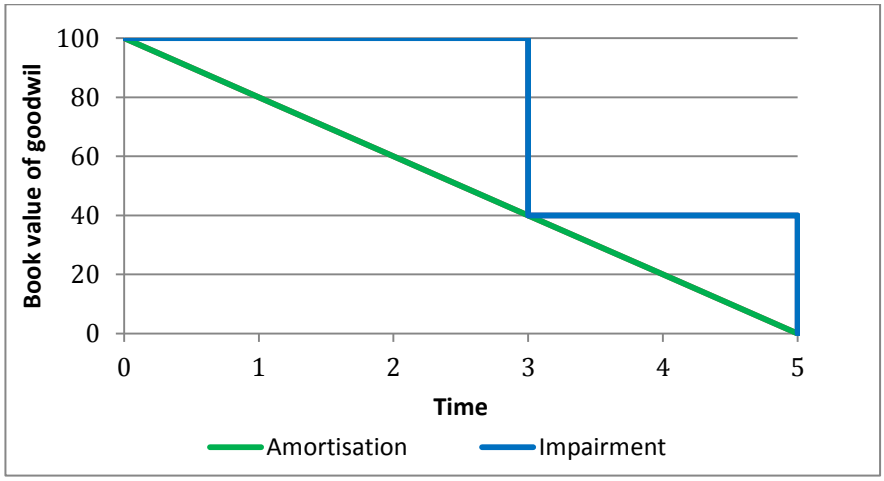

Exhibit (1). Impairment of testing of goodwill versus annual amortizations

3) Net profit is more volatile. Assuming that the accumulated amount of impairments is equal to amortizations over time, but that the individual impairments will be greater as they occur less frequently.

The above conclusions regarding net income apply to other measures of profitability as well, such as operating income. Measures excluding amortizations/impairments of intangible assets will of course remain unaffected.

The above effects relating to the income statement affects the balance sheet as well. The carrying value of goodwill will be greater or the same when under the impairment-only approach. The size of the consolidated balance sheet, measured by total assets, will therefore be bigger. The size of equity will follow the same pattern, leading to an improved equity ratio. In analogy with the reasoning in 3), total assets, equity and the equity ratio will be more volatile in the IFRS regime than the Swedish GAAP regime in the context of goodwill treatment.

2.1.4 Problems with the impairment process

There are a number of problems linked to the accounting of goodwill mentioned in academic research regarding the accounting of goodwill. Much concern has been highlighted regarding the measurement of goodwill, especially linked to managerial discretion inherent in the process of impairment testing. An important idea behind IAS 36 and the discretion in the impairment approach is that it gives a better opportunity for managers to convey private information about the financial situation of their company, making financial statements convey more value-relevant information. However, management might also use discretion in an opportunistic fashion. Managers might overstate, understate, or even not recognize any impairment loss on goodwill depending on their assumptions and it can be difficult for investors to verify the underlying assumptions. Management may have incentives to minimize impairment charges of goodwill to report higher earnings. Thus, the discretion inherent in the impairment approach of goodwill could either improve or impair the information content in financial statements (Beaver, Correia & McNichols 2012).

One of the key reasons that management has discretion over goodwill impairment is that companies may calculate the recoverable amount as the value in use, which is based on management's own assumptions regarding the future development within the limits of IAS 36. Gauffin & Thörnsten (2010) find that Swedish companies in almost all cases calculate the recoverable amount as value in use. Evidence from the height of the financial crisis in 2008 point to especially the discount factor as incorrectly estimated. Companies did not raise their discount factor as spreads on company bonds widened. This could have resulted in too low impairments of goodwill. During a period of high uncertainty and increasing risk, only 17% of companies on the Swedish stock exchange choose to raise their reported discount factor decreasing the probability of impairment charges even if it should be reasonable (Gauffin, Thörnsten 2010).

Another goodwill-related area influenced by managerial discretion is the performance of a purchase analysis. Companies should capitalize identifiable intangible assets if they meet a set of criteria as stated in IAS 38 "Intangible Assets", which are amortized over their useful life. If the intangibles do not meet the recognition criteria in IAS 38, they will instead be classified as goodwill. Companies can report higher earnings by minimizing the amount of intangible assets identified, and afterwards minimize goodwill impairment. Hamberg, Paananen & Novak (2011) conclude that following the transition to IFRS in Sweden, "firms

have more unspecific intangible assets making future earnings more dependent on managers' discretionary decisions".

Additional research has investigated the relationship between discretion in goodwill reporting and earnings management, a strategy in which management intentionally manipulates the company's earnings in order to make them match pre-determined targets. Abughazaleh, Al-Hares & Roberts (2011) finds a significant relation between goodwill impairments and recent CEO changes in the United Kingdom. It is well known that when new management enters a company, there are incentives for taking "big baths", by writing down assets and making restructuring provisions as these costs can be blamed on the old management. This relieves future income of such charges, increasing the opportunity for showing improved earnings. Furthermore, the study also found a significant correlation between abnormal pre-write-off earnings and higher amounts of reported goodwill impairment losses.

According to IAS 36, an impairment test should be carried out on the lowest level of the CGU within an entity to which goodwill has been allocated. This creates further problems in achieving value-relevant corporate reporting. As some acquired companies become closely integrated to the acquired company, the calculation of the recoverable amount has to be made at a higher level, including more businesses than the entity to which the goodwill was assigned originally at the time of consolidation. Impairment testing on this higher level may result in goodwill never being impaired.

Another problem related to the concept of goodwill is that different ways of corporate growth, either organic or through acquisitions, has an implication on the size of goodwill capitalized on the consolidated balance sheet. This illustrates the problems of accounting goodwill versus economic goodwill (White, Sondhi & Fried 2003). Under IFRS, it is clear that internally generated goodwill is not capitalized. As organically growing companies expense charges needed to grow, acquisitive companies instead are able to capitalize goodwill as they grow by purchasing other companies. This creates a distortion in the comparability of companies, which have different growth methods. Although this is a problem present pre-IFRS in Sweden as well, the distortion becomes more substantial under the IFRS regime when the relative size of goodwill is expected to be greater.

White, Sondhi & Fried (2003) put forward the different views of whether goodwill is simply the capitalized present value of excess returns, or a subjective concept that often turns out to

be short-lived. They take a radical approach, stating that analysts for purposes of analysis should simply remove goodwill from reported balance sheets, emphasizing that the existence of economic goodwill is largely independent of the existence of accounting goodwill. Due to the uncertainty of goodwill, relatively large amounts of goodwill on companies' balance sheets can then be seen as a risk factor. This is because large impairment of goodwill can have severe consequences for the financial strength of a company. A large write-down will reduce equity with the same amount, creating a higher debt to equity ratio and may even result in negative equity for the company. This may force companies to initiate a new share issue in order to comply with debt covenants issued by debt holders or even keep the firm from going into default (Malmqvist 2010).

2.1.5 Empirical evidence on Sweden

Goodwill is often a large asset noted on the balance sheets of Swedish listed companies. Gauffin & Nilsson (2011) showed that for Swedish listed companies goodwill in relation to equity was nearly 30 % at the end of 2008.

Sahut, Boulerne & Teulon (2011) has found that goodwill impairments after the transition to IFRS have been smaller than goodwill amortizations prior to 2005 in Sweden. The transition to IFRS reporting in 2005 has increased the amount of capitalized goodwill substantially in Sweden, with the average amount of goodwill as percentage of total assets growing by more than 27 % from the period 2002 – 2004 to 2005 – 2007.

Gauffin & Thörnsten (2010) point to the impairment approach of IAS 36 as an important reason why goodwill is still a large part of total assets despite the financial crisis. They show that the total decrease in goodwill on the Stockholm stock exchange was only 1.5 percent during 2008. As future excess profits would be expected to decrease significantly this seems unreasonable. The authors reason that the lack of goodwill impairment was due to companies trying to defend its equity in a period of high uncertainty and being afraid that large impairments might result in negative stock price reactions.

Carlsson, Sandell & Yard (2013) point to another factor, which could influence the size of impairments – companies have difficulties applying the IAS 36 standard. IAS 36 states that the calculation of value in use should be based on a discount factor before tax. The study however finds that in 2011, 26% of Swedish listed companies reported the discount factor after tax, while 11% did not clearly state whether the discount factor was before or after tax. Incorrect application of IAS 36 was also the most common reason companies on the

Swedish NASDAQ OMX received critique from the Surveillance commission in 2012 (Carlsson, Sandell & Yard 2013).

Hjelström & Schuster (2011) found that the compliance with IAS 36 was a key issue during Swedish companies' transition to IFRS. The study found that managers were worried that they might disclose sensitive forecast information through the assumptions on cash flow projections in calculating value in use. The study, in line with Carlsson, Sandell & Yard (2013), also indicated that there was an uncertainty as to which disclosures were actually required and an awareness that the company may not be complying with all the disclosure requirements in the standard. The issue was often handled through extensive discussions involving top management, auditors and other firms with a preference for waiting to see what kind of practices would emerge.

2.2 Bankruptcy models based on accounting ratios

Numerous studies in predicting bankruptcy have been conducted during the previous decades. Researchers have found that accounting-based models have significant explanatory power in predicting bankruptcy, but although both the statistical methods and parameters have changed over the years, their explanatory powers have not evolved significantly (Bellovary, Giacomino & Akers 2007).

2.2.1 Skogsvik model

In his doctor degree thesis, Skogsvik (1987) presented a bankruptcy prediction model based on probit analysis[1] using accounting figures as explanatory variables. The purpose of Skogsvik's thesis was to compare two models developed for current cost accounting (CCA) and historical cost accounting (HCA). As the financial statements used in this thesis are constructed using historical cost accounting, we use Skogsvik's HCA-based model. Skogsvik presented variants of the model to predict bankruptcy over different time horizons ranging from one up to six years. From the model, a score "V" is generated. This score can be transposed to a percentage risk of bankruptcy obtained from a normal distribution.

