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Disclosure level and information asymmetry in the Swedish setting

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Abstract

The purpose of this paper is to examine the association between the level of voluntary disclosure in the annual report and information asymmetry in Sweden, hypothesising a negative association between the two. The study is performed on data from 22 Swedish companies listed on Nasdaq OMX Stockholm Stock Exchange in the time period 2001-2004. Each firms' annual report for the individual years have been rated with a disclosure index, consisting of 62 voluntary factors of disclosure. The disclosure score acts as a proxy for the level of voluntary disclosure. As a measure for information asymmetry, the median relative daily bid-ask spread calculated for the week, month, quarter and a full year after publication of the annual report is used. This is done to be able to analyse the effect of a change in disclosure over different time periods. The empirical study finds a statistical significant negative association between the level of voluntary disclosure and information asymmetry, confirming our hypothesis.

Keywords: Disclosure, Information Asymmetry, Sweden

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1. Introduction

There is currently an intense debate in Sweden regarding disclosure, both what the companies should disclose and how often reporting should be performed. Mandatory use of IAS/IFRS since 2005 and demands for quarterly reporting from the Nasdaq OMX Stockholm stock exchange set the stage that the companies have to live and act on. Although, are higher reporting requirements beneficial or do they do more harm than good?

This study aims to closer examine the level of voluntary disclosure prior to the implementation of IAS/IFRS in Sweden and the association with information asymmetry. Our aim is to examine whether an increase in voluntary disclosure reduces information asymmetry in Sweden as theory suggests. Previous studies are mainly on US data examining the effect on a yearly basis. Our contribution to literature is that we perform the study on Swedish data and especially that we examine the relation over different time periods to observe the time effect which has not, to our knowledge, been done before.

Our study is inspired by the work by Petersen and Plenborg (2006) performed on Danish data and we use their constructed disclosure index because of the similarities in the institutional and regulatory setting between Denmark and Sweden. The characteristics of the Swedish and Danish institutional setting are similar to most non-US settings and this differentiates our study since most previous studies on this topic have been done in the US.

As the mandatory transition to IAS/IFRS was implemented in 2005, the disclosure requirements became far more comprehensive than previously. We have chosen to study the period leading up to this, 2001-2004, with the intention to capture a voluntary increase in disclosure as companies prepare for the new standards. Hellman (2011) finds that adoption of IFRS/IAS was done gradually by firms until full transition in 2005, and that companies have the opportunity to choose whether to use Swedish GAAP or IAS/IFRS, in the years leading up to 2005, when the hard adoption with legal obligations became mandatory.

The index constructed by Peterson and Plenborg (2006), is aimed for industrial companies inspired mainly by AIMR and previously constructed indexes but adjusted to fit the Nordic regulatory setting. What differentiates our study as of the time aspect, we measure the effect on the week, month, quarter and year after publication of the annual report in contrast to most

studies only testing the yearly effect. This enables us to more carefully study the effect from increased disclosure on information asymmetry in detail.

For our study, we use a sample of 22 production oriented industrial companies (Appendix B) and rate the content of their annual report from 2001-2004 according the disclosure index (Appendix A), consisting of 62 indicators in five categories. We then perform a regression where the disclosure score is an explanatory variable and bid-ask spread, measured as the median of the week, month, quarter and year after publication date as dependant variable. In this regression, other variables were carefully selected and included based on theory regarding information asymmetry, described more in depth in chapter 4.

The results show that the average level of disclosure increases by an average of 27.5% on the four year period and the bid-ask spread decreases on a yearly average basis of 61.6% over the period. Running an OLS-regression shows a statistically significant negative association between disclosure score and our proxy for information asymmetry, even after controlling for heteroscedasticity, time and firm fixed effects and self-selection bias of the firm management through a 2SLS-regression. Regarding the time effect, we observe a more substantial effect on a shorter time period after disclosure date which we believe is due to the distortion effect when new information is distributed from the company the longer after publication date that is measured. In short, the importance and value-relevance of the information in the annual report decreases with time.

1.1 Purpose

The main purpose of this study is to examine the relationship between the quality of the information provided by companies and information asymmetry in the Swedish institutional setting.

This is an interesting topic since there are very few or no studies investigating the relationship in Sweden, although it is an area of interest and research in other parts of the world, especially the US. What differentiates our study further and perhaps most important, where we can provide a new perspective and research, is to offer a fuller understanding of the aforementioned association over time. This is made possible since we aim to examine the association over different time period, which, has not been done previously according to our knowledge.

1.2 Delimitation

Information asymmetry is closely related to cost of capital. Other studies such as Botosan (1997) and Francis Nanda and Olsson (2008) use a similar approach as this study but expand their studies beyond information asymmetry to cost of capital. A natural continuation of this study would be to also examine how the cost of capital for the companies in the sample is affected. We have chosen to limit our study to only examine information asymmetry due to limitations in time. A further study could be performed on the results we present and examine how cost of capital is associated with information disclosure.

1.3 Disposition

Following this introductory part, chapter 1, a review of previous literature on the topic will be provided in chapter 2. In this part, relevant terms and theories will be presented that are necessary to develop an understanding of the topic in question and to subsequently build our hypothesis and to form the regression model. In chapter 3, the hypothesis will be developed based on the literature review. Following that in chapter 4, the research design will be described and we will explain the method and statistical techniques used in the study. In this part, the regression model will also be specified and the variables motivated. Chapter 5 includes sample selection and descriptive statistics where the raw data will be presented and analyzed in a first step to draw preliminary conclusions. The following part, chapter 6, covers empirical results where the outcomes from the statistical assessments will be provided and commented upon. Chapter 7 is analysis covering a robustness check to control and assure that the results found in chapter 6 are statistically correct, as well as analysis of the results found and comparisons with other similar studies on the topic. Chapter 8 covers conclusion about the results and their reliability followed by concluding remarks and suggestions for future research in chapter 9.

2. Literature review

2.1 Agency theory

In a perfect market, the market conditions and distribution of information assures that all participants have the same access to information regarding company specific data and events, thus insuring that there is no information asymmetry. In this setting, there is no informatory advantage on any part of a transaction since both parties have access to the same information. Although, if a market is not perfect, this implies that there is information asymmetry arising from the fact that one part (the company) possesses more information about its processes and events than the other part (the investor). This difference in information is referred to as the agency problem. The principal (investor) investing in a company typically does not intend to play an active role in the management and delegate this responsibility to an entrepreneur (agent) who is put in charge of running the company, thus managing the investment. The different interests of the agent and the principal give rise to the agency problem and an incentive structure is constructed to assure that the interests are aligned (Ross, 1973).

To mitigate the agency problem, there are significant regulations governing corporate reporting and disclosure, in Sweden there are specific requirements for all listed companies and additional rules for actors on the Nasdaq OMX Stockholm stock exchange. Although, firms have incentives to optimally trade off the costs and benefits of voluntary disclosure, to produce to most efficient level of disclosure.

There are different types of reporting such as the annual report, quarterly reports, press releases and news distributed by the company. The only one that is audited is the annual report and this would suggest an increased reliability although there is no research, to our knowledge, that studies if auditors enhance the credibility of financial statements as this is a difficult topic to examine.

2.2 Information asymmetry and the cost of capital

Barry and Brown (1985) provide a theory stating that if the disclosure made by companies is imperfect, investors will bear risks in forecasting future payoff from their investments. As a result of this, if the risk is non-diversifiable, they will require a higher required return to account for the information risk. Therefore, firms with high level of disclosure, hence low information risk, will

sustain lower cost of capital than comparable firms with lower level of disclosure, all else constant. Lang and Lundholm (1996) show that an increase in disclosure leads to lower estimation risk and reduced information asymmetry.

Botosan and Plumlee (2002) find a significantly negative coefficient on the annual report score even for firms with high analyst following when using a large sample.

In a study regarding the debt part of the total cost of capital, Sengupta (1998) finds that firms distributing a higher level of disclosure quality experience a lower cost of debt. This is consistent with theory regarding adverse selection and the fact that the bank requires a higher rate due to information risk and uncertainty.

Copeland & Galai (1983) and Glosten & Milgrom (1985) show that adverse selection tends to reduce the liquidity in firm shares and hence to attract investors, the firm must give the investors a discount on the price of new issues of equity. Diamond & Verrecchia (1991) and Kim & Verrecchia (1994) argue that voluntary disclosure reduces information asymmetry among both informed and uninformed investors. Firms with high disclosure can therefore be more certain that new offers will occur at a “fair price” according to the market and the liquidity in the firm’s stock will increase as a result. The higher liquidity is regarded as an indication that the share is more interesting as an investment object due to higher disclosure levels (Leuz & Verrecchia, 2000).

The theory regarding disclosure and liquidity was tested by Welker (1995), the study documented a significant negative relation between analysts’ ratings of firms disclosure and the bid-ask spread, consequently increasing liquidity in equity markets. Healy et al. (1999) also finds that firms that increase their disclosure experience contemporaneous increases in stock prices that are unrelated to current earnings performance.

Empirical research on stock liquidity shows that an increase in liquidity results in lower information asymmetry and as a result a lower cost of capital (Diamond & Verrecchia, 1991; Botosan, 1997; Leuz & Verrecchia, 2000; Botosan & Plumlee, 2002).

