Stockholm School of Economics
Master Thesis in Finance

INSIDER TRADING AND ANALYST COVERAGE

- Testing the crowding out hypothesis and its implications on market efficiency

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ABSTRACT

In this paper we study the relationship between insider trading and analyst coverage and test the hypothesis that insiders crowd out analysts in order to examine the effects of insider trading on market efficiency. The study is based on insider transactions taking place on the OMX Stockholm Stock Exchange between 1997 and 2007 and the impact of insider trading on analyst coverage is tested at the firm-wide level through zero-inflated Poisson (ZIP) and Tobit regressions including analyst coverage as the dependant variable and insider trading as an explanatory variable. Variables that in previous research have been proven to affect analyst coverage, such as firm size, liquidity and ownership structure, are also included as explanatory variables.

We find evidence of a significant, negative relationship between insider trading and analyst coverage, indicating that insider trading has signaling effects.

Key words: Insider trading, analyst coverage, market efficiency, ZIP

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1. INTRODUCTION

The distribution of information is an essential part of efficient markets. There are several actors on financial markets that are more informed than the public and for a market to reach higher efficiency levels this information need to reach the public. The idea behind analyst coverage is to promote market efficiency by spreading information to lesser informed parties and thus increasing the speed with which news are incorporated in the market. Analysts covering a company collect information from various different sources, and then use their own market quantifications to construct a valuation for the company that is sold on to clients and potential investors. Analyst valuations are aimed at incorporating all of the publicly available information into a valuation that combines the firm's internal value and market prospects. These analyst activities are important to the efficiency of financial markets as they pass on information and thus increase the amount of information that is reflected in share prices (Dempsey 1989).

However, while analysts interpret information that is already public, there is a way of spreading information that has not yet been disclosed, through signaling by another informed party, an insider. An insider is generally described as an officer, director or key employee of a company, a person owning 10% or more of the company's stock or anyone who has inside (non-public) information. Naturally, the information of an insider is not of the same kind as that of an analyst, but rather more firm-specific. The insider might have knowledge about future business strategies and deals that the public has not yet been informed of, and can thus to an extent predict the future cash flows of the company.

In 1992 Fishman and Hagerty (1992) provided a theoretical framework for analysing the impact of insider trading on informed outsiders. By introducing insiders in the model, the number of equilibrium analysts decreased remarkably. The presence of insiders affects the expected return for informed outsiders, such as analysts, by insiders revealing information to the market before it is publicly available as well as by losses incurred by analysts or their clients in trades against insiders.

On an efficient market all information available is incorporated into stock prices. Do insiders have a place in this market? Does the information conveyed by insiders actually have value to outside investors? Here, opinions are largely divided. It could be argued that insiders do not have enough information to correctly value their own company in relation to other firms and thus that their signaling effects are of no value.

It could also be argued that insiders convey different information to the market than analysts do. Given the scope of the analyst's knowledge and build up of her valuation from financials, reports, peer valuations and market outlook, it is reasonable to assume that the analyst has better knowledge of the basic valuation, while the insider's knowledge captures changes and insider trading communicates new, firm-specific, information quickly.

In most developed economies insider trading is regulated. According to Swedish law an insider is someone who is employed by or has another position that normally implies that he or she has knowledge of circumstances that has impact on stock prices or the prices of other financial instruments and thus can be said to be in possession of inside information (Svensk författningssamling, Insider strafflag , SFS 2000:1086). An insider is prohibited to use this information to affect stock prices. In reality, however, insiders are not completely prohibited from trading in the stocks of their firm, although trading before certain high-impact events such as financial reports is illegal and all insider trading is closely monitored. An insider that sells or buys stock must report this to Finansinspektionen within five days of the trade. Insiders thus provide the public with information through trading in the stock of their company, as these trades are disclosed and available to the public. As previously mentioned however, the value of this information has been debated. An insider might know more about the specific business details of the firm, but does not necessarily have the same knowledge of valuation theory competitors' future prospects and market conditions as an analyst and might therefore have problems putting her firm into context and value it correctly.