The sample used to develop the model consisted of 379 Swedish companies, whereof 51 failed in the observation period of 1966 to 1980[2]. The companies included in the selection

[1] A discrete probit model is a type of regression where the dependant variable follows a discrete binary distribution, for instance bankrupt or non-bankrupt.

[2] This creates a choice-based sample bias, which is further described in section 2.2.3

were corporations classified as either mining or manufacturing companies, having 200 or more employees or assets worth over SEK 20 million (1970 prices, equivalent to SEK ~150 million in 2013 prices). The definition of business failure was (1) bankruptcy or composition agreement, (2) voluntary shutdown of the primary production activity, or (3) receipt of a substantial subsidy provided by the state to avoid bankruptcy. The mean percentage error using historical cost accounting ratios was 16.7 % one year prior to bankruptcy, implying that approximately 1 out of 6 companies were expected to be classified incorrectly as bankrupt or non-bankrupt. The parameters used are described below, followed by the coefficients used in the model predicting the risk of bankruptcy within one year in [1]:

$R_1 =$ Return on assets (EBIT divided by average total assets)
$R_2 =$ Interest rate (interest expense divided by average liabilities)
$R_3 =$ Inverted inventory turnover (average inventory divided by sales)
$R_4 =$ Shareholder equity ratio (equity divided by total assets)
$R_5 =$ Change in owner's equity ($(E_t - E_{t-1})/E_{t-1}$)
$R_6 =$ Normalized measure of R_2 (R_2 affected by interest rates for four last years)

[1] $$V = -1.5 - 4.3 \cdot R_1 + 22.6 \cdot R_2 + 1.6 \cdot R_3 - 4.5 \cdot R_4 + 0.2 \cdot R_5 - 0.1 \cdot R_6$$

The higher the value of V, the higher will the estimated risk of bankruptcy be. Subsequently, the parameters measuring interest rate and inverted inventory turnover (R_2 and R_3) are presented with positive coefficients. Intuitively, a high interest may be a sign of creditors demanding a higher premium due to increased risk; a high inverted inventory turnover may be a sign of decreasing demand. The parameter measuring change in owner's equity (R_5) has a positive coefficient in Skogsvik's model as well, implying that an increase in equity from one year to the next is associated with a higher risk of bankruptcy. This characteristic may seem strange, as an increase in equity normally would be interpreted as a sign of increased financial health. In his article, Skogsvik highlights this strange result, unable to find an explanation even after controlling for extreme values (Skogsvik 1987). This coefficient however, is the second smallest in the model, decreasing its impact. Note that a higher shareholder equity ratio (R_4) is still associated with lower risk. The other parameters in Skogsvik's model are presented with negative coefficients, which implies that higher values are associated with a lower estimated risk of bankruptcy.

2.2.2 Ohlson model

In his study "Financial ratios and the probabilistic prediction of bankruptcy" Ohlson presented a bankruptcy prediction model based on accounting ratios. Similar to Skogsvik's model, it generates a score (O-score), which can be transposed into a predicted probability of default. Ohlson built his model based on a logistic approach (logit approach)[3], comprising of nine explanatory variables, including both financial ratios and dummy variables. One of the advantages with the logit approach (as well as the probit approach) is that it does not require the predictors to be normally distributed, a property that enables the use of dummy variables. (Ohlson 1980)

Ohlson created his model based on a sample of firms, consisting of 105 failing and 2,058 non-failing companies, observed under the period 1970 to 1976.[4] All companies used in Ohlson's study were listed industrial companies. Utilities, transportation and financial services companies were excluded. Ohlson presented three different models, which sought to estimate the probability of bankruptcy (1) one year in advance, (2) two years in advance, given that the firm did not go bankrupt during the first year, and (3) within two years.[5] In his study, Ohlson achieved a prediction accuracy of 96 % in predicting bankruptcy within one year.

The parameters in his one-year model (1) are described below, followed by a presentation of their respective coefficients below in [2]:

1. *SIZE* = log(Total assets divided by GNP price-level index). The index assumes a base value of 100 for 1968. Total assets are as reported in dollars
2. *TLTA* = Total liabilities divided by total assets
3. *WCTA* = Working capital divided by total assets
4. *CLCA* = Current liabilities divided by current assets
5. *OENEG* = One if total liabilities exceeds total assets, zero otherwise
6. *NITA* = Net income divided by total assets
7. *FUTL* = Funds provided by operations divided by total liabilities
8. *INTWO* = One if net income was negative for the last two years, zero otherwise

[3] A type of regression analysis used for predicting the outcome of a categorical dependent variable

[4] This creates a choice-based sample bias, which is further described in section 2.2.3

[5] When referring to the two-year estimation period in our thesis we refer to model (3)

9. *CHIN* = $(NI_t - NI_{t-1})/(|NI_t| + |NI_{t-1}|)$, change in net income. NI is net income for the most recent period. The denominator acts as a level indicator.

$$[2] \quad O = -1.32 - 0.407SIZE + 6.03TLTA - 1.43WCTA + 0.0757CLCA$$
$$-1.72OENEG - 2.37NITA - 1.83FUTL + 0.285INTWO - 0.521CHIN$$

SIZE, WCTA, NITA, FUTL and CHIN are ratios thought to decrease the probability of failure, consequently presented as negative coefficients, lowering the predicted risk of bankruptcy as they increase. OENEG, which tries to capture the effect of presenting negative equity, is assumed to increase the risk of bankruptcy and therefore has a positive coefficient in Ohlson's prediction models, as do TLTA, CLCA and INTWO.

To extract the implied bankruptcy risk implied from the O-score, the following formula is used:

$$[3] \quad P(fail) = \frac{1}{(1 + \exp(-O\text{-}score))}$$

2.2.3 Choice based sample bias

The Skogsvik and Ohlson models are estimated from non-random samples of firms, where the proportion of bankrupt firms in the estimation sample differs from the corresponding fraction in the population. This choice based sample bias leads to estimated bankruptcy probabilities that are biased towards being too high (Skogsvik, Skogsvik 2013). To transform the model predictions to the probabilities of bankruptcy we use in the model, the below formula to calculate an unbiased risk of bankruptcy is used:

$$[4] \quad P(fail)_{pop} = P(fail)_{est} * \left[\frac{\phi*(1-prop)}{prop*(1-\phi)+p(fail)_{est}*(\phi-prop)}\right]$$

- prop = Number of failure companies in relation to total number of companies in the estimation sample
- ϕ = Proportion of failure companies in the population of companies
- $p(fail)_{est}$ = The probability of failure in the estimation sample
- $p(fail)_{pop}$ = The probability of failure in the population

In calculating the risk of failure in the population we have estimated the a priori risk of failure to 1.5% for 2012. This is based on historical levels of bankruptcy rates for Swedish listed firms in business cycles comparable to the economic climate of 2012.

2.3 Goodwill and bankruptcy models

Assuming goodwill impairments under the IFRS regime being lower than the amortizations prior to 2005 in Sweden, general effects on commonly used types of parameters in bankruptcy prediction models can be predicted. Common parameters in bankruptcy prediction models, as apparent in the Ohlson and Skogsvik models, relates to margins, leverage and return on capital.

First, margins including amortization/impairment (such as the EBIT-margin) will be higher. Second, as the reported profits will be higher the equity and the equity ratio will increase. Furthermore, as goodwill is larger due to smaller write-downs, the consolidated balance sheet will be larger as well. The impact from the above changes should reasonably be related to a lower predicted risk of bankruptcy in estimation models.

The effect on return on capital measures (e.g. ROA, ROE and ROCE), does not have a predetermined direction from impairments being lower than amortizations. The relative growths of the nominator (earnings) and denominator (capital) determine this outcome. For instance, if the relative increase in the earnings measure increases more than the relative growth in the capital base, the measure will increase. In the Skogsvik and Ohlson models, higher measures of return on capital are associated with lower predictions of bankruptcy.

From the above discussion, it seems probable that a change in the level of goodwill write-downs will impact the predicted level of bankruptcy level generated by accounting-based models. The balance sheets and income statements of public corporations have clearly changed since the transition to IFRS in Sweden and the relative amounts of intangibles have grown, often to a size larger than equity (Hamberg, Paananen & Novak 2011, Sahut, Boulerne & Teulon 2011, Gauffin, Nilsson 2011). Meanwhile, although goodwill can be an asset related with risk (Malmqvist, 2010), neither the Skogsvik or Ohlson model has any parameters explicitly taking goodwill or intangibles into account when predicting bankruptcy risk.

Some research have investigated the subject of increased discretion relating to intangibles and the prediction of bankruptcy in non-IFRS contexts. In an US context, studies have investigated whether the ability to predict bankruptcy using accounting ratios has declined over time as managerial discretion and the importance of intangible assets have increased over time (Beaver, McNichols & Rhie 2005, Beaver, Correia & McNichols 2012). While the earlier studies only find a slight deterioration in predictive ability, the more recent study

identifies that a more distinct decrease has taken place. While contributing to the understanding of bankruptcy prediction, these studies do not evaluate how existent models currently in use have been affected by intangibles. In Australia, Jones (2011) investigates the discretionary capitalization of identifiable intangibles from a bankruptcy risk perspective. The study finds that failing firms capitalize intangibles more aggressively than non-failing firms, and identifies a strong association with the propensity to capitalize intangibles and earnings management proxies. Furthermore, Jones (2011) finds that voluntary capitalization of intangibles is associated with a higher risk of bankruptcy and has strong predictive power in a bankruptcy prediction model. Jones (2011) argue that companies that opportunistically capitalizing intangibles might be able to hide deteriorating performance.