2.3 Information characteristics

Bhushan (1989a, b) and Lang & Lundholm (1996) argue that if information is not distributed through required disclosures, then voluntary disclosures lowers the cost of information acquisition for the analysts covering the company. As a result of this, increased disclosure would, in theory, increase the supply of information to the public. The effect on demand for analyst

services is though unknown since if the company already convey all information to the investor, the need for analysts decreases. Although, with more information, the recommendation made by analyst will bear more strength through a more rigorous analysis, the effect is therefore unclear.

This theory is investigated by Lang & Lundholm (1993) where they find that firms with a higher level of disclosure have larger analyst following. Healy et al. (1999) and Francis et al. (1998) find similar patterns in their studies of information intermediation. They conclude that this concerns firms depending on size. We interpret that as a reason to include firm size as a variable affecting information asymmetry.

Botosan (1997) does not find a statistically significant association between disclosure level and the cost of capital in her study for pooled data for a one-year period. Although the evidence for firms with high level of analyst following did not show a statistical relationship, firms not closely followed by financial analysts experienced a lower cost of capital as a result of increased disclosure. This indicates that the disclosure level is more relevant for firms not widely followed by analysts as information reaches the market slower. She argues that a reason for this is that for widely followed firms, the annual report may not provide a powerful proxy for overall disclosure level. This indicates that if there is a rich information environment surrounding the company, the effect from increased disclosure in the annual report might be mitigated.

This phenomenon has also been studied by Leuz & Verrecchia (2000) and they come to the conclusion that an increase in the level of disclosure in an already rich information environment is mainly incremental. The economic consequences resulting from the change are therefore hard to substantiate empirically. Increased disclosure might therefore not affect proxies for information asymmetry in an already rich information environment.

A common assumption in papers examining the relationship between the level of disclosure and information asymmetry is that investors' private information is exogenously endowed, meaning the investors receive information through annual reports, press releases, information intermediation and similar (Verrecchia, 2001). However, relaxing the assumption and model that information acquisition is an endogenous decision, investors have incentives to acquire private information ahead of forthcoming disclosures to benefit from the possession of more information than the counterpart.

These incentives increase in the frequency and the level of disclosure as this enables sophisticated investors more opportunities to profit from private information acquisition. As these

investors possess private information due to asymmetric information, the party accommodating the deal will require a larger bid-ask spread. As a result of this, it is possible that a higher disclosure level and more frequent reporting can lead to increases in the proxies for information asymmetry contrary to the earlier mentioned theories, although the substantiality of the effect is unknown and there are limited or no literature deeply covering the topic of discussion. In the Swedish setting, companies release four interim reports and the annual report. The annual report and the report for the first quarter are often published in a short interval. Assuming endogenous endowment of information, the total effect on information asymmetry leading up to publishing of the next report is unknown, depending on the time period measured, the effect might vary.

2.4 Time effect

An interesting area to investigate is whether the effects from a change in the level of voluntary disclosure result in temporary or sustainable effects, that is, the short and long term effects. Although, since the annual report only represent a fraction of the information that firms' reveal during a year, consideration must be taken regarding how far from the publishing of the annual report effects from a change in disclosure level can be observed. A relevant question is whether the effect from increased disclosure is only temporary and absorbed by the market, in other words, parameters return to pre-event levels. Botosan and Plumlee (2002) for instance show that the cost of equity decreases in annual report disclosure level but increases in the quarterly report disclosure level as a result of increased disclosure. This indicates that there might be a need to examine different time periods to better understand the effects of increased disclosure.

As the annual report only represents one of many sources of information distributed by the firm, anything presented will primarily be interesting for investors ahead of forthcoming reports or news. In other words, the value of the annual report assumedly perishes as new material becomes public. Most other studies measure the level of disclosure in the annual report and then observe the effect on information asymmetry for the full following year. Although, in previous research, the effect of increased disclosure measured on different time periods after disclosure date has not yet been examined.

Furthermore, Kim & Verrecchia (1994) argue that market makers are not capable of interpreting information as fast as traders that closely follow the company, hence must take this in consideration when setting the bid-ask spread. They suggest that market makers adjust the

spread ahead of announcements and that they fall back to levels prevailing before anticipation of the announcement. They do not investigate this further but an interesting point is how long it takes for this effect by market makers to diminish and it is therefore of interest to study different time periods after the announcement and examine the effects. Alford (2003) also shows in an international comparison that information such as accounting earnings from Sweden and Denmark are either less timely or less value-relevant than U.S. GAAP earnings. These results indicate that the effect from increased disclosure in US and Sweden might differ.

2.5 Ownership

Diamond & Verrecchia (1991) concludes that to have a low cost of capital, the firm must attract large positions from institutional investors. Following that, Kim & Verrecchia (1994) argue that an increase in voluntary disclosure, and as a result, increase in stock liquidity, is associated with increased institutional ownership. Healy et al. (1999) also find that a higher disclosure level is followed by increases in institutional ownership, stock liquidity, stock returns and analyst following when investigating whether firms benefit from expanded voluntary disclosure. The Swedish setting consists of numerous large institutional investors with heavy holdings in well-known Swedish companies. However, a large share of the industrial companies on Nasdaq OMX Stockholm stock exchange are old, family owned companies where the majority of shares are owned by the family itself. For our study, as a result of our sample firms, it will be more relevant to investigate general ownership concentration rather than what fraction of the owners that is institutional. Either way, there seems to be an association between ownership and disclosure, or at least an interesting topic of investigation. Healy & Palepu (2001) mentions this as a potential research area, although, it has been difficult to draw strong conclusions in previous studies.

Approaching the theory from another direction, Petersen and Plenborg (2006) argue that a high level of ownership concentration might decrease disclosure as block owners find information from other sources than official publications. Implying increased information asymmetry for firms with high ownership concentration.

3. Hypothesis development

According to theory, as described in the previous chapter, there seems to be an association between voluntary disclosure and information asymmetry. This has been the topic of extensive research although the empirical results are not unambiguous and there are calls for more research into the various aspects of the association.

There are several theories covering the information environment that the companies are active within that might affect the association and these are important to acknowledge and take into consideration. As mentioned, a rich information environment might cause the theoretical effect from increased disclosure to diminish and become difficult to empirically substantiate. Information acquisition from informed traders might also lead to information asymmetry ahead of the disclosure date and also around the publication of quarterly reports and similar, possibly distorting the effects from increased disclosure. To account for this, as the effect from the information environment and trading from informed investors is unknown, we feel the need to test the association for different time periods. This assures that we capture the effect from increased disclosure and can analyze it in respect to information asymmetry for different time periods. We can then draw conclusions whether the effect from increased disclosure is absorbed by the market or a permanent effect.

Formulating our hypothesis based on earlier studies, we expect to find a negative association between the level of voluntary disclosure and information asymmetry, although previous work show mixed results. Our hypothesis is therefore that:

The level of voluntary disclosure is negatively associated with information asymmetry

4. Research Design

4.1 Selection of disclosure type

A key consideration is the choice of disclosure type, in other words, what type of information medium to assign ratings and use as a proxy for disclosure level. Previous studies use, in except of annual report, management forecasts, conference calls and press releases (Francis, Nanda and Olsson, 2008). The use of items to examine for voluntary disclosure varies. Although, the most commonly used is the annual report as it is the most extensive information report distributed by the firms. Francis, Nanda and Olsson (2008) found robust evidence for the annual report in line with theory but opposite relations for voluntary disclosure measures based on management forecasts and conference calls, and no relation for press releases.

The annual report has however been debated in literature regarding how well it manages to include time-relevant information. Information included in the annual report might have been distributed previously during the year through press releases before it is included in the annual report and the effect from this voluntary disclosure has therefore already been absorbed by the market in the proxy for information asymmetry. Healy & Palepu (2001) also addresses the problem of defining the timing of a change in disclosure level. The level of information distribution changes gradually during the year and, as a result of this, it is difficult to infer if the changes in disclosure followed or preceded changes in other variables. Consequently it might be difficult to draw reliable conclusions on the causality when using one yearly report as a proxy for the total information flow during the year.

Despite the issues regarding time-relevance, we have chosen to use the annual report due to the positive empirical results and because it is the most commonly used disclosure measurement including Botosan (1997), Francis, Nanda & Olsson (2008), Leuz & Verrecchia (2000) and Lang & Lundholm (1993) among others.

4.2 Disclosure index

The selection/creation of the disclosure index is of prime importance as it represents the proxy for the disclosure quality. Hence, it must capture the different types of information distributed by companies to market, shareholders and owners. Furthermore, since this is a study investigating

the effect of disclosure on information asymmetry, it is important that the index is constructed in such a way that it only includes voluntary information disclosures.

We concluded that we did not possess sufficient knowledge to consider ourselves capable of creating a new disclosure index; consequently we decided to investigate existing disclosure indices used in previous literature. Since the reporting environment and requirements differ between different regulatory settings, it must be taken into consideration that the chosen index must be suitable for the Swedish market. Many prior studies use data from Association of Investment Management Research (AIMR), now the CFA Institute, as a proxy for disclosure quality (Lang and Lundholm, 1993), (Healy et al., 1999) among others. AIMR publishes a disclosure index for roughly 500 firms in 22 different industries every year based on assessments by financial analysts. Another solution used in previous studies would be to construct a new disclosure index, as done by Miller (2002), Botosan (1997) and Francis, Nanda & Olsson (2008).