In his 1985 article *Continuous Auctions and Insider Trading*, Kyle (1985) develops a model of insider trading with sequential auctions and a single inside trader who exploits her monopoly power over time in order to examine the "informational content of prices, the liquidity characteristics of a speculative market, and the value of private information to an insider." (Kyle 1985, p.1315)

Kyle's model illustrates that the strategic exercise of monopoly power by an insider does not have to be contradictory to efficient price allocation. Even though it might be possible for the insider to exploit her knowledge, on a market with continuous trading she is only able to do so initially, until the new information that her trading provides has been incorporated into stock prices. Thus it can be argued that insider trading leads to the incorporation of new information into the market, which would increase efficiency, provided that the information is in fact “correct”.

Another aspect on insider trading and concentrated ownership is given by Holmström and Tirole (1993) who concluded that the amount of information contained in the stock price depends on the liquidity of the market. When a market is efficient it incorporates performance information that cannot be extracted from the firm’s profit data. This gives rise to the opinion that an efficient stock market should be used for monitoring performance as it provides information that the board of the company might have overlooked. A board uses subjective information that is not easily translated into compensation decisions. Stock prices are important not because they are accurate, but because they are objective, third-party performance monitors. This gives further strength to the argument that insiders and the market provides complimentary information.

To conclude whether or not there is any value captured by insider trading, it has been studied whether or not insider trading is profitable and the insider actually gains anything from her trading. A study on the American market concluded that insider purchases earn abnormal returns of more than 6% per year (Jeng et al. 2003). On the Swedish market Sjöholm and Skoog (2006) in their master thesis concluded that both buy and sell transactions for insiders on the Stockholm Stock Exchange provided abnormal returns on both short-and long-term horizons.

It can be argued that the abnormal returns on insider trades are due to public belief in the information provided by insiders and trading upon the signaling of the insider. This would imply that insider trading has a negative effect on market efficiency as the information does not actually contain the value that it was believed to have and that market prices thus would capture flawed information.

If the information of insiders has value, or is believed to contain value, insiders would crowd out analysts and analyst trading frequency decrease analyst following as it would increase competition. As concluded by Fishman and Hagerty (1992) analyst following is costly and will thus decrease if the analyst does not expect to be paid enough to at least break even. Even if analyst information and insider signalling are complementary, there are bound to be areas where the two overlap and thus induces competition between insiders and analysts in providing information to the market. In addition, buying stocks in companies with high frequency of insider trading poses a risk of trading against a more informed counterpart - thus insider trading can undermine the customer base for analyst reports. If there exists a crowding on analyst coverage this could thus be explained both by an indirect and a direct, with the indirect effect being the risk of trading against an insider and the direct being competition between insider signals and analysts.

Since the regulation of insider trading plays an important role in economies with developed stock markets and is vital to the public's trust in the financial system, this is an important question to consider.

1.1 Purpose and contribution

In order to investigate the market impact of insider trading this paper seeks to further research the information given by insiders and analysts and their respective importance. This will be done by testing the relationship between insider trading and analyst coverage at the firm level. This relationship has been established at a national level by the cross-country analysis of Bushman et al (2003). We aim to test these results at the firm-wide level with regression analysis with analyst coverage as the dependant variable and including control variables that in previous research have been established to have an impact on analyst following. When testing the results at a firm-wide level we use disclosed insider transactions and can thus examine the signaling effect of actual insider trading rather than that of insider trading regulations or insider ownership. The relationship between insiders and analysts has previously neither been studied on the Swedish market nor on the firm level for a data sample of this size. We will also test whether the crowding out effect still occurs if the risk of trading against an insider is decreased to a minimum, which provides complimentary evidence to earlier research that insiders' trading activities reveal information to the market.

1.2 Outline

The rest of the paper is organized as follows. First we go through previous research on insider trading and its effects on analyst coverage in more detail. Then the theoretical background of the control variables employed is presented. This is followed by our hypotheses and sub-hypotheses. We then present our data set and the methodology used as well as our main results. The thesis in finalized by the analysis of these results and the conclusions drawn from it.

2. THEORETICAL AND EMPIRICAL DISCUSSION

2.1 Comparable research

The effects of insider trading, especially its impact on market efficiency but also on firm value have been extensively studied, along with its economical impact. Researchers have here been of divided opinions. Manne (1966) and Dye (1984), among others, have found insider trading to increase firm value, while others, for example, Fischer (1992) concluded that it had a negative effect on the value of a firm.