2.4 Credit ratings

Credit ratings are opinions about credit risk and express the credit rating institutions' forward-looking opinion about a company's overall creditworthiness in order to pay its financial obligations in full and on time. The ratings are expressions of the relative credit risk of companies according to standardized quality categories. They do not express precisely expected default rates. A company's rating refers to long-term developments and do not respond to short-term market fluctuations; however, new significant information which could alter the risk of default risk is reflected in up- or downgrades. (Standard and Poor's 2012b)

Ratings are stated on a scale with AAA designating the lowest probability of default and C the highest. Ratings above BB are called investment grade, while ratings below are categorized as speculative grade to illustrate the difference in risk. Rating categories can be modified by adding a minus or plus (rating modifiers) to give a more detailed description of the risk. (Standard and Poor's 2012b)

Rating agencies base their ratings on a combination of quantitative information from a review of the financial performance, policies, and risk management strategies and qualitative information from discussions with the company's management on long-term strategies and ability to meet financial obligations, as well as assessing the specific business, regulatory and economic context. (Dittrich 2007)

A large body of research has been devoted to investigate, whether credit ratings provide accurate information about the creditworthiness of companies. Although empirical evidence on the information value of credit ratings is mixed, recent studies have shown that there is a

very high correlation between rating categories and default rates of corporate bonds. (Dittrich 2007, Purda 2011)

Credit ratings have been subject to critique as well, for instance regarding the stability and timeliness of credit ratings. Credit rating institutions assess default risk over long time-horizons. As a result, the stability of credit ratings may come at the expense of ratings being temporarily too high or low despite providing a reasonable evaluation of long-term credit quality. (Purda 2011)

3 Test logic and general hypotheses

To measure the effects from the transition from Swedish GAAP to IFRS with regards to goodwill accounting, we use two sets of financial statements for each company in our sample. These represent two different regimes of goodwill accounting: 1) reported financial statements representing the IFRS regime of goodwill accounting, and 2) financial statements simulating the goodwill accounting in accordance with Swedish GAAP. For convenience, we denote the reported IFRS figures as the *IFRS setting*, while the latter sets of financial statements will be referred to as *Swedish GAAP setting.* By applying the Skogsvik and Ohlson models in these two settings, we are able to measure how the prediction of bankruptcy is affected by the accounting of goodwill.

First, we investigate whether the different treatments of goodwill has a significant impact on the predicted level of bankruptcy. As empirical research indicates that goodwill impairments behave differently than goodwill amortizations prior to IFRS, and this has direct impact on parameters used in bankruptcy prediction models, we expect the estimates of bankruptcy risk to be different between the two settings. We assess this under the sub-hypothesis H_A, in which we test the null hypothesis of the change in goodwill reporting not affecting the estimated risk of bankruptcy against a two-sided alternative hypothesis.

$H_{A,0}$: The transition from amortization to impairment testing of goodwill has not affected the prediction estimates made by bankruptcy models based on accounting ratios

$H_{A,1}$: The transition from amortization to impairment testing of goodwill has affected the prediction estimates made by bankruptcy models based on accounting ratios

Second, we investigate whether the predictive ability of accounting-based bankruptcy models has been impaired following the new accounting of goodwill in Sweden. If we reject

the null-hypothesis under H_A, this could imply that the bankruptcy models have become obsolete following the change in accounting for goodwill. To measure the predictive ability of the Skogsvik and Ohlson model, we use the default risk implied from credit ratings as a proxy for *actual* bankruptcy risk. By comparing this proxy with the bankruptcy model estimates for each model, we investigate if the ability to make good predictions is lower in the IFRS setting. This assessment is made under H_B, which is stated below:

$H_{B,0}$: The change in accounting standard does not affect (or improves) the ability of bankruptcy models based on accounting ratios to predict bankruptcy

$H_{B,1}$: The change in accounting standard impairs the ability of bankruptcy models based on accounting ratios to predict bankruptcy

4 Method

4.1 Sample

Our sample consists of 23 companies listed on the Swedish stock exchange (For complete list, please see Appendix). These all have available credit ratings and goodwill on their balance sheets. All companies have reported in accordance with Swedish GAAP before the transition to IFRS in 2005.

From an initial list of 252 Swedish listed companies (Please refer to Table 11 in the Appendix), we excluded certain companies as follows: First, we excluded companies not rated by Fitch, Moody's, S&P or Swedbank. Credit ratings are typically not available for smaller companies and companies without debt. Second, we excluded companies not appropriate to use on the Skogsvik and Ohlson models, such as financial institutions, investment companies and real estate companies. Third, as that did not report any goodwill on their consolidated balance sheets. Fourth, we excluded companies that have previously reported according to a different accounting standard than Swedish GAAP prior to transitioning to IFRS, underwent a significant change in operations or were introduced to the Swedish stock exchange after 2005.

The bias created from restricting our sample to companies rated by credit institutions should be commented upon. These companies often share certain firm characteristics not shared by all companies, such as being larger public companies with significant debt. This could limit the extent to which we can draw general conclusions from our study. We should also take

caution when drawing conclusions in a context outside of Sweden, as our sample is restricted to only include companies listed on the Swedish stock exchange.

4.2 Transformation of credit ratings

A majority of the ratings used as a proxy for bankruptcy risk have been issued by Standard & Poor's, while the other ratings are from Swedbank (who uses the same scale as S&P). As Fitch and Moody's have rated no companies not covered by S&P ratings, their ratings were not used in this study. In the case Swedbank and S&P have assigned companies with different ratings, the ratings from S&P were used.

As ratings may change over time, it is important to choose a rating that is relevant to the point in time when we measure bankruptcy using the Skogsvik and Ohlson models. To estimate the risk of bankruptcy for 2012, we use accounting ratios from the annual reports of the fiscal year of 2011. We therefore use the latest rating available for the fiscal year end 2012 and the two following months. For instance, if a company's fiscal year is equivalent to the calendar year, we use the latest rating in the period 2011-31-12 to 2012-29-02. This approach gives room for "sticky" ratings to adapt as new information regarding the companies' performance in the last quarterly report of 2011, while the first quarterly report of the 2012 fiscal year is yet not released. However, no ratings changed in this two-month span for our sample, illustrating the long-term nature of credit ratings. We then proceeded to transform these ratings into probabilities of default using information provided by S&P on the historical rates of default for European companies in specific rating categories (Standard and Poor's 2012a).

We compare the estimates of bankruptcy from the prediction models based on accounting ratios with the rating-based default risk. Essentially, we are evaluating the validity of estimates (Skogsvik and Ohlson bankruptcy estimates) by comparing them with *other* estimates (credit rating default estimates). Some concerns with using credit ratings as a proxy for bankruptcy risk are addressed below.

There is a definition difference between default rates and bankruptcy rates, with the former being defined as the failure to pay interest or principal when due and the latter being defined as a legal proceeding involving a business that is unable to pay outstanding debts. Default and bankruptcy should however, be expected to be related in a consistent fashion as bankruptcy often follows a series of defaults.

Estimates from credit ratings are expressions of relative credit risk and do not express precisely expected bankruptcy rates as the Skogsvik and Ohlson estimates. The transformation of credit ratings to risk of "bankruptcy" is based on historical default rates of European rated firms. Hence, whether these are relevant in the 2012 economic environment can be questioned.

It could be assumed that there might be a difference in method for how different credit rating institutions determine companies' default risk. As we use credit ratings from both S&P and Swedbank this might be of concern, however when comparing credit ratings for the companies in our sample we see only small differences. This is in line with previous research indicating that the predictive ability of credit ratings does not differ markedly between rating institutions (Purda 2011).

The long-term stability of credit ratings, where new significant information is shown through up- and downgrades, means these can be temporarily off when comparing to the short-term performance of companies. We address the issue of credit ratings potentially being off in the short-term by checking the robustness of our results using financial information for the fiscal year 2010 instead of 2011 and comparing with credit rating estimates (Please refer to 6.1 Robustness checks).

4.3 Creation of fictional goodwill dataset

We create a fictional data set termed the *Swedish GAAP setting*, simulating how post-IFRS financial statements would have appeared if goodwill were still linearly amortized in line with Swedish GAAP. By creating a fictional dataset, we isolate the effect on goodwill reporting from other changes in the transition to IFRS reporting. Ideally, we would like to have information regarding the acquisition values and age of all goodwill elements available when creating the fictional financial statements. However, different levels of detailed data among companies, motivates a more general method for consistency in the creation of the Swedish GAAP setting between different companies. We are therefore required to make certain assumptions in creating the Swedish GAAP setting.

Conceptually, starting from 2005 (the year of transition to IFRS), the Swedish GAAP setting is created by adding back impairments of goodwill under IFRS reporting, replacing them by amortizations based on assumptions in our model.

First, goodwill present in the closing balance of 2004 is amortized in the same pace as prior to IFRS individually for each company. However, as some parts of this "pre-IFRS goodwill" will eventually become fully amortized, this must be taken into account in our model. Therefore, we progressively decrease the amount of "pre-IFRS" goodwill being amortized each year. Assuming goodwill is on average amortized over 20 years, uniformly distributed in terms of age and amount, this corresponds to the level of amortization of "pre-IFRS" goodwill decreasing with 1/20 every year. For instance, if the simulated level of "pre-IFRS goodwill" amortization is *A* in 2005, it will be 19/20**A* in 2006 and 18/20**A* in 2007 etc.

Furthermore, as companies acquire and divest goodwill, we have to take this into account as well. Goodwill capitalized post-2005 is amortized with 1/20 of its acquisition value every year. In case a company divests goodwill, this is either identified to a specific age and amount and lowered accordingly, or will otherwise be assumed to be goodwill acquired prior to 2005.

In conclusion, the estimated amount of simulated goodwill amortizations is the sum of "pre-IFRS" goodwill amortizations and the amortizations of post-2005 acquired goodwill, adjusted for divestments. After we simulate the goodwill amortizations, we construct fictional income statements and balance sheets in the period 2005 to 2011, simulating a setting where goodwill is amortized as under Swedish GAAP prior to IFRS. As goodwill does not have any tax-effect, we do not adjust the tax expense in the income statement. Goodwill impairment/amortization is the only factor we change.

4.4 Statistical tests

The statistical tests used in investigating our two sub-hypotheses H_A and H_B are described below in 4.4.1 and 4.4.2 respectively. H_A is investigated through two parametrical approaches and one non-parametrical one; H_B is examined using one parametrical and two non-parametrical tests.