As no disclosure index similar to the AIMR exists for Swedish companies we decided to use an index constructed by Petersen and Plenborg (2006) adapted for the Danish stock market. We chose to use this particular index because of the proximity and similarities that exist between the regulatory disclosure environment in Sweden and Denmark. The design of the disclosure index is influenced by earlier studies by Botosan (1997), Jenkins (1994), the Nørby (2001) committee's recommendations and PwC Value Reporting (1999). A common influence in all of these papers is the focus on investors' need and the index consists of five categories: (1) strategic issues, (2) competition and outlook, (3) production details, (4) marketing strategy, and (5) human capital. Both PwC (1999) and Nørby (2001) agree on the importance of a clear statement of the company's strategic positioning and success factors for investors. This category gives the investors information on the basic business idea and long-term vision. The second category, competition and outlook, includes information on market size, growth, market share and competitiveness, which is recognized by PwC (1999) as among top ten most important value drivers for understanding business. The importance of information on production is supported by both Botosan (1997) and Jenkins (1994). Since our sample consists of manufacturing industrial companies the factors in the category "production" are intuitively important for investors in this study. Investors with knowledge in the industry are given the possibility to understand success factors by having the methods and products described. Marketing strategy have only been given limited emphasizes in earlier studies of this type. Doyle (2000) and Porter (1996) however study

the importance of marketing for company success and how it can be connected to creation of shareholder value. This category is therefore included in the index. The last category is related to factors concerning intellectual and human capital. Petersen and Plenborg (2006) claim that there is an increasing interest from investors regarding personnel related information and consequently include the human capital category. The disclosure index was developed with special emphasis on investigating industrial production oriented companies and this has been taken into account when choosing the sample of firms.

The index consists of 62 indicators distributed between the five categories (see Appendix A). The Swedish Annual Accounts Act does not require any of the indicators (except the rare case of giving a “true and fair view”); hence disclosing any of them is entirely voluntary which is necessary in line with the purpose of our paper to investigate the effect of voluntary disclosure.

Following the reasoning of Petersen and Plenborg (2006) we conclude that even though the measurement of ‘level of disclosure’ is measured quantitatively, they should also be qualitative in order to be informative. This gives a better picture of the quality of the disclosure and not only the volume as done by, for example, Miller (2002). Since the index is constructed based on prior research and reports by the authors, it indirectly provides evidence of the qualitative nature of the indicators as well. What differentiates their index from the one Botosan (1997) uses is the equal emphasis on quantitative as well as qualitative indicators. While Botosan (1997) argues that quantitative measures are more precise, Petersen and Plenborg (2006) claims that there is no research that examines the impact of individual measures of disclosure on information asymmetry and hence, we assign equal weights to both measurements in a conservative manner.

After selecting the disclosure index, the annual reports of the sample of firms were carefully assigned points for each of the 62 indicators with an equal weight of one point per indicator, adding up to a maximum score of 62. A self-constructed index requires subjective assessment on the importance of items disclosed by the firm as well as the judgment if an item fulfills the requirements to be given one point. In addition, Heitzman et al. (2010) point out that self-constructed disclosure measures ignore the materiality of the disclosed items. We are aware that the assessment and rating of the reports in the index is subjectively affected by our personal judgments. We however consider the possible subjectivity not to be a major problem since the importance lies in the relative score between companies.

The reason for limiting the sample to industrial companies is that disclosure standards vary among industries. By choosing one industry we find a sample of firms with differences in the level of disclosure but the reports will still put emphasize on the same areas of information in accordance with reasoning by Botosan (1997). By this procedure, we avoid accidentally capturing differences related to industry standards.

4.3 Time

The choice of time period is important for our study since, as previously mentioned, Leuz and Verrecchia (2000) points out that an increase in the level of disclosure in already rich information environments is largely incremental, leading to economic consequences that are difficult to substantiate empirically. They argue that an explanation for the mixed empirical results regarding the correlation between the level of disclosure and the firms' cost of capital are due to this phenomenon.

Considering the development of the regulatory setting for mandatory information in the annual report in Sweden, implementation of IAS/IFRS in 2005 led to higher requirements regarding the distribution of information. Since all listed companies in EU must comply with IAS/IFRS standards from 2005 and the already rich information environment in Sweden at that time, we suspect that choosing a later time period will lead to a too rich environment to make a thorough assessment. Because of this, we decided to use a time period ahead of the mandatory implementation of IAS/IFRS, although, we did not want our study to be outdated. Therefore, in line with Petersen and Plenborg (2006) choosing a 4-year time span for their study, we chose to investigate voluntary disclosure over the period 2001-2004.

The second reason for the choice of time period is that in order to observe a change in level of disclosure, the years leading up to 2005 are suitable as we believe that companies voluntarily prepare for the implementation of IAS/IFRS by improving the disclosure level in the annual report. This theory is confirmed in the research by Hellman (2011). None of the companies in the studied sample have fully implemented IFRS/IAS during the period, all state that the new standards will be fully applied during 2005. Many also comment that adaptations have been made gradually as anticipated.

Since the annual report only is one point of measure for the level of information disclosure during the year, this study will investigate if variations in information asymmetry can

be found depending on time elapsed from the date of publication. The reasoning is that information presented in the annual report will be less important to investors as time passes and other reports are released. By examining the information asymmetry on week, month, quarter and year, we intend to capture changes as time passes from the publishing of the report. It is not possible to say that the effects are completely isolated but it will be interesting to see if the results from the regression differ depending on the time period after the publication date.

4.4 Measure of information asymmetry

There is no explicit method of measuring information asymmetry, as it cannot be directly observed. Hence we need to use a proxy for it that captures the desired effect.

Extensive research exists in the area of information asymmetry and there are several different proxies readily available, although the usefulness of the different proxies is debated. A common measure is the bid-ask spread. The theory is that the more severe the information asymmetry is, the market maker demands a wider spread to cover higher expected losses from trading with informed investors. In that respect, the proxy is very explicitly linked to information asymmetry and bid-ask spread is therefore used and accepted as it captures the essence of information asymmetry (Leuz and Verrecchia, 2000). Among others, Welker (1995), Leuz and Verrecchia (2000) and Petersen and Plenborg (2006) use the relative bid-ask spread as a measure for information asymmetry.

Clarke and Shastri (2001) finds in a comparison of proxies for information asymmetry that microstructure measure such as the bid-ask spread are superior to analysts' forecasts, firms' growth opportunities, and stock return structure. They determine in their study that the bid-ask spread is related to firm characteristics that ex-ante should be associated with information asymmetry. Therefore, we have chosen the bid-ask spread as our proxy for information asymmetry in this paper.

4.5 Regression model

In light of existing literature, information asymmetry is regressed on relevant firm characteristics and disclosure score.

$$\text{Spread}_t = \alpha_0 + \alpha_1 \text{DS}_t + \alpha_2 \text{Size}_t + \alpha_3 \text{Turnover}_t + \alpha_4 \text{Volatility}_t + \alpha_5 \text{Ownership}_t + \alpha_6 \text{Profitability}_t + \alpha_7 \text{Solvency}_t + \varepsilon_t$$

4.5.1 Information asymmetry

The dependent variable in our study, as previously mentioned, is the relative bid-ask spread, representing the proxy for information asymmetry (spread). We measure the bid-ask spread as $(\text{ask} - \text{bid})/((\text{ask} + \text{bid})/2)$ according to the methodology used by Mohd (2005) and Silber (2005). We use the median spread for the period in concern, which in our study is the week, month, quarter and the year after the annual report has been published. The spread must be in relative form due to comparability between companies.

4.5.2 Disclosure score

Disclosure score (DS) is the firms' individual score on the 62 indicators. This is our main variable of interest that we are examining. According to previous literature this variable is expected to be negatively associated with information asymmetry. For display purposes we have chosen to use the relative score by transforming the absolute score into percentage of the total.

4.5.3 Size

We have included the variable size due to the fact that prior research shows a significant association between market value and proxies for information asymmetry and disclosure level (Botosan, 1997), (Leuz and Verrecchia, 2000), (Lang and Lundholm, 1993). Botosan (1997) claims that size could be a correlated omitted variable if excluded from the analysis and we have therefor chosen to include it.

The theory is that larger companies have more responsibilities and pressure from shareholders to disclose more comprehensively. We expect firm size to be negatively associated with relative bid-ask spread in accordance with the study by Leuz and Verrecchia (2000) due to

the aforementioned reasoning. Lang and Lundholm (1993) also find a positive correlation between firm size and disclosure level.

Size is the logarithm of market value of a firm's equity, calculated as the average of the logarithm of the market value of equity for the beginning and end of the prior year.

4.5.4 Turnover

Following Leuz and Verrecchia (2000) and Daske et al. (2008) we control for turnover. We measure turnover as the logarithm of the median daily share turnover ratio during the year (SEK value of trades divided by market cap) for the current year. According to theory, an increase in daily trading volume increases stock liquidity. In turn, liquidity is a measure of willingness to trade in a stock and is therefore, according to theory, negatively correlated with information asymmetry.