The theoretical relationship between insiders and investment advisors, that we aim to study in this thesis, has also to some extent been established by Bushman, Piotroski and Smith (2003) who examined the association at a country level, but focused on insider trading regulations rather than actual insider trading. The authors analyzed the initiation, adoption and first enforcement of laws prohibiting insider trading in a number of countries. They argued that enforcement activity reduced insider trading occurrence and also found that analyst activity increased after the first enforcement activity. This was, however, only found to be true for the first enforcement and not the other events tested; the adoption of insider laws and the increase of restrictions within the same law.

Another researcher, Bhushan, examined the relationship on a firm level. Bhushan (1989) include insiders in his article on firm characteristics and analyst following and found a significant negative correlation between the insider variable and analyst coverage. The insider variable he used, however, was not insider trading but rather the percentage of shares in a firm controlled by insiders. An increase in the percentage of shares had a negative effect on the number of analysts following the firm. Bhushan discusses several reason as to why, one being that the more shares are held by insiders the lower the number of shares on the market and thus less demand for analyst services. Furthermore, Bhushan argues that increased insider holdings might be associated with increased secrecy, for example, and may thus increase the cost of providing analyst services.

In *Do Insiders Crowd Out Analysts?* Gilbert et al. (2006) examine the impact of firm-year aggregate insider trading intensity on the level of analyst coverage. Employing transaction data from New Zealand and using count models as well as censored regression, they concluded that insider trading had a significantly negative effect on analyst following. The sample employed consisted of 83 companies, listed on the New Zealand Exchange (NZX) between 1997 and 2003 and two different measures of analyst coverage were used: the number of analyst forecasts available for a company at the end of the calendar year and the percentage of the total number of analysts following companies that had provided a forecast for the company in question.

2.2 Determinants of analyst coverage

The dependent variable of the analysis and what we are aiming to explain with our models is analyst coverage. That a firm is covered by analysts means that there are analysts providing at least one annual earnings forecast for the firm.

The main hypothesis is that insider trading has negative affects analyst coverage, but as insider trading is not the only determinant of analyst coverage a number of additional variables have been constructed in order to isolate the impact of insider trading. These additional explaining variables included are constructed to control for factors that have been established to affect analyst coverage in previous research. The variables controlled for are market value of the traded company, liquidity, price over cash flow, leverage, beta and a measure of how many per cent of the shares that are “tightly held”, that is, controlled by share holders who hold more than 5 per cent of the company each or by insiders. Finally, time trends are controlled for using a time dummy variable.

Firm size is almost a given in this context and it has be shown by several researchers (such as Bhushan 1989) that larger firms attract greater analyst coverage. Larger firms are also more likely to generate investment banking fees and brokerage income for securities firms (Fortin, Roth 2007). The firm size variable is thus also expected to be positively related to analyst coverage in the sample.

As shown by Dahlquist, Pinkowitz, Stulz and Williamson (2003) liquidity impacts analysts’ coverage decisions in somewhat the same manner as firm size. The more liquid the stock the more interested the public is in it and the more likely the bank is to gain brokerage commissions etcetera. Good analyst coverage is associated with increased liquidity and the research of Roulstone (2003) suggests that this is done through analysts increasing the amount of firm information that is publicly known, so it is difficult here to separate what is actually determining what.

Furthermore, analysts tend to shy away from companies with very concentrated share ownership, as discussed by Lang et al. (2003), the exception here being companies controlled by the government, which complements the findings of Bhushan (1989) as governments are long term owners who are not very likely to do any trading in the firm's share, which implies that governmental ownership could not be used as a proxy for insider trading. As Gilbert et al (2006) concluded for the New Zealand market, the Swedish market is also characterised by high levels of institutional holdings and family-controlled companies. This situation suggests that concentrated share ownership could have an impact on analyst coverage, which is the reason as to why we have chosen to incorporate it into our analysis.

In the literature on analyst coverage a firm's growth rate has also been discussed as an influencing factor. Ang and Ciccone (2001) used price over cash flow and earnings over price as proxies to discover growth firms. The logic behind doing so is that analysts might shy away from companies with unpredictable earnings patterns, which is exactly what high growth firms are. Other studies have used book-to-market as the unpredictable earnings proxy. In our analysis we have chosen to include price over cash flow as we believe it to be a more economically relevant