As both hypotheses are examined with several tests, we use the following decision rule to establish a rule of thumb of whether to reject the null-hypotheses: if more than two thirds (67 %) of the respective tests for each of the two models suggest a rejection at the conventional 5 % significance level, we accept the current alternative hypothesis.

4.4.1 H_A

To examine our first sub-hypothesis, we perform three series of statistical tests: an Ordinary Least Square regression (OLS), a paired t-test and a Wilcoxon signed rank test.

First, the bankruptcy estimates from the IFRS accounting figures are denoted as PB_{IFRS} while estimates in the Swedish GAAP setting are denoted as $PB_{SWEGAAP}$. When performing the OLS regression, we set $PB_{SWEGAAP}$ as the dependent variable while PB_{IFRS} is set as the independent variable [5]. By investigating the estimated coefficients and their level of significance, we are then able to spot general effects in the level of estimated risk of bankruptcy depending on the accounting for goodwill. In addition, we perform an F-test shown in [6], jointly testing whether the slope is equal to one and the intercept is equal to zero: H_0: $\beta_0 = 0$, $\beta_1 = 1$, H_1: $\beta_0 \neq 0$ and/or $\beta_1 \neq 1$. If the change in account setting does not affect bankruptcy prediction estimates, values on both axes will be the same and H_0 should be accepted.

$$[5] \quad PB_{SWEGAAP,i} = \beta_0 + \beta_1 * PB_{IFRS,i} + \varepsilon_i$$

$$[6] \quad F = \frac{(SSE(r) - SSE)/r}{SSE/(n - K - 1)} \sim F_{r;(n-K-1)}$$

Second, we perform a Student's t-test for matched pairs. The test [7] examines the average difference between corresponding observations, i.e. the average difference of the estimated level of bankruptcy risk depending on the accounting for goodwill. This provides a complementary test to the OLS regression above.

$$[7] \quad t = \frac{(\bar{D} - D_0)/r}{S_D/\sqrt{n}} \sim t_{n-1}$$

The above tests rely for their validity on an assumption that the observations follow a normal distribution. As the sample size in our study is small (23 observations), we cannot use the central limit theorem. Therefore we interpret our results from the above tests with caution. Moreover, estimated parameters may be affected by odd extreme observations, especially as the sample in the study is small. Therefore, we complement our tests with the non-parametric Wilcoxon signed rank test [8]. The Wilcoxon test is not sensitive to extreme

values as the above tests, and only requires 20 or more observations to approximately follow a normal distribution. The Wilcoxon signed rank test examines if the median difference between the matched pairs is zero against a two-sided alternative.

$$[8] \qquad W = \frac{W - \mu_T}{\sigma_T} \sim N(0,1)$$

4.4.2 H_B

First, we perform a non-parametrical test categorizing accounting-based bankruptcy risk estimates into corresponding rating categories. The observations are plotted as Exhibit (2) illustrates. From this table, we make a discretionary classification of whether the bankruptcy estimates are "correct" or "incorrect". Observations located in the green fields are regarded as "correct" estimations of bankruptcy risk; otherwise they are regarded as "incorrect" estimations of risk (ignore yellow fields here). We leave some room for discrepancy between the two parameters. For instance, if the accounting models generates a risk estimate that correspond to the risk in an A rating, this estimation will be regarded as "correct" even if the company has an A+ or A- rating. Moreover, we also conduct the test with a wider classification border, where observations in the yellow fields are classified as "correct" as well (i.e. in the previous example, the bankruptcy estimate using accounting-based prediction models will be regarded as correct if the actual rating is even AA- or BBB+). Misclassification can hence occur in two ways: the accounting model-based risk of bankruptcy may be overstated compared to credit rating-based risk; or the opposite, accounting model-based risk may be understated with regards to credit rating-based risk. The analysis makes no distinctions between the two types of errors.

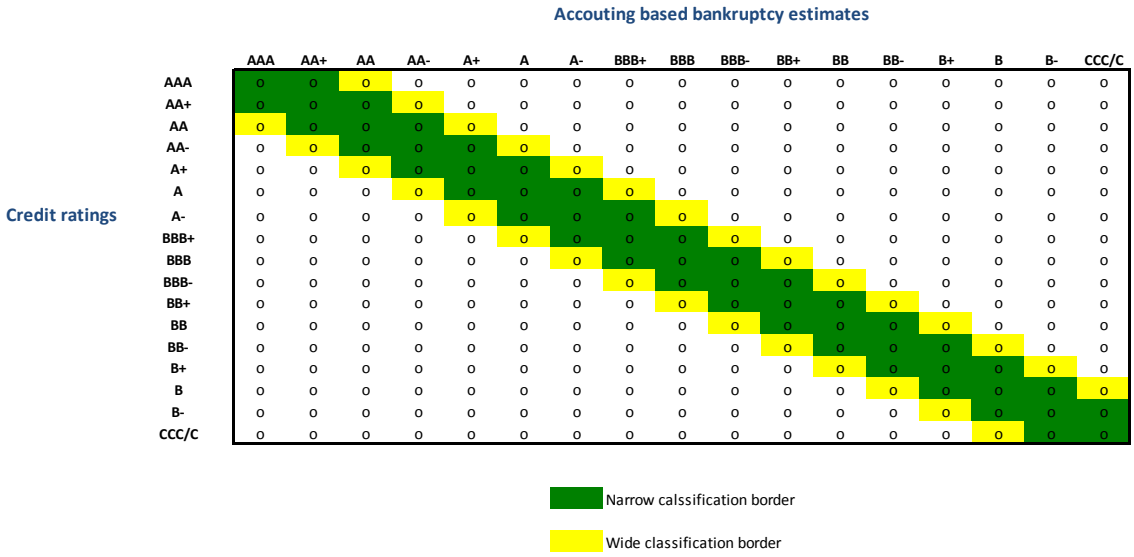

Exhibit (2). Contingency table for classification of bankruptcy estimates as correct or incorrect. The green field indicates the narrow classification border. The yellow field indicates the wider classification border. Note that the accounting based bankruptcy estimates are transposed into "ratings categories" in line with how credit ratings are transposed into percentage probabilities.

The results generated from the above exercise are inserted in the two-by-two contingency table shown in Exhibit (3). For each contingency table (one for the Ohlson model and one for the Skogsvik model) a test statistic "*T*" is computed by the formula in equation [9], following a chi-square distribution with one degree of freedom. This set-up enables us to test H_B directly as it compares the accuracy of the accounting-based model depending on the accounting setting with regards to goodwill. $H_{B,0}$ is rejected if T exceeds the (1-α) quantile of the chi-square distribution. The test is performed in analogy with Elam (1975).

	Correct	Incorrect
Swedish GAAP setting	O_{11}	O_{12}
IFRS setting	O_{21}	O_{22}

Exhibit (3). Two-by-two contingency table used in comparing the accuracy of the Skogsvik and Ohlson model depending on goodwill reporting.

$$[9] \qquad T = \frac{N(O_{11}O_{22} - O_{12}O_{21})^2}{n_1 n_2 (O_{11} + O_{21})(O_{12} + O_{22})} \sim \chi^2_{(r-1)(c-1)}$$

Where: $n_1 = O_{11} + O_{12};\ n_2 = O_{21} + O_{22};\ N = n_1 + n_2$

Second, we create an "accuracy variable" (or "error variable") by calculating the absolute difference between the credit rating-based default risk and the bankruptcy estimates generated from the Ohlson and Skogsvik model. This enables us to run a paired t-test similar to the one in H_A, investigating if the average *absolute* error is greater under the IFRS setting than under the Swedish GAAP setting. Moreover, we also test whether the variance of the error variable is greater in the IFRS setting than in the Swedish GAAP setting. The test for variance is not a direct assessment of H_B, but rather a test to better understand the nature of the data.

Last, we compare the level of correlation between rating and accounting-based bankruptcy predictions. We use the Spearman rank correlation coefficient at it is not sensitive to odd extreme observations. The test is non-parametric, and can be used for general population distributions. It is important to emphasize that this approach enables no direct statistical comparison between the two models. We simply observe the difference in the correlation coefficient depending on the accounting setting.

It would be tempting to perform an OLS regression with the accounting-based bankruptcy estimates as regressors on the rating-based risk of bankruptcy. However, it might not be appropriate to "force" such a linear relationship between the two variables, due to the discrete distribution of the rating-based variable.

5 Results and Analysis

The results from our study are described below, divided into three sections. In 5.1 we comment on the financial statements from the different accounting settings, how the individual parameters in the bankruptcy models have changed and their effect on the estimated risk of bankruptcy. In 5.2 and 5.3 we describe the results with regards to H_A and H_B respectively.

5.1 Descriptive statistics

The accumulated goodwill impairments in the IFRS regime under the period 2005 to 2011 are smaller than the accumulated amortizations in the Swedish GAAP setting for the same period, affecting the respective financial statements used for our analysis. In the balance

sheet, the relative size of goodwill to assets is greater in the IFRS setting. In the income statement, EBIT and net income are greater in the IFRS setting (Table (13) in Appendix shows the results for the individual companies in our sample).

The differences in the sizes of the parameters in the bankruptcy prediction models are investigated below. Table (1) and (2) depict the outcomes from the Skogsvik and Ohlson model depending on accounting setting. The mean difference is tested with a paired t-test, testing the null hypothesis of the measures being unchanged against a two-sided alternative hypothesis. Note that the effects on an aggregate level are not considered in the below discussion, we only consider the effects on the individual parameters. Parameters unaffected by the accounting of goodwill are left out of the discussion (denoted by "–").

Table (1). Average size of Skogsvik model parameters. ΔEstimated risk denotes the transition from Swedish GAAP to IFRS with regards to goodwill accounting. The significance of the mean difference refers to paired t-test statistic.