4.5.5 Volatility

A measurement of volatility is reoccurring in studies similar to ours, either in the form of a beta or as a direct measurement of volatility, used by Glosten and Harris (1988), Leuz and Verrecchia (2000) among others. According to theory, a higher volatility leads to higher risk for the market maker, who hence requires a larger spread to accommodate the deal. As a result of this, we expect volatility to be positively correlated with the relative bid-ask spread.

We calculate volatility as the logarithm of the standard deviations of daily returns during the year.

4.5.6 Ownership

Following Petersen and Plenborg (2005) reasoning we use ownership as a control variable because we believe that the ownership structure in Sweden, with high owner concentration, affects the level of disclosure. Firms with large block owners may provide less voluntary information as the shareholders find other ways to acquire information than through the annual report. Thus will the expected sign on the coefficient be positive in relation to the relative bid-ask spread, but owner concentration should be negatively correlated to disclosure score. Leuz and Verrecchia (2000) use the opposite measure, free float, the percentage of shares *not* held by block

owners. They find the coefficient in the model to be negative. We calculate the data for the ownership variable as the total percentage of shares held by block holders of more than 5%.

4.5.7 Profitability

We have chosen to use a measure of profitability as a control variable following Lang and Lundholm (1993) and Petersen and Plenborg (2006) to account for the firms' willingness to disclose more when they are performing well. A better performance would in theory increase the willingness of the managers to disclose more information in light of their success. Lang and Lundholm (1993) show in their research that firm performance is positively correlated to disclosure quality, confirming the theory that firms performing well also disclose more information.

Healy & Palepu (2001) argue that changes in disclosure are rarely random events; rather, they coincide with changes in firm economics and governance. Although, increased level of disclosure may induce risk of litigation. As a result of this, the sign of the association between information asymmetry and our measurement of profitability is unclear.

The measure for profitability that we use is ROCE, return on capital employed, calculated as net operating profit after taxes scaled by capital employed. ROCE is a good measure of performance in relation to long-term invested capital. It is a commonly used and well-known measure which serves our purpose.

4.5.8 Solvency

Solvency is relevant due to the reasoning that if the company has a high solvency, the risk of bankruptcy is lower and that should result in a lower relative bid-ask spread. Although, with a low solvency, debt holders monitor the company more closely to avoid unanticipated bankruptcy and demand more information, it is therefore unknown what sign the association has between solvency and information asymmetry (Petersen and Plenborg (2006)). Our measure of solvency is calculated as book value of debt divided by total book value of equity (D/E) for the year.

4.6 Data collection

Share price related data such as share price and the value of trades, needed to calculate volatility and the bid-ask spread was collected from Nasdaq OMX. Company data such as market capitalization, solvency and return on capital employed has been collected from Thompson Reuters Datastream while ownership data was collected from SIS Ägarservice. The collected data was then treated according to previously mentioned techniques to receive the control variables.

Annual reports were collected from the respective companies' web archives and the publication dates were either taken from press releases by the company or through contact with the IR (investor relations) department at the firms'. In those rare cases where the disclosure date was missing for a specific year for a company, estimates were made based upon the IR departments' qualified estimates and the publication date for the other years, which tend to be fairly close to each other. The median bid ask-spread was then calculated for the week, month, quarter and year following the publication date.

4.7 Statistical research design

The first step in our statistical analysis of our sample data is a simple OLS (ordinary least squares) regression of our information asymmetry proxy on disclosure score (DS) and control variables.

Acknowledging that our data set consists of panel data, as disclosure score (DS) and the other variables are measured over a four-year period and hence giving cross-sectional time series data. To address this, a time fixed effects regression is performed to address the possibility that changes in disclosure score may be explained by time alone. As time progresses, the mobility on capital markets increases as well as market maturity, there are several variables possibly explaining changes in disclosure score dependent upon time.

The second stage to control for the panel data issue is a firm fixed model that generates unbiased estimates under the assumption that unobservable firm characteristics, which affect both disclosure score and information asymmetry, are constant over time. This is a common approach to address the endogeneity concern.

The next step in our statistical analysis is to control our sample for the existence of heteroscedasticity, in other words, to observe if there are sub-populations that have different variability from others. This might be a problem because the presence of heteroscedasticity can

invalidate the statistical significance test working under the assumption that modeling errors are uncorrelated and normally distributed. To check for heteroscedasticity, a Breusch-Pagen test is performed and after that a robust regression is implemented to observe the effect on our regression model.

An issue in a study like this, as pointed out in previous literature (Hail, 2002), (Healy & Palepu, 2001), is the self-selection bias. Firms with the highest disclosure score tend to report the highest contemporary earnings. To control for the effect of self-selection bias, we perform a two stage least square model (2SLS), controlling for the self-selection bias in the profitability variable.

5. Sample selection and descriptive statistics

5.1 Sample selection

Due to the selection of the index by Petersen and Plenborg (2006), as previously mentioned, the sample selection of firms became important due to the fact that they constructed the index for the purpose of industrial, production oriented, companies. As a result of this, with the fact in mind that we were to perform the study on Swedish companies, our starting point was the OMX Stockholm Industrial Index – SX2000GI.

The OMX Stockholm Industrial Index was chosen because it is the largest index in Sweden covering the industrial sector and therefore includes all the companies that we are interested in. It consists of 71 firms from both large, mid and small cap on the Nasdaq OMX Stockholm stock exchange, assuring that our initial sample does not exclude relevant companies.

For the purpose of the study, to assure that the sample companies are similar in both reporting requirements and patterns of disclosure, which is assumed to be different in different industries, we further narrowed our selection. This was done by removing firms which did not have a production line such as industrial consulting companies and services based firms. We also removed two companies represented by two stock classes in the index. The next step was to limit our selection based on firm size to assure that our sample would not include too small companies that differ too much in reporting from large industrial firms. The selection process was important to assure that firms are relatively alike, hence taken into account that similar firms roughly report the same pieces of information.

After these procedures, we ended up with a sample consisting of 22 firms (see Appendix B), the annual reports for the period 2001-2004 were then hand collected for each company. Subsequently, we individually examined and graded the annual reports according to the disclosure index.

Table 1

Descriptive statistics

Variables ^a	<i>n</i> ^b	Mean	Median	25% percentile	75% percentile	Standard deviation
DS	87	0.319	0.323	0.258	0.387	0.086
SpreadY	87	0.008	0.005	0.004	0.009	0.008
SpreadQ	87	0.009	0.006	0.003	0.009	0.009
SpreadM	87	0.009	0.005	0.003	0.009	0.010
SpreadW	87	0.010	0.005	0.003	0.009	0.014
Size	87	6.883	6.800	6.100	7.600	0.728
Turnover	87	-0.027	-0.057	-0.469	0.472	0.549
Volatility	87	-1.672	-1.700	-1.800	-1.600	0.151
Owner	87	0.500	0.538	0.346	0.680	0.212
Profitability	88	0.116	0.116	0.076	0.172	0.093
Solvency	88	2.533	1.822	1.314	2.731	2.804

^a DS is the firms' disclosure score on the 62 indicators in % of total. Spread is the average bid ask spread for the period, Y=year, Q=quarter, M=month, W=week after the annual report is published. Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed. Solvency is the book value of debt divided by total book value of equity for the year.

^b *n* is the number of observations

5.2 Descriptive statistics

In Table 1 we display the descriptive statistics for our sample data. In contrast to Petersen and Plenborg (2006), our disclosure score is measured in percentage of the total maximum score in the index. The average and the median of the disclosure score is roughly 32% which results in a score of approximately 20 points. It is interesting to compare this to Petersen and Plenborg (2006) as they use the same index. For their sample of Danish firms during the period 1997-2000, they receive an average score of 12.8, roughly 21%. It is clear that our sample receives significantly higher results and this might be due to the later time period of examination and firms' preparing for IAS/IFRS. The statistics imply a symmetric distribution of disclosure score as the first quartile is 6.8 percentage points below median and the third quartile is 6.8 percentage points above the median.

Notable regarding the bid-ask spread is that the longer period measured after disclosure date, the lower the relative spread and standard deviation, indicating that bid-ask spread is decreasing with time. Compared to Petersen and Plenborg (2006) we see a significantly lower bid-ask spread, with a possible explanation that the Nasdaq OMX Stockholm stock exchange has a higher liquidity than the Danish counterpart as a result of the significant difference in size.

Compared to their study, it is important to highlight that 36 firm-year observations in our sample constitute a part of the OMXS30 index in contrast to the Danish study where only 4 firm-year observations in the sample take part in the OMXC20 index. This is definitely a key explanation as this results in higher liquidity and as a result a lower bid-ask spread according to theory.

An interesting variable to comment upon, due to the previously mentioned theory regarding ownership and the effect on the both disclosure score and the relative bid-ask spread is, to compare level of ownership between our study, Petersen and Plenborg (2006) and the US setting. Sweden as well as Denmark is characterized by concentrated holdings, in comparison to a more dispersed structure in many US firms (Shleifer & Vishny, 1997). In our sample we see mean (median) level of ownership is 50% (54%) compared to Petersen and Plenborg (2006) findings of 56% (60%), confirming the resemblance between the markets.