	Skogsvik model			
Variable	*Swedish GAAP setting*	*IFRS setting*	*Mean difference*	*Δestimated risk*
R_1 (ROA)	0.091	0.095	-0.003	decreases
R_2 (int. rate)	0.022	0.022	-	
R_3 (invert. Inventory turnover)	0.153	0.153	-	
R_4 (equity ratio)	0.340	0.375	-0.035***	decreases
R_5 (Δequity)	0.004	0.029	-0.025***	increases
R_6 (normalized R_2)	-0.542	-0.542	-	

*** p<0.01, ** p<0.05, * p<0.1

In the Skogsvik model, the return on asset variable (R_1) is somewhat higher under IFRS, although not significantly. This vague effect is in line with our discussion about the effect on return on capital-measures in section 2.3 Goodwill and bankruptcy models. The equity ratio (R_4) is significantly higher in the IFRS setting than the corresponding ratio under Swedish GAAP reporting, associated with a lower predicted risk of bankruptcy. The change in equity variable (R_5) is significantly higher under the IFRS reporting standard than under Swedish GAAP. As R_5 has a positive coefficient in Skogsvik's model, this change is associated with an increased risk of bankruptcy. This characteristic may seem counter-intuitive, and is discussed in section 2.2.1 Skogsvik model.

Table (2). Average size of Ohlson model parameters. Δ Estimated risk denotes the transition from Swedish GAAP to IFRS with regards to goodwill accounting. The significance of the mean difference refers to paired t-test statistic.

	Ohlson model			
Variable	*Swedish GAAP setting*	*IFRS setting*	*Mean difference*	*Δestimated risk*
SIZE	17.098	17.152	-0.055***	decreases
TLTA	0.660	0.625	0.035***	decreases
WCTA	0.122	0.122	-	
CLCA	0.770	0.770	-	
OENEG	0.000	0.000	-	
NITA	0.056	0.061	-0.005**	decreases
FUTL	0.123	0.123	-	
INTWO	0.000	0.000	-	
CHIN	0.100	0.016	0.085*	increases

*** p<0.01, ** p<0.05, * p<0.1

In the Ohlson model, the SIZE variable is significantly higher in the IFRS setting than in the Swedish GAAP setting on a 1% level, associated with a lower predicted risk of bankruptcy. The TLTA variable (total liabilities divided by total assets) is lower in the IFRS setting, significant on a 1% level. This is also linked to a lower prediction of bankruptcy in the Ohlson model. Furthermore, the NITA variable (net income to total assets) is significantly higher in the IFRS setting, associated with a lower predicted bankruptcy risk. This result is different from the return on capital measure in the Skogsvik model (ROA), which is not significantly different between the two accounting settings. The CHIN variable (change in net income) is lower in the IFRS setting, associated with a higher estimated risk of bankruptcy, although only on a 10% significance level.

Before assessing the tests relating to H_A and H_B, it should be noted the Ohlson and Skogsvik models behaves differently in terms of the general predictions of bankruptcy (without taking goodwill accounting into consideration). First, the Ohlson model generally generates higher estimates of risk than the Skogsvik. Second, the variability of estimated bankruptcy risk is higher in the Ohlson model than in the Skogsvik model (see table (12) in the appendix).

5.2 H_A

Table (3). Estimated coefficients from OLS regressions on Skogsvik and Ohlson model.

VARIABLES	SKOG_IFRS	*VARIABLES*	OHL_IFRS
SKOG_SWEGAAP	0.443**	OHL_SWEGAAP	0.564***
	(0.196)		(0.179)
Constant	0.000168	Constant	0.000705
	(0.000119)		(0.000421)
Observations	23	*Observations*	23
R-squared	0.533	*R-squared*	0.743
	Robust standard errors in parentheses		
F-statistic	26.042***		22.795***

*** p<0.01, ** p<0.05, * p<0.1

When regressing the estimated bankruptcy risk generated from IFRS setting on the ones the Swedish GAAP setting, $\hat{\beta}_1$ is smaller than 1 in both the Skogsvik and Ohlson model. The slope coefficients are significant on the 5 % and 1 % levels respectively.[6] The estimated coefficients are shown in Table (3). Furthermore, the null-hypothesis of the F-test jointly testing whether $\beta_0 = 0$ and $\beta_1 = 1$ is rejected at the 1 % significance level for both models.

Table (4). Mean estimated bankruptcy risk depending on input data for Skogsvik and Ohlson model; results from paired t-test, significance sign relates to double-sided test.

Variable	*Mean*	*Variable*	*Mean*
SKOG_SWEGAAP	0.000852	OHL_SWEGAAP	0.003472
SKOG_IFRS	0.000545	OHL_IFRS	0.002664
Difference	0.000306	Difference	0.000808
t-statistic	2.307**	*t-statistic*	1.880*

*** p<0.01, ** p<0.05, * p<0.1

The paired t-tests examining the differences between the bankruptcy prediction estimates indicate the same trend as the two OLS regressions as shown in Table (4). In the Skogsvik model, the average estimated risk of bankruptcy is more than 50 % higher in the Swedish GAAP setting than in the IFRS setting; the difference is significant on the 5 % level. The corresponding change is more modest in the Ohlson model, where the average risk of bankruptcy is 30 % higher in the Swedish GAAP setting; however, the difference is not significant on a 5 % level.

[6] The regressions were performed with robust standard errors to correct for heteroskedasticity as this arrangement did have a marked effect on the estimated standard errors.

Table (5). Chi-square statistics for Wilcoxon signed rank test.

Model	*chi-square*
SKOG	4.045***
OHL	3.680***

*** p<0.01, ** p<0.05, * p<0.1

The Wilcoxon signed rank tests supports a rejection of the null hypothesis that the median difference between the matched pairs is equal to zero. The null-hypothesis is rejected at a 1 % significance level for both models as shown in Table (5).

Table (6). Summary of tests related to H_A.

		Test of $H_{A,0}$	
Test		*Skogsvik*	*Ohlson*
OLS regression	- t-test	reject**	reject***
	- F-test	reject***	reject***
Paired t-test		reject**	accept
Wilcoxon signed rank test		reject***	reject***
Summary		*reject*	*reject*

*** p<0.01, ** p<0.05

In summary, the tests support a rejection of $H_{A,0}$ both for the Skogsvik and Ohlson model. The tests consistently indicate that the estimations of risk are higher in the Swedish GAAP setting than the IFRS setting.

5.3 H_B

Table (7). Frequencies in two-by-two contingency table with corresponding T-value for Skogsvik and Ohlson model using narrow classification scheme.

	Correct	*Incorrect*		*Correct*	*Incorrect*
SKOG_SWEGAAP	9	14	*OHL_SWEGAAP*	8	15
SKOG_IFRS	7	16	*OHL_IFRS*	10	13
T-statistic	0,383		*T-statistic*	0,365	

*** p<0.01, ** p<0.05, * p<0.1

Neither of the chi-square statistics from two-by-two contingency table supports a rejection of $H_{B,0}$ as shown in Table (7). The results suggest no significance dependence between correct/incorrect estimation and whether goodwill is amortized or only tested for impairment. For both models, estimates are more frequently "incorrect" than "correct" when categorizing observations in accordance with the main narrow classification border. When classifying the accounting based bankruptcy prediction in accordance with the wide classification border more observations are classified as correct. The frequencies of incorrect and correct estimates are however unchanged for both models when comparing the IFRS setting to the Swedish GAAP setting.

Table (8). Mean absolute error depending on input data for Skogsvik and Ohlson model; results from paired t-test, significance sign relates to one-sided test.

Variable	*Mean absolute error*	*Variable*	*Mean absolute error*
SKOG_SWEGAAP	0.0021398	OHL_SWEGAAP	0.0023726
SKOG_IFRS	0.0021542	OHL_IFRS	0.0017599
Difference	-0.0000144	Difference	0.0006127
t-statistic	-0.100	*t-statistic*	1.395

*** p<0.01, ** p<0.05, * p<0.1

Table (8) shows the t-tests comparing the mean absolute estimation error between rating and accounting-based bankruptcy estimates. They indicate no significant decreases in predictive ability compared to credit rating estimates following the transition from Swedish GAAP to IFRS with regards to goodwill accounting: the null hypothesis cannot be rejected for any of the two models. The F-test investigating the variances of the error variable does not suggest that the variance is greater in the IFRS setting than in the Swedish GAAP setting.

Table (9). Spearman's correlation coefficient between rating and accounting-based bankruptcy prediction

Model	*input data*	*Rating-based bankruptcy risk*	*Model*	*input data*	*Rating-based bankruptcy risk*
SKOG	SWEGAAP	0.3340	OHL	SWEGAAP	0.1650
	IFRS	0.2842		IFRS	0.2375

*** p<0.01, ** p<0.05, * p<0.1

Spearman's rho between rating and accounting-based bankruptcy estimates is 0.28 for the Skogsvik model with IFRS figures and 0.33 with the Swedish GAAP ones as shown in Table (8). For the Ohlson model, it is 0.24 and 0.17 respectively. None of the correlations are significant and are throughout low.

Table (10). Summary of tests related to H_B.

	Test of $H_{B,0}$	
Test	*Skogsvik*	*Ohlson*
Paired t-test	accept	accept
Contingency table	accept	accept
Spearman correlation	accept	accept
Summary	*accept*	*accept*

*** p<0.01, ** p<0.05

In summary we accept the null-hypothesis under H_B that the change in accounting standard does not affect the ability of accounting-based models to predict bankruptcy.

6 Discussion

When analyzing the results generated in the study, some points which could potentially affect the conclusions drawn from the study should be commented upon.

The sample in the study is homogenous in terms of credit ratings with companies mostly having high ratings. The bankruptcy models as expected also provide corresponding low risks of default. Although the *relative* estimates of risk are substantially higher in the Swedish GAAP setting than in the IFRS setting, the *absolute* difference is small due to the seemingly low risk of bankruptcy in our sample companies. It would be valuable to conduct the study on a sample containing more companies where the estimated risk of bankruptcy is higher such as Consilium in our sample, to investigate the impact of goodwill accounting and bankruptcy prediction under such circumstances.

Relating to the method, we investigate the subject of goodwill accounting and bankruptcy prediction by comparing actual accounting figures (IFRS setting) with simulated ones (Swedish GAAP setting). This implies that the relevance of our results relies on the plausibility of the assumptions made when creating the accounting figures simulating goodwill amortizations. As the accounting ratios in the Swedish GAAP setting have behaved as expected when compared with those in the IFRS setting and coincided with what could be expected based on theory and empirical studies as described in chapter 2 Theory and previous research, we believe that the simulation has been plausible.

Stating the assumptions clearly behind the simulation of Swedish GAAP and how credit ratings have been transposed means that others should be able to replicate our study.

Regarding the statistical tests to investigate our hypotheses, we use both parametrical and non-parametrical tests. It is important to emphasize their different characteristics, especially as they examine the same problems. On one hand the parametrical tests should be interpreted with caution as we have not been able to determine if they follow a normal distribution after performing tests for skewness and kurtosis as well as looking at histograms to judge how the data is distributed.

The results for H_B, illustrate that we have difficulties establishing a general relation between the bankruptcy risk implied from credit ratings and the estimates from the Skogsvik and Ohlson models. Given the marked changes in H_A, one would expect to identify a difference in the accuracy obtained from bankruptcy estimates based on the Swedish GAAP setting and

IFRS setting accounting figures. We have not been able to establish why we fail to find a general relation. We reason that it is related to using credit ratings, as these are stable due to their long-term evaluation horizon, it might be difficult to establish a relation between very small estimates of default. A larger sample might have accommodated this, making general trends more observable in H_B. Using the same method as the one developed in this study could then be applied to larger geographies, which have undergone the same change from amortization to impairment e.g. the US.

Two possible alternatives to using credit ratings as a proxy of bankruptcy risk are the risks implied from credit default swaps and bond pricing, which could generate new understandings of goodwill in the context of bankruptcy prediction. The volatile nature and the risk of distortion from these products being traded daily might on the other hand present other problems such as obtaining reliable mean values over time for bankruptcy risk.

6.1 Robustness checks

To check the robustness of our results, we have re-run our tests making certain alterations to our either assumptions or made certain other changes.

We started by excluding two observations identified as outliers. First, Consilium was excluded due to its low credit rating. Compared to the rest of the sample it also stood out as the only small-cap company. Second, Securitas was omitted because of its high amount of goodwill and low equity ratio, characteristics giving a large difference between its IFRS and Swedish GAAP financial statements. $H_{A,0}$ was still rejected as all tests indicated the same results as our main tests at the same significance level or higher (although $\hat{\beta}_1$ was markedly higher in the OLS regression, triggered by the removal of Securitas). We were still not able to reject H_B, the two-by-two contingency table test and Spearman rank coefficient generated no conclusions conflicting with those in the main results. However, the results from the paired t-test conflicted with those in the main test with regards to the Skogsvik model. The paired t-test of the absolute value of the error variable suggested a rejection of the null-hypothesis on a 1 % significance level for the Skogsvik level; the implications from this test were unchanged for the Ohlson model. We do not put any real significance to this partial result, but conclude that the paired t-test of the absolute value of the error in itself might be sensitive to how the data looks.

To check the robustness with regards to the choice of a priori risk of bankruptcy in the prediction models, we re-ran our statistical tests with the a priori risk adjusted upwards and

downwards 0.5 percentage points (from 1.5% to 2.0% and 1.0% respectively). Overall, the results were unaffected; the same hypotheses were rejected and accepted at the same significance levels. As the a priori adjustment affects the aggregate bankruptcy upwards and downwards, this could indicate that the reason we do not find significance in H_B is not due to consistently over- or underestimating the risk of bankruptcy in our prediction models when compared to credit rating estimates. This check is especially relevant for the Skogsvik model, which consistently generate bankruptcy estimates that are lower than the rating-based risk of bankruptcy both in the IFRS and Swedish GAAP setting.

To further investigate the robustness of our results, the performed the statistical tests using two-year estimates of bankruptcy as well. This means we used the two-year specifications of the bankruptcy models and transformed credit ratings using two-year historical default rates. The tests of the two hypotheses on aggregate generated the same results when using two-year estimates. Differences pertained to: $H_{A,}$ where we rejected the null-hypothesis at higher significance levels for the paired t-test, while in H_B, the spearman correlation coefficient was now significant in both the IFRS and Swedish GAAP setting for the Ohlson model[7]. We are thus not able to draw any different conclusion, we still saw that $H_{A,0}$ was rejected, while $H_{B,0}$ was not.

To assess the problem of ratings being stable over time, as well as the infrequent nature of goodwill impairments, we also perform our statistical tests based on data from 2010. The results indicated no significant sensitivity with regards to the timing of the test. In line with our main results, $H_{A,0}$ was rejected as the predicted risk of bankruptcy in the Swedish GAAP setting was higher than in the IFRS setting, while $H_{B,0}$ could not be rejected.

The robustness checks show that there seems to be a high degree of reliability in our study, while the reasoning above cautions the extent to which we are able to draw general conclusions from our study.

[7] The significance level of the correlation coefficient in the Swedish GAAP setting was adjacent to a five per cent significance level at 5.2 %.

7 Conclusions

The purpose of this study was to investigate whether the new impairment approach for goodwill under IFRS has affected the predictive ability of bankruptcy models based on accounting ratios.

We show there has been a significant change in the level of estimates of bankruptcy risk following the transition from goodwill amortization to an impairment-only approach. Due to lower write-offs in the IFRS regime than in our simulated Swedish GAAP setting, companies show higher earnings and stronger balance sheets. This generates lower estimates of bankruptcy from the two models investigated.

The study also investigated whether the predictive ability of accounting-based bankruptcy prediction models have been impaired following this transition. The study could not find any evidence of a significant change in the ability to predict risk when comparing to market estimates of default from credit ratings. Future studies could investigate this issue further.

We believe our results are useful for practitioners who frequently incorporate percentage estimates of risk into their models. As we show in this study, these estimates can differ markedly on a percentage basis depending on individual accounting rules. This cautions the blind use of models, which might have come obsolete following potentially impactful accounting changes.

Future research could investigate to which degree the findings in this study affects economic decision making for market participants. We believe it would also be of interest to look into how models can be made more robust with regards to how goodwill is accounted for and develop new models explicitly taking this into account.

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Appendix

Table (11). List of companies excluded to meet criteria in study

Total	252
No credit rating available	-198
Financial/Investment/REIT	-18
Non-Swedish GAAP before IFR	-9
Other problem	-4
Sample	**23**

Table (12). Sample list; credit ratings and bankruptcy estimates from ratings, Skogsvik model and Ohlson model.

			Skogsvik model		*Ohlson model*	
Company	***Credit rating***	***Rating implied risk***	***IFRS setting***	***SWEGAAP setting***	***IFRS setting***	***SWEGAAP setting***
Alfa Laval	BBB+	0.0897%	0.0082%	0.0138%	0.1106%	0.1388%
Assa Abloy	A-	0.0653%	0.0178%	0.0726%	0.1558%	0.3203%
Atlas Copco	A	0.0500%	0.0041%	0.0050%	0.0738%	0.0793%
Boliden	BB+	0.3605%	0.0013%	0.0016%	0.0643%	0.0700%
Consilium	B+	1.8997%	0.1002%	0.1156%	1.0372%	1.0979%
Electrolux	BBB+	0.0897%	0.0702%	0.0783%	0.4322%	0.4658%
Ericsson	BBB+	0.0897%	0.0019%	0.0025%	0.0304%	0.0333%
Getinge	BBB-	0.2615%	0.0434%	0.0934%	0.2109%	0.3028%
Hexagon	BB+	0.3605%	0.0062%	0.0179%	0.1019%	0.1174%
Husqvarna	BBB-	0.2615%	0.0581%	0.0876%	0.1677%	0.1976%
Meda	BBB-	0.2615%	0.0537%	0.1343%	0.2358%	0.3703%
NCC	BBB-	0.2615%	0.1722%	0.1996%	0.5620%	0.6065%
PEAB	BB	0.6400%	0.1776%	0.2044%	0.6276%	0.6806%
Sandvik	BBB+	0.0897%	0.1284%	0.1345%	0.1507%	0.1520%
SCA	BBB+	0.0897%	0.0165%	0.0125%	0.1582%	0.1063%
Scania	A-	0.0653%	0.0213%	0.0233%	0.1826%	0.1902%
Securitas	BBB+	0.0897%	0.0874%	0.3947%	0.6516%	1.6532%
SKANSKA	BBB+	0.0897%	0.0538%	0.0813%	0.3688%	0.4553%
SSAB	BB+	0.3605%	0.0139%	0.0302%	0.0752%	0.0726%
Stena AB	BB+	0.3605%	0.1339%	0.1380%	0.2982%	0.3031%
Tele2	BBB+	0.0897%	0.0029%	0.0088%	0.0702%	0.1212%
Trelleborg	BBB	0.1200%	0.0048%	0.0137%	0.1382%	0.2065%
Volvo	BBB	0.1200%	0.0763%	0.0950%	0.2228%	0.2454%

Table (13). Descriptive statistics of goodwill characteristics in IFRS setting from 2011 annual reports.