In table 2 we display the descriptive statistics for our sample data as the score per year and disclosure quality while this is presented in table 3 as the percentage of total disclosure score per category. Table 2 is for visual and descriptive purposes only as the data from Table 3 in percentage form is used later in the analysis and the empirical results.

As shown in Table 3, the average (median) disclosure score (DS) increases over the time period from 2001 to 2004 from 27.4% (30.6%) to 35.0% (35.5%) of total disclosure score, indicating an increase in disclosure by 27.5 (15.8%). This is in line with our previously suggested reasoning that companies are preparing for IAS/IFRS by increasing disclosure to slowly adapt to the new standards. Although, this might also be a natural effect from investors demanding more information and a development of the informatory setting in which the companies are present.

Another distinct feature easily recognized in Table 3 is that Strategic issues (STRA) experience the highest relative disclosure score compared to the other disclosure categories. A possible explanation for this might be that investors considers strategic issues most important when estimating both value and insecurity in a company, hence this might be the category that companies choose to focus on the most.

Table 2

Descriptive statistics per disclosure category from 2001 to 2004

Year	<i>n</i> ^a	<u>DS</u>		<u>STRA</u> ^b		<u>COMP</u>		<u>PROD</u>		<u>MARK</u>		<u>HR</u>	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2001	21	17.0	19.0	6.6	7.0	3.4	4.0	3.2	3.0	1.9	1.0	1.9	2.0
2002	22	19.1	19.5	7.0	7.5	3.9	3.5	3.7	3.0	2.3	2.0	2.2	2.0
2003	22	21.3	21.5	8.1	8.0	4.1	5.0	4.5	4.0	2.3	2.0	2.2	2.0
2004	22	21.7	22.0	8.5	8.5	4.2	4.5	4.5	4.0	2.2	2.0	2.3	2.0
% change		27.5%	15.8%	27.7%	21.4%	22.0%	12.5%	41.0%	33.3%	19.9%	100.0%	21.7%	0.0%

Table 3

Descriptive statistics per disclosure category from 2001 to 2004 in % of total score

Year	<i>n</i> ^a	<u>DS</u>		<u>STRA</u> ^b		<u>COMP</u>		<u>PROD</u>		<u>MARK</u>		<u>HR</u>	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2001	21	27.4%	30.6%	55.2%	58.3%	26.4%	30.8%	24.5%	23.1%	14.3%	7.7%	17.3%	18.2%
2002	22	30.8%	31.5%	58.7%	62.5%	29.7%	26.9%	28.3%	23.1%	17.8%	15.4%	19.8%	18.2%
2003	22	34.4%	34.7%	67.8%	66.7%	31.8%	38.5%	34.6%	30.8%	17.8%	15.4%	20.2%	18.2%
2004	22	35.0%	35.5%	70.5%	70.8%	32.2%	34.6%	34.6%	30.8%	17.1%	15.4%	21.1%	18.2%
% change		27.5%	15.8%	27.7%	21.4%	22.0%	12.5%	41.0%	33.3%	19.9%	100.0%	21.7%	0.0%

^a*n* is the number of observations^bDS is the firms' disclosure score on the 62 indicators. STRA is the firms' disclosure score on strategic issues (12 indicators). COMP is the firms' disclosure score on competitive landscape and outlook (13 indicators). PROD is the firms' disclosure score on production details (13 indicators). MARK is the firms' disclosure score on marketing strategy (13 indicators). HR is the firms' disclosure score on human capital (11 indicators).

Following the reasoning by Petersen and Plenborg (2006) we show that even though firms are becoming more dependent upon intangible resources such as skills of the employees, internal procedures, marketing and image-building, hard tangible measures seems to dominate the disclosure priorities of firms. Marketing strategy (MARK) and Human capital (HR) receive the lowest relative disclosure scores while tangible areas such as Competitive landscape (COMP) and Production details (PROD) show significantly higher relative disclosure scores.

The increase in the different disclosure qualities is fairly similar with one exception, Production Details (PROD) which shows a significant average (median) increase of 41.0% (33.3%) indicating that this might be an area of higher importance or that disclosure in this category has been limited in the past compared to future requirements.

Table 4

Descriptive statistics for the bid-ask spread from 2001 to 2004

		<u>Year^b</u>		<u>Quarter</u>		<u>Month</u>		<u>Week</u>	
	<i>n</i> ^a	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2001	21	1.4% ^c	0.8%	1.3%	0.7%	1.3%	0.6%	1.6%	0.7%
2002	22	0.7%	0.5%	1.0%	0.7%	1.3%	0.7%	1.4%	0.7%
2003	22	0.6%	0.5%	0.6%	0.5%	0.6%	0.5%	0.5%	0.5%
2004	22	0.5%	0.4%	0.5%	0.4%	0.5%	0.4%	0.5%	0.4%
% change		-61.6%	-49.4%	-59.4%	-36.5%	-59.0%	-24.4%	-67.5%	-37.6%

^a *n* is the number of observations^b The time period measured after the disclosure date^c Bid-ask spread is the average bid-ask spread, measured as the absolute spread scaled by the average of the bid and ask spread

Displayed in Table 4 is the descriptive statistics from 2001 to 2004 for the bid ask spread and it is clear by looking at the collected data that there is a wide decrease over the time period for both week, month, quarter and year. This is in line with expectations as we assumed that the firms would increase their disclosure in anticipation of the IAS/IFRS and hence in theory lower the proxy for information asymmetry.

As a conclusion of the descriptive statistics, data provide preliminary evidence in support of our hypothesis that an increased voluntary disclosure leads to a lower information asymmetry.

6. Empirical results

Table 5

Pearson correlation coefficients

Variables ^a	Spread ^d	DS	Size	Turnover	Volatility	Owner	Profitability	Solvency
SpreadY ^e	1	-0.418*** ^{b, c}	-0.624***	-0.609***	0.346***	0.362***	0.077	-0.143
SpreadQ ^e	1	-0.377***	-0.602***	-0.610***	0.354***	0.359***	0.180**	-0.150*
SpreadM ^e	1	-0.410***	-0.621***	-0.582***	0.352***	0.343***	0.137	-0.142*
SpreadW ^e	1	-0.382***	-0.515***	-0.481***	0.363***	0.251***	0.243**	-0.127
DS		1	0.159*	0.345***	-0.440***	0.076	0.063	-0.278***
Size			1	0.775***	0.015	-0.591***	-0.141*	0.304***
Turnover				1	-0.041	-0.685***	-0.145*	0.116
Volatility					1	-0.236**	-0.199**	0.448***
Owner						1	0.004	-0.251***
Profitability							1	-0.254***
Solvency								1

^a DS is the firms' disclosure score on the 62 indicators. Spread is the average bid ask spread for the period, Y=year, Q=quarter, M=month, W=week after the annual report is published. Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed. Solvency is the book value of debt divided by total book value of equity for the year.

^b Significance levels quoted above are for a two-tail test of statistical significance.

* Significant at $0.05 < \alpha \leq 0.10$

** Significant at $0.01 < \alpha \leq 0.05$

*** Significant at $\alpha \leq 0.01$

^c The number of observations used in the correlation analysis is 87-88

^d Spread is the respective spread measure a year, quarter, month and week after the disclosure date

^e Respective spread (Year, Quarter, Month, Week) has been run separately with the variables and constructed in the same table for display and comparative purposes

Table 5 displays the Pearson correlation coefficients between the regression variables, although, note that the tests have been run separately for each of the four spread-measures (year, quarter, month, week) and constructed in the same table for comparative purposes.

The correlation between the proxy for information asymmetry (the relative bid-ask spread) and the proxy for voluntary disclosure (disclosure score) is negative for the four time periods and statistical significant at the 0.01 level. This supports the hypothesis that a higher voluntary disclosure reduces the information asymmetry.

Table 6

Regression on proxy for information asymmetry on disclosure score, size, turnover, volatility, ownership, profitability, and solvency

Period ^a	Intercept	DS ^b	Size	Turnover	Volatility	Ownership	Profitability	Solvency	R ²
$\text{Spread}_t = \alpha_0 + \alpha_1 \text{DS}_t + \alpha_2 \text{Size}_t + \alpha_3 \text{Turnover}_t + \alpha_4 \text{Volatility}_t + \alpha_5 \text{Ownership}_t + \alpha_6 \text{Profitability}_t + \alpha_7 \text{Solvency}_t + \varepsilon_t$									
Year	0.070 (6.645)*** ^c	-0.019 (-2.338)**	-0.004 (-2.884)***	-0.002 (-0.921)	0.019 (4.278)***	0.004 (0.961)	0.003 (0.542)	-0.001 (-2.419)**	0.600
Quarter	0.080 (6.203)***	-0.016 (-1.639)	-0.003 (-2.240)**	-0.003 (-1.287)	0.027 (4.956)***	0.005 (1.083)	0.015 (2.019)**	-0.001 (-2.432)**	0.601
Month	0.098 (6.938)***	-0.027 (-2.481)**	-0.006 (-3.313)***	-0.001 (-0.232)	0.027 (4.494)***	0.007 (1.243)	0.013 (1.546)	-0.001 (-2.181)**	0.599
Week	0.129 (5.929)***	-0.038 (-2.253)**	-0.006 (-2.454)**	0.001 (0.187)	0.042 (4.547)***	0.010 (1.208)	0.039 (3.024)***	-0.001 (-1.980)**	0.524

^a Period is the time period after the disclosure date that the median spread has been measured^b DS is the firms' disclosure score on the 62 indicators. Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed. Solvency is the book value of debt divided by total book value of equity for the year.^c Significance levels quoted above are for a two-tail test of statistical significance.* Significant at $0.05 < \alpha \leq 0.10$ ** Significant at $0.01 < \alpha \leq 0.05$ *** Significant at $\alpha \leq 0.01$

As expected, the correlation between size and disclosure score (the relative bid-ask spread) is statistically significant and positive (negative), at the 0.10 level and the (0.01) level respectively. We see a high correlation between size and turnover and owner, which might be an explanation why owner is not statistically significant in respect to the correlation with disclosure score.

The results of the main regression are reported in Table 6. Four separate regressions have been run for each time period, (year, quarter, month, week), where the median relative bid-ask spread for the time period is used as the dependent variable. This procedure is used to examine and determine any possible differences in effect as discussed previously in the literature section regarding time effects. Through this process, we will conclude whether the assumed effect from disclosure on information asymmetry is temporary or permanent and get a fuller understanding of the effect over different time periods.

As shown in Table 6, the variable of interest, Disclosure Score (DS), has a negative beta for all time periods and is statistically significant at the 0.05 level for Year, Month and Week.

These results are in line with expectations and theory that an increase in disclosure reduces the information asymmetry. Although, from the regression, the Disclosure Score (DS) measured as the median the quarter after publication date is not statistically significant.

Our variable for size takes on the predicted negative sign, implying that large companies experience a smaller relative spread. Size is also highly statistically significant for all time period at the 0.01 level for Year and Month and at the 0.05 level for Quarter and Week.

Turnover displays a negative sign for the beta for all of the time periods except Week, although due to the volatility after publishing date in the merely five days of measurement, the sign of the beta for this time period can be neglected when drawing conclusions regarding the effect. The reason why the sign differs for week might be due to the effect of market makers increasing the bid-ask spread in anticipation of publication and that this effect has not disappeared yet for turnover measured on a weekly basis after publication as mentioned in the literature part of this study. The sign for turnover is in line with theory and our prediction, although not statistically significant. The sign of the beta for volatility is positive and highly statistically significant at the 0.01 level in line with theory and our expectations stating that a higher volatility leads to higher risk for the market maker, who will require a larger bid-ask spread as previously mentioned.

As mentioned in the description of the regression model, ownership is predicted to be negatively associated with disclosure score and positively associated with the bid-ask spread as large owners find other ways to receive information than through the annual report and hence, the pressure on the company to deliver a high level of voluntary disclosure decreases. This effect is shown in our study as the sign of the beta for ownership is in line with our expectations, although not statistically significant for any of the time periods in question.

Profitability (ROCE) experiences a positive sign of the beta, indicating that companies performing well enjoy a higher relative spread, possibly due to the risk of litigation associated with an increase in disclosure. The sign was not clear according to theory as companies might be willing to report more (higher voluntary disclosure) when they are performing well, although, as proven in our regression, the litigation effect seems to be the most dominant effect. Profitability is statistically significant at the 0.01 level for week and at the 0.05 level for quarter and not significant for year and month. The significance levels for profitability are in line with the

preliminary evidence found in the Pearson correlation matrix regarding correlation between profitability and the spreads for different time periods.

Solvency is another variable where the sign of the beta is unclear since a high solvency would result in lower risk although with a low solvency, the bank requires more information. We find a negative sign for the beta of solvency indicating that the second theory is central in predicting the effect. Solvency is statistically significant at the 0.05 level for all time periods.

The overall model shows an adjusted R^2 of 60.0% when the relative bid-ask spread is measured over a year, and then 60.1%, 59.9% and 52.4% respectively for quarter, month and week. This indicates that our model has a good explanatory power for the effect on our proxy for information asymmetry (the relative bid-ask spread) for all time-periods.

As previously shown in the descriptive statistics in Table 2, there is a tendency to increase voluntary disclosure over time. The above regression in Table 6 shows that the sign on the DS (disclosure score) beta is negative and significant at the 0.05 level for year, month and week, although not significant at quarter. This confirms our hypothesis that an increase in voluntary disclosure as measured by disclosure score decreases information asymmetry measured by the relative bid-ask spread.

To give an easily interpretable conclusion regarding disclosure, an increase by 10 percentage units of the total score in voluntary Disclosure Score (DS) leads to, according to our model, a decrease in the relative bid-ask spread measure on a yearly measure by 0.0019. This can be compared with the descriptive statistics for the spread in Table 1 where we see that the mean (median) spread measured on a yearly basis is 0.008 (0.005). A conclusion of this is that it is beneficial for companies to disclose more to sustain a lower information asymmetry.

In Table 7, the Disclosure Score (DS) variable has been separated into the five categories previously mentioned; strategic issues, competitive landscape and outlook, production details, marketing strategy and human capital. What is important to note regarding the regression, is that for the relative spread measured on a yearly basis, all the signs on the betas except production details are according to expectations. Looking at the other time periods for the bid-ask spread measure, we find, contradictory to our expectations, that competitive landscape and outlook, production details and human capital commonly experience the opposite sign on the beta. This is troublesome although functions more as a test of the index itself and its components, a key aspect to take notice upon as the index plays a central part in our study.

Table 7

Regression on proxy for information asymmetry on the five disclosure categories: size, turnover, volatility, ownership, profitability and solvency

Period ^a	Intercept	STRA ^b	COMP	PROD	MARK	HR	Size	Turnover	Volatility	Ownership	Profitability	Solvency	R ²
Spread _t = $\alpha_0 + \alpha_1$ STRA _t + α_2 COMP _t + α_3 PROD _t + α_4 MARK _t + α_5 HR _t + α_6 Size _t + α_7 Turnover _t + α_8 Volatility _t + α_9 Ownership _t + α_{10} Profitability _t + α_{11} Solvency _t + ε_t													
Year	0.071 (6.372)*** ^c	-0.008 (-1.462)	-0.002 (-0.439)	0.000 (0.054)	-0.007 (-1.015)	-0.002 (-0.232)	-0.004 (-2.822)***	-0.002 (-0.756)	0.018 (3.921)***	0.004 (0.847)	0.005 (0.655)	-0.001 (-2.340)	0.606
Quarter	0.080 (5.917)***	-0.011 (-1.669)*	0.001 (0.112)	0.002 (0.331)	-0.006 (-0.768)	0.001 (0.058)	-0.003 (-2.148)**	-0.003 (-1.144)	0.026 (4.549)***	0.006 (1.019)	0.019 (2.171)**	-0.001 (-2.318)**	0.611
Month	0.098 (6.910)***	-0.024 (-3.383)***	0.005 (0.856)	0.005 (0.864)	-0.008 (-0.973)	0.000 (-0.034)	-0.006 (-3.301)***	0.000 (-0.074)	0.025 (4.150)***	0.008 (1.385)	0.022 (2.404)**	-0.001 (-2.083)**	0.641
Week	0.130 (5.803)***	-0.031 (-2.748)***	0.005 (0.466)	0.006 (0.593)	-0.002 (-0.574)	-0.002 (-0.126)	-0.007 (-2.406)**	0.001 (0.246)	0.039 (4.194)***	0.011 (1.264)	0.050 (3.531)***	-0.001 (-1.893)*	0.555

^a Period is the time period after the disclosure date that the median spread has been measured^b STRA is the firms' disclosure score on strategic issues (12 indicators). COMP is the firms' disclosure score on competitive landscape and outlook (13 indicators). PROD is the firms' disclosure score on production details (13 indicators). MARK is the firms' disclosure score on marketing strategy (13 indicators). HR is the firms' disclosure score on human capital (11 indicators). Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed. Solvency is the book value of debt divided by total book value of equity for the year.^c Significance levels quoted above are for a two-tail test of statistical significance.* Significant at 0.05 < α ≤ 0.10** Significant at 0.01 < α ≤ 0.05*** Significant at α ≤ 0.01

Although, in the regression with the five disclosure categories, only strategic issues is statistically significant (at 0.01 level for week and month and at 0.10 level for quarter) except for year which is not significant. This is surprising given the results shown in Table 6 with the full regression, although, a possible explanation is that the categories are more useful to investors when combined than by themselves. It is notable that the beta of strategic issues (the only statistically significant category) is merely slightly less than the beta for the Disclosure Score (DS) in the full regression (-0.031 compared to -0.038 on a weekly bid-ask spread measurement basis). This might indicate that strategic issues are more relevant for investors as when they determine the value of the company and the risk surrounding it as it is the most forward-looking category. As a conclusion, the category strategic issues is indicated to be more important when investors discount the future in their analysis process.

7. Analysis

7.1 Robustness/sensitivity check

As previously mentioned in part 4.6, a key concern is that due to the presence of panel data, the increase in voluntary disclosure might be explained by time alone, meaning that companies decide to increase their disclosure as a result of time. This could be caused by other variables such as that the stock market may have matured over time or that the capital mobility, ability and accessibility to trade shares in different countries possibly increases. To control for this, a time fixed effect regression was performed (not tabulated). The results did not change the overall findings, neither the sign nor significance levels for disclosure score for the different time periods. A firm fixed model, generating unbiased estimates and addressing the endogeneity problem, was also performed (not tabulated). Again the overall findings remained the same regarding signs and significance levels.

To be able to draw legitimate conclusions regarding the validity of the study, the regression must be tested for heteroscedasticity, because an assumption made in the OLS-regression is that the error term is homoscedastic. This means that the variance is constant and independent to the values on the explaining variable. To test for this a Breusch-Pagan test was performed for the four regressions (spread for year, quarter, month and week). The Breusch-Pagan test showed that our regressions were heteroscedastic for all four time-periods; hence we had to perform a robust regression.

The results from the robust regression shown in Table 8 indicates that the conclusions from the OLS-regressions still holds as there no difference in the sign nor significance levels for Disclosure Score (DS). This indicates that there are no significant effects on the regression on our variable of interest due to heteroscedasticity problems with the data.

The next procedure to control our model for is the self-selection bias that occurs because firms that performs well tends to report the highest contemporaneous earnings performance. To be able to reliably draw conclusions from the results in our OLS-regression we therefore perform a 2SLS (two-stage-least-squares) regression to control for this self-selection bias in the profitability term, displayed in Table 9.

Table 8

Robust regression on proxy for information asymmetry on disclosure score, size, turnover, volatility, ownership, profitability, and solvency

Period ^a	Intercept	DS ^b	Size	Turnover	Volatility	Ownership	Profitability	Solvency	R ²
$\text{Spread}_t = \alpha_0 + \alpha_1 \text{DS}_t + \alpha_2 \text{Size}_t + \alpha_3 \text{Turnover}_t + \alpha_4 \text{Volatility}_t + \alpha_5 \text{Ownership}_t + \alpha_6 \text{Profitability}_t + \alpha_7 \text{Solvency}_t + \varepsilon_t$									
Year	0.072*** ^c	-0.020**	-0.004***	-0.002	0.019***	0.004	0.004	-0.001***	0.599
Quarter	0.081***	-0.017	-0.004**	-0.003	0.027***	0.006	0.016	-0.001***	0.601
Month	0.099***	-0.027**	-0.006***	0.000	0.027***	0.007	0.013	-0.001***	0.599
Week	0.130***	-0.038**	-0.007**	0.001	0.042***	0.011	0.039**	-0.001***	0.524

^a Period is the time period after the disclosure date that the median spread has been measured

^b DS is the firms' disclosure score on the 62 indicators. Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed. Solvency is the book value of debt divided by total book value of equity for the year.

^c Significance levels quoted above are for a two-tail test of statistical significance.

* Significant at $0.05 < \alpha \leq 0.10$

** Significant at $0.01 < \alpha \leq 0.05$

*** Significant at $\alpha \leq 0.01$

The 2SLS procedure was performed in the same manner as Petersen & Plenborg (2006) procedure. The first stage was to predict the variable for profitability and then, to avoid perfect multicollinearity, one variable had to be removed from the independent variables in the second stage regression. The likely candidate for removal is solvency since it has the highest correlation with profitability as seen in Table 5 (coefficient -0.254).

The results from the 2SLS regression as shown in Table 9 indicate that our previous results from the OLS-regression stands as the association between Disclosure Score (DS) and our proxy for information asymmetry (bid-ask spread) is negative and highly statistically significant.

Table 9

2SLS regression on proxy for information asymmetry on disclosure score, size, turnover, volatility, ownership and profitability

Period ^a	Intercept	DS ^b	Size	Turnover	Volatility	Ownership	Profitability	R ²
$\text{Spread}_t = \alpha_0 + \alpha_1 \text{DS}_t + \alpha_2 \text{Size}_t + \alpha_3 \text{Turnover}_t + \alpha_4 \text{Volatility}_t + \alpha_5 \text{Ownership}_t + \alpha_6 \text{Profitability}_t + \varepsilon_t$								
Year	0.072 (6.807)*** ^c	-0.030 (-3.118)***	-0.004 (-3.236)***	0.005 (1.506)	0.028 (4.201)**	0.019 (2.627)***	0.091 (2.565)**	0.598
Quarter	0.082 (6.222)***	-0.030 (-2.475)**	-0.004 (-2.513)**	0.005 (1.250)	0.038 (4.551)***	0.024 (2.645)***	0.122 (2.777)***	0.580
Month	0.100 (6.989)***	-0.040 (-3.086)***	-0.006 (-3.607)***	0.008 (1.723)*	0.038 (4.155)***	0.025 (2.550)**	0.118 (2.469)**	0.587
Week	0.133 (5.747)***	-0.057 (-2.693)***	-0.007 (-2.604)**	0.012 (1.748)*	0.057 (3.919)***	0.036 (2.268)**	0.186 (2.430)**	0.469

^a Period is the time period after the disclosure date that the median spread has been measured^b DS is the firms' disclosure score on the 62 indicators. Size is the log of the market value of equity. Turnover is the log of the median daily share turnover ratio during the year. Volatility is calculated as the log of the standard deviations of daily returns during the year. Owner is the % of total shares held by block holders of more than 5%. Profitability is return on capital employed calculated as net operating profit after taxes scaled by capital employed.^c Significance levels quoted above are for a two-tail test of statistical significance.* Significant at $0.05 < \alpha \leq 0.10$ ** Significant at $0.01 < \alpha \leq 0.05$ *** Significant at $\alpha \leq 0.01$

7.2 Results

The results shown both in the preliminary analysis through descriptive statistics and Pearson's correlation coefficients indicate a negative association between Disclosure Score (DS) and our proxy for information asymmetry (bid-ask spread). This is confirmed in the OLS-regression where we conclude that the negative association is statistically significant at the 0.05 level for all time periods measured except for quarter. These results are robust even when testing the statistical regression model through a time and firm fixed effects. Breusch-Pagan test for heteroscedasticity and a 2SLS model for self-selection bias.

An interesting topic of discussion is why the association between bid-ask spread measured on a quarterly basis and Disclosure Score (DS) was not statistically significant when it in fact was significant for all other time periods. Our reasoning develops from theory on the informational environment. The annual report is of course not the only disclosure during the year, another very important piece of information is the quarterly report. All companies in our sample provides quarterly reporting as it is mandatory in Sweden and the report for the first quarter is published in

the time window where we measure the bid-ask spread on quarterly basis but not on monthly basis. This implies distortion in the information asymmetry around the publishing of the first quarter report according to our theories on information acquisition.

The theory regarding information acquisition states that informed traders will try to acquire private information ahead of the distribution of the quarterly report and this will be taken into consideration by the market maker. The market maker will therefore increase the bid-ask spread in anticipation of the report to avoid losses from trading with informed traders. As a result of this, we suspect that the effect of information acquisition distorts the effect from increased disclosure when bid-ask spread is measured on a quarterly basis. We think this is the reason why the association is not statistically significant for this time period.

What differentiates our study is our focus on different time periods and it is therefore interesting to comment upon the differences. What is readily observable is that the betas of the explanatory variables decrease the longer time period after disclosure date that is measured. An explanation for this might be that the more information is provided; the lower is the effect of our explanatory variables on the dependent variable. Since that there is a steady flow of information over the year including press releases and quarterly reports among other things, it seems as though the value of the annual report diminishes over time. Although, the effect from the disclosure in the annual report is, according to our study, permanent, in the sense that the effect is statistically significant until the next annual report publication.

Another explanation why the betas decrease depending on time period is in line with theory regarding a rich information environment. It states that the richer the environment, additional disclosure decreases in importance and effect. This would suggest that measuring over a longer time period, meanwhile information is continually distributed, the effect of the annual report decreases. This is in line with our findings and we can therefore give empirical evidence for the theory.

Although, looking at the complete study, we can conclude that our hypothesis regarding the negative association between voluntary disclosure and information asymmetry is confirmed and statistically significant.

7.3 Discussion of potential errors

Through the statistical method we control for several potential sources of error. We consider the adjustments carried out sufficient to correct these potential errors. What might still bias the results are potential errors in the collected data. All data have been handled manually in excel for formatting; this entails the risk of human errors in the handling. We have also mentioned possible subjectivity in the rating of annual reports. Controlling the ratings, both individually and in collaboration between the authors has minimized that risk. Each index factor for each report have been discussed and controlled by both authors.

A major issue concerns the dates of publishing of the annual reports. The majority of dates are reliable but the few that we had to base on qualified estimates might differ to some extent. Most firms publish their annual report in a small range of days from year to year, given that and the input from the IR-department we believe the potential error to be small but not completely negligible, especially when bid-ask spread is measured on a weekly basis.

7.4 Comparison with other studies

It is interesting to compare our results with other studies as our institutional setting is different from the US; hence, our results give new perspectives on the effect of voluntary disclosure on information asymmetry. First and foremost, the comparability of our study is when the relative bid-ask spread is measured on a yearly basis as this is the common practice and we have not found any research covering different time periods in the sense that is performed in this study. As a result of this, this is the time measured that will be compared below and displayed in Table 10.

Table 10 includes US studies and Petersen and Plenborg study on Danish companies. What differentiates the Swedish institutional setting from the US is the higher degree of disclosure freedom, companies are more able to choose what to disclose. Similar to the reasoning by Petersen and Plenborg (2006), the setting in Sweden and Denmark have in common a high level of ownership concentration, lower litigation costs and lower investor protection than the US. Although, the results shown in Table 10 indicate that the main conclusions when comparing the Sweden and the US is that the central parts show similar results. The sign on disclosure is the same in all studies comparing relative bid-ask spread and statistically significant at the 0.05 level or better.

Table 10

Comparison of studies on the association between disclosure quality and various proxies for information asymmetry

	Dependent variable	Sign on disclosure	Significance level	Explanatory power (R^2)	Control variables
Welker (1995)	Bid-ask spread	negative	0.01	62.6%	Standard deviation (return), price per share, trading volume
Botosan (1997)	Expected cost of equity	negative		13.5%	Beta, size
Sengupta (1998)	Credit rating	negative	0.05	66.0%	D/E, margin, size, asset, maturity, yield, convertible, subordinated debt, interest coverage ratio
Leuz and Verrecchia (2000)	Bid-ask spread	negative	0.05	81.6%	Size, volume, volatility, free float, Investor Mills ratio
	Trading volume	positive	0.05	37.5%	
	Volatility	positive	0.10	22.3%	
Hail (2002)	Expected cost of equity	negative	0.01	37.8%	Beta, size
Botosan & Plumlee (2002)	Expected cost of equity	positive		5.1%	Beta, size
Petersen & Plenborg (2006)	Bid-ask spread	negative	0.01	29.4%	Beta, size, solvency, profitability, ownership
	Trading volume	positive	0.01	18.6%	
Results based on Swedish data (this study)	Bid-ask spread	negative	0.05	60.0%	Size, turnover, volatility, ownership, profitability, solvency

Notable is that the explanatory power of our regression model is in line with studies from the US. Botosan (1997) and Botosan & Plumlee (2002) are exceptions with low explanatory power of 13.5% and 5.1% respectively and no statistical significance, possible due to the limited number on control variables, only using beta and size. Although, the conclusion from the comparison is that the impact from increased disclosure on information asymmetry seems not to be sensitive to the different institutional settings between countries.

8. Conclusion

8.1 Inference

What conclusions can be drawn from the above results? We find that there is a negative association between level of disclosure and information asymmetry. Firms that disclose more comprehensive information in their annual reports experience a lower information asymmetry between informed and uninformed traders. Conversely, a firm can lower the information asymmetry by improving the flow of information to the market. This concludes our early reasoning in the principal-agent theory. This also implies strong incentives for firms to increase their disclosure. A decreased information asymmetry theoretically leads to lower cost of capital. That decrease must however be weighed against the cost of increasing disclosure before any final conclusions can be drawn. Another conclusion is that the information environment is increasingly getting richer, potentially decreasing the marginal effect of increased disclosure.

The question regarding if our sample is representative for the population is the next point. Since we have only selected companies from one industry we cannot draw strong conclusions whether this is true or not. Although, we believe that the main findings regarding the association between disclosure level and information asymmetry are robust regardless of industry.

8.2 Reliability

The reliability of this report should be considered reasonably high, meaning the possibility of being able to repeat the study with the same results. The main area of concern should be the elements of subjectivity in the rating of the annual reports. We have minimized this through precautions to be as sure as possible to give a fair scoring regardless of company. Due to the subjectivity of the grading, repeating the study would perhaps result in slightly different results, although the main conclusions are expected to be in line with our findings.

8.3 Validity

Turning to the statistical method of this study, we can conclude that we receive similar results when testing the regression for robustness, self-selection bias in disclosure level and fixed effects. These are rigorous checks to control for statistical errors due to heteroscedasticity and other

effects. The validity of our chosen approach where we also study the effects on shorter time periods can be discussed. An area of concern is that a few of the disclosure dates are missing and had to be estimated according to pattern and qualified estimates by the companies' IR-departments. This mainly affects the tests measured on weekly basis as this is only five days of trading and hence affected the most if the disclosure date is wrong. The strongest conclusions can therefore be drawn statistically from the analysis based on longer time periods.

Comparing our study with previous literature on the topic, we can see that our model has a good explanatory power and this indicates a good regression model, avoiding omitted variables that could have affected the outcome.

Overall, through the rigorous statistical tests performed and the carefulness when selecting variables based on previous literature assures that our model and the results show what they are intended to show.

8.4 Generalizability

There are several aspects on how generalizable this study is; industry characteristics, time and the geographical aspect is a few. This study is on a sample of 22 industrial companies in Sweden. We cannot be sure that these results apply for the total population of listed companies at the Stockholm Stock Exchange. The information environment for other industries might differ from that of the industrial industry although the general conclusion that increased disclosure reduces information asymmetry should still hold true. What is seen in most studies is that indexes are constructed and used for specific industries, although, the results from these studies should also be representable to draw wider conclusions regarding the aforementioned association. Studies have been performed in different industries with similar results and we therefore conclude that our results can be generalized for other industries.

If turning to the time aspect, empirical results in this study as well as other indicate a general increase in information from companies to investors. This could mean that the information environment today is far richer than in 2004. Although, the results from our study should be generalizable for different time period, as we have controlled for time fixed effects in our regression and due to the fact that there are several other studies investigating other time periods with the same conclusions.

Studies performed in the US, Germany, Denmark and Switzerland show similar main results as for Sweden. This implies that the results are generalizable to some extent when it comes to geography. This is however only true for the basic conclusions and the exact results cannot be expected for any other country due to different institutional and regulatory settings. The Danish results are close to the Swedish and a conclusion would be that the institutional settings are alike, giving similar results. A special emphasis is given to the information environment in different countries as we do not know the effect in a too rich environment. If the environment is rich, increased disclosure might not have the same effect on the information asymmetry. It would therefore be interesting to continue studies on a later time period under IAS/IFRS to see if there is an optimal level of disclosure and if increases in information in such a setting can actually have negative consequences.

9. Concluding remarks and suggestion for future research

This study aimed to examine the association between the level of disclosure and information asymmetry and furthermore to develop a better understanding of the effect over time by testing for different time periods. The hypothesised negative association in the aforementioned relationship proved to be true in the empirical findings and the effect proved statistically significant for all time periods except on a quarterly basis. This is possibly due to the launch of the quarterly report distorting the effect from a change in disclosure. The study regarding the time effect is interesting since it has not been done in previous literature and we can statistically draw the conclusion that the effect is strongest immediately after the publication of the annual report

Suggestions for further research would be to proceed from these results, taking it one step further and analysing the effect on cost of capital as well. We consider that to be a natural continuation as changes in cost of capital could be described as an explicit result of changes in information asymmetry. That would help to better explain the economic consequences of a decision to change the level of disclosure made by firms.

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Thompson Reuters Datastream

Appendix A

Strategic issues (12 indicators)

A statement of corporate goals or objectives is provided?
A general statement of corporate strategy is provided?
Actions taken to achieve the corporate goal are discussed?
A time frame for achieving corporate goals is provided?
Attitude towards ethical questions is provided?
Strategy towards environmental issues is provided?
Detailed segment performance is provided?
Changes in ROCE or EVA are provided?
Commercial risk assessments are provided?
Financial risk assessments are provided?
Interest or exchange risks are discussed?
Other risk assessments are discussed?

Competitive landscape and outlook (13 indicators)

The principal markets are identified?
Specific characteristics of these markets are described?
The market sizes are estimated?
Market share are provided?
The competitive landscapes are discussed?
Barriers to entry are discussed?
The market growths are estimated?
Change in market shares is discussed?
Impact of barriers to entry on profits is discussed?
The impact of competition on profits is discussed?
A forecast of market share is estimated?
Impact of barriers to entry on future profits is discussed?
The impact of competition on future profits is discussed?

Production details (13 indicators)

A general description of the business is provided?
The principal products/services are identified?
Specific characteristics of these products/services are described?
Speed to market is discussed?
R&D expenditures are discussed?
Investments in production are discussed?
Product development cycle is discussed?
Ratio of inputs to outputs is discussed?
New products are discussed?
Rejection/defect rates are discussed?

Volume of materials consumed is discussed?
Changes in production methods are discussed?
Changes in product materials are discussed?

Marketing strategy (13 indicators)

Marketing strategy is provided?
Sales strategy is described?
Distribution channels are described?
Sales and marketing costs are provided
Brand equity/visibility ratings are discussed?
Customer turnover rates are discussed?
Customer satisfaction level is discussed?
Customer mix is discussed?
Revenues from new products/services are discussed?
Order backlog is provided?
Percent of order backlog to be shipped next year is provided?
Amount of new orders placed this year is provided?
Change in inventory is discussed?

Human capital (11 indicators)

Experience of management team is discussed?
Description of workforce is provided?
Amount spent on education is provided?
Employee retention rates are provided?
Average revenue per employee is provided?
Average age of key employees is provided?
Age of key employees is provided?
Other Measurement of intellectual capital is provided?
Investment in ERP is provided?
Strategy for measurement of human capital is discussed?
Strategy regarding ERP system is discussed?

Appendix B

Atlas Copco
Volvo
Sandvik
SCANIA
ASSA ABLOY
ABB Ltd
SKF
Alfa Laval
Hexagon
Skanska
Trelleborg
NCC
SAAB
NIBE Industrier
Peab
SWECO
Beijer
Addtech
B&B TOOLS
Nolato
Fagerhult
Gunnebo