	IFRS setting				
	GW/Tot. Assets	***GW/Equity***	***GW impairment/Sales***	***GW impairment/EBIT***	***GW impairment/Net Income***
Company					
AlfaLaval	27.7%	63.0%	0.0%	0.0%	0.0%
AssaAbloy	48.8%	113.8%	0.0%	0.0%	0.1%
AtlasCopcc	13.3%	34.5%	0.1%	0.4%	0.5%
Boliden	8.2%	15.4%	0.0%	0.0%	0.0%
Consilium	4.8%	13.3%	0.0%	0.0%	0.0%
Electrolux	7.9%	29.1%	0.0%	0.0%	0.0%
Ericsson	9.8%	18.9%	0.0%	0.1%	0.1%
Getinge	40.5%	114.8%	0.1%	0.6%	0.9%
Hexagon	49.5%	104.7%	0.0%	0.0%	0.0%
Husqvarna	20.5%	49.5%	0.0%	0.0%	0.0%
Meda	37.1%	95.9%	0.0%	0.0%	0.0%
NCC	4.9%	19.4%	0.1%	1.6%	2.4%
PEAB	5.7%	22.4%	0.0%	1.4%	2.2%
Sandvik	9.1%	26.7%	1.3%	12.2%	21.2%
SCA	6.8%	15.4%	4.6%	138.4%	495.5%
Scania	1.0%	3.3%	0.0%	0.0%	0.0%
Securitas	40.2%	160.0%	0.0%	0.0%	0.0%
SKANSKA	6.1%	25.6%	0.0%	0.4%	0.4%
SSAB	29.8%	61.5%	0.0%	0.3%	0.5%
Stena	1.5%	4.9%	0.0%	0.0%	0.0%
Tele2	22.6%	49.0%	0.0%	0.0%	0.0%
Trelleborg	34.4%	73.1%	0.0%	0.0%	0.0%
Volvo	6.8%	27.9%	0.0%	0.0%	0.0%
Average	19%	50%	0%	7%	23%

Table (14). Descriptive statistics of goodwill characteristics in Swedish GAAP setting in fictional 2011 annual reports.

	Swedish GAAP setting				
	GW/Tot. Assets	***GW/Equity***	***GW amortization/Sales***	***GW amortization/EBIT***	***GW amortization/Net Income***
Company					
AlfaLaval	23.8%	58.2%	1.5%	10.4%	15.8%
AssaAbloy	40.4%	120.6%	3.2%	34.4%	62.5%
AtlasCopcc	11.7%	31.4%	0.6%	3.0%	4.1%
Boliden	5.7%	11.0%	0.3%	2.8%	3.9%
Consilium	3.2%	9.2%	0.2%	4.1%	8.4%
Electrolux	7.1%	26.9%	0.3%	10.2%	15.7%
Ericsson	7.0%	13.9%	0.7%	9.1%	13.4%
Getinge	36.0%	118.5%	3.7%	25.9%	46.3%
Hexagon	44.3%	105.8%	6.3%	45.9%	83.8%
Husqvarna	17.0%	43.8%	1.0%	22.8%	41.4%
Meda	30.6%	94.6%	5.7%	38.3%	83.7%
NCC	3.2%	13.4%	0.1%	4.0%	6.2%
PEAB	4.3%	17.6%	0.2%	7.3%	12.1%
Sandvik	7.2%	21.9%	0.5%	4.3%	7.1%
SCA	4.9%	11.3%	0.4%	5.9%	8.7%
Scania	0.1%	0.5%	0.1%	1.0%	1.3%
Securitas	29.5%	250.9%	1.1%	32.4%	71.9%
SKANSKA	1.9%	9.5%	0.4%	5.9%	6.5%
SSAB	23.9%	54.1%	2.2%	63.1%	164.4%
Stena	1.2%	4.0%	0.3%	1.8%	3.3%
Tele2	11.1%	29.1%	1.8%	11.6%	17.3%
Trelleborg	26.9%	65.6%	1.6%	24.1%	42.6%
Volvo	4.8%	21.2%	0.4%	5.2%	7.9%
Average	15%	49%	1%	16%	32%

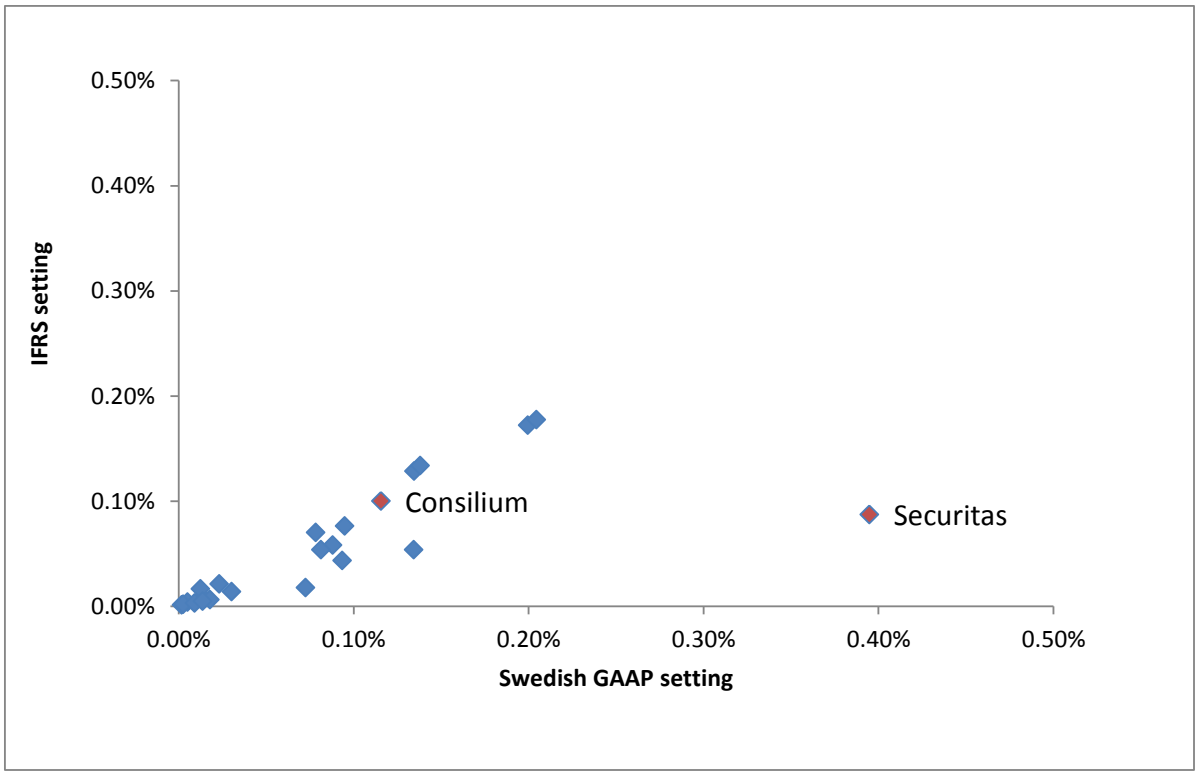

Exhibit 4 Scatter plot of estimated one-year bankruptcy risk in IFRS setting and Swedish GAAP setting with the Skogsvik model

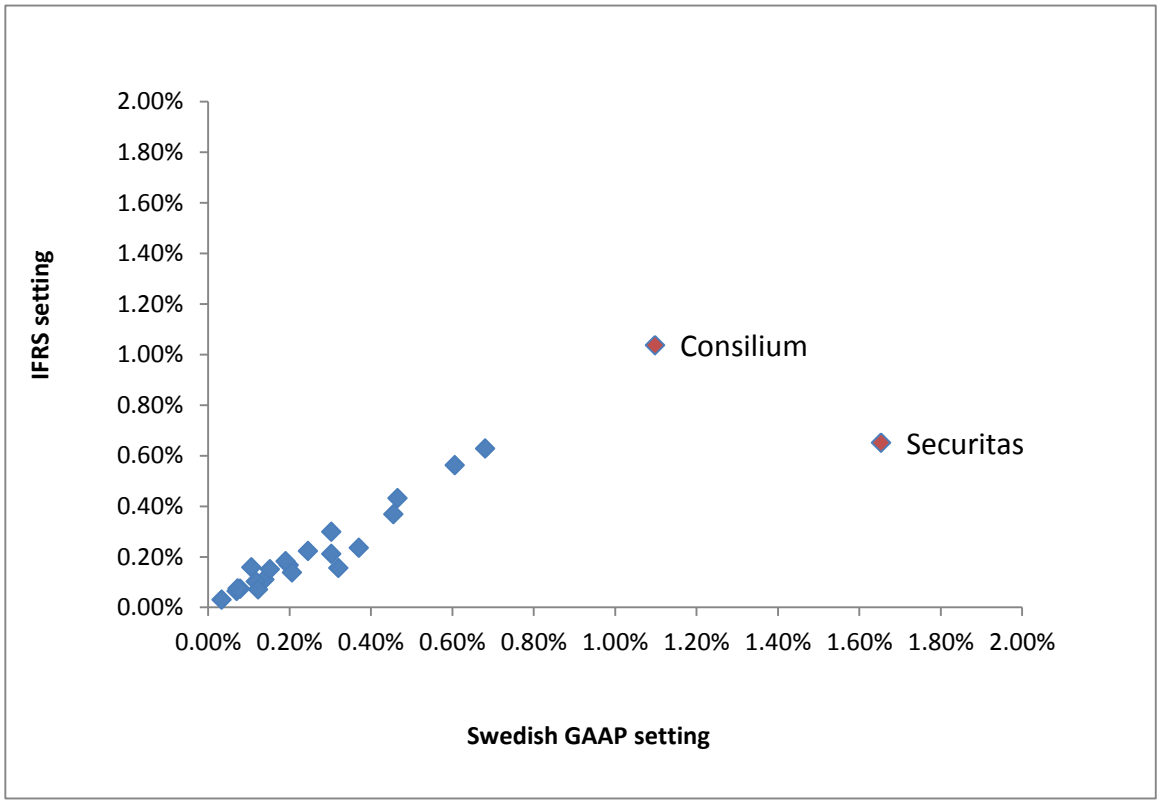

Exhibit 5 Scatter plot of estimated one-year bankruptcy risk in IFRS setting and Swedish GAAP setting with the Ohlson model

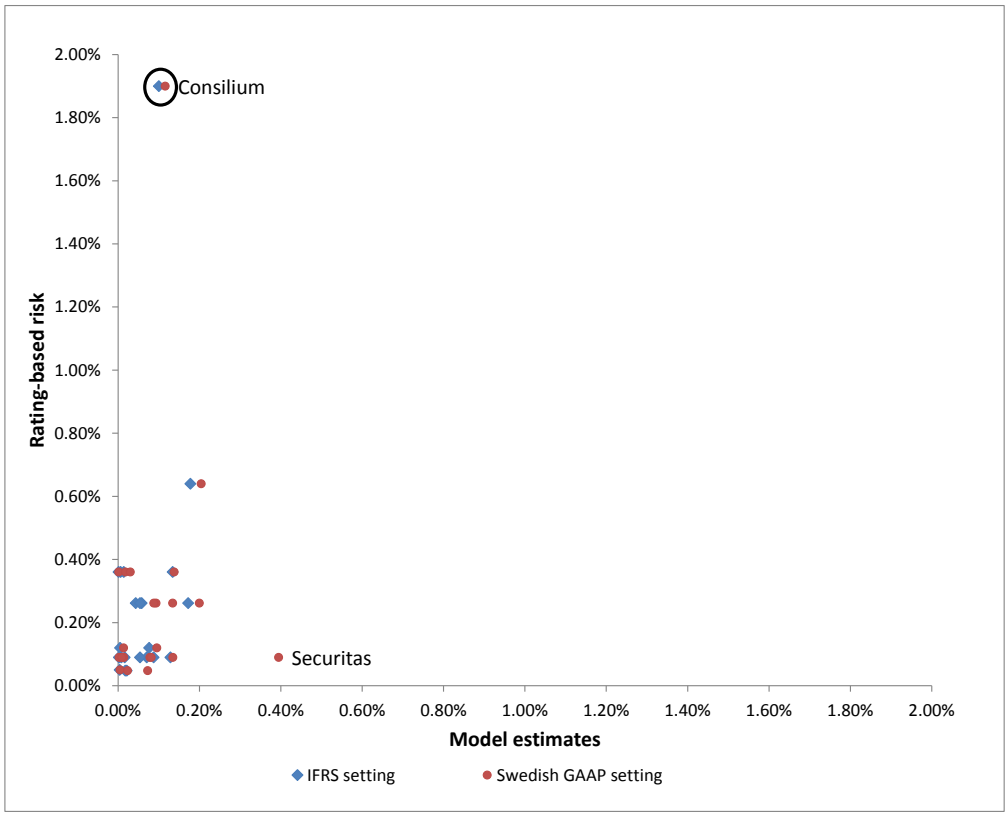

Exhibit 6 Scatter plot of one-year estimated risk of bankruptcy from ratings and the Skogsvik model. Note that observation on y-axis follow a discrete distribution.

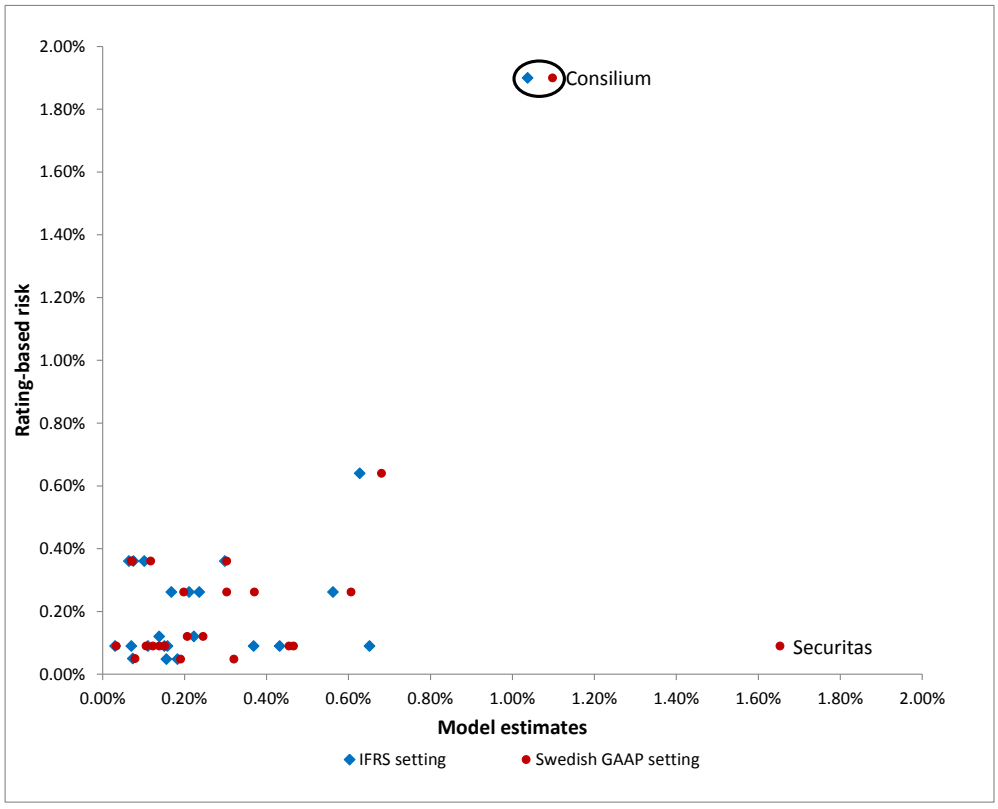

Exhibit 7 Scatter plot of one-year estimated risk of bankruptcy from ratings and the Ohlson model. Note that observation on y-axis follow a discrete distribution.

Table (15) Frequencies in two-by-two contingency table with corresponding T-value for Skogsvik and Ohlson model using wide classification scheme.

	Correct	*Incorrect*		*Correct*	*Incorrect*
SKOG_SWEGAAP	13	10	*OHL_SWEGAAP*	16	7
SKOG_IFRS	13	10	*OHL_IFRS*	16	7
T-statistic	0		*T-statistic*	0	

*** p<0.01, ** p<0.05, * p<0.1

Table (16) Summary of hypothesis testing excluding outliers (Consilium and Securitas). In H_A, the OLS regression and paired t-test indicated that the estimates of risk were higher in the Swedish GAAP setting than in the IFRS setting (consistent with main results).

		Test of $H_{A,0}$			Test of $H_{B,0}$	
Test		*Skogsvik*	*Ohlson*	*Test*	*Skogsvik*	*Ohlson*
OLS regression	- t-test of β_1-hat	reject***	reject***	*Paired t-test*	reject***	accept
	- F-test	reject***	reject***	*Contingency table*	accept	accept
Paired t-test		reject***	reject***	*Spearman correlation*	accept	accept
Wilcoxon signed rank test		reject***	reject***	*Summary*	*accept*	*accept*
Summary		*reject*	*reject*			

*** p<0.01, ** p<0.05

Table (17) Summary of hypothesis testing with a priori risk of bankruptcy equal to 2.0% (+ 0.5 p.p.t.) .In H_A, the OLS regression and paired t-test indicated that the estimates of risk were higher in the Swedish GAAP setting than in the IFRS setting (consistent with main results).

		Test of $H_{A,0}$			Test of $H_{B,0}$	
Test		*Skogsvik*	*Ohlson*	*Test*	*Skogsvik*	*Ohlson*
OLS regression	- t-test of β_1-hat	reject***	reject***	*Paired t-test*	accept	accept
	- F-test	reject***	reject***	*Contingency table*	accept	accept
Paired t-test		reject**	accept	*Spearman correlation*	accept	accept
Wilcoxon signed rank test		reject***	reject***	*Summary*	*accept*	*accept*
Summary		*reject*	*reject*			

*** p<0.01, ** p<0.05

Table (18) Hypothesis testing with a priori risk of bankruptcy equal to 1.0% (- 0.5 p.p.t.). In H_A, the OLS regression and paired t-test indicated that the estimates of risk were higher in the Swedish GAAP setting than in the IFRS setting (consistent with main results).

		Test of $H_{A,0}$			Test of $H_{B,0}$	
Test		*Skogsvik*	*Ohlson*	*Test*	*Skogsvik*	*Ohlson*
OLS regression	- t-test of β_1-hat	reject***	reject***	*Paired t-test*	accept	accept
	- F-test	reject***	reject***	*Contingency table*	accept	accept
Paired t-test		reject**	accept	*Spearman correlation*	accept	accept
Wilcoxon signed rank test		reject***	reject***	*Summary*	*accept*	*accept*
Summary		*reject*	*reject*			

*** p<0.01, ** p<0.05

Table (19) Hypothesis testing with 2-year risks of bankruptcy. In H_A, the OLS regression and paired t-test indicated that the estimates of risk were higher in the Swedish GAAP setting than in the IFRS setting (consistent with main results).

		Test of $H_{A,0}$			Test of $H_{B,0}$	
Test		*Skogsvik*	*Ohlson*	*Test*	*Skogsvik*	*Ohlson*
OLS regression	- t-test of β_1-hat	reject***	reject***	*Paired t-test*	accept	accept
	- F-test	reject***	reject***	*Contingency table*	accept	accept
Paired t-test		reject***	reject**	*Spearman correlation*	accept	accept
Wilcoxon signed rank test		reject***	reject***	*Summary*	*accept*	*accept*
Summary		*reject*	*reject*			

*** p<0.01, ** p<0.05

Table (20) Hypothesis testing with 2010 figures instead of 2011. In H_A, the OLS regression and paired t-test indicated that the estimates of risk were higher in the Swedish GAAP setting than in the IFRS setting (consistent with main results).

		Test of $H_{A,0}$			Test of $H_{B,0}$	
Test		*Skogsvik*	*Ohlson*	*Test*	*Skogsvik*	*Ohlson*
OLS regression	- t-test of β_1-hat	reject**	reject***	*Paired t-test*	accept	accept
	- F-test	reject***	reject***	*Contingency table*	accept	accept
Paired t-test		reject**	reject**	*Spearman correlation*	accept	accept
Wilcoxon signed rank test		reject**	reject**	*Summary*	*accept*	*accept*
Summary		*reject*	*reject*			

*** p<0.01, ** p<0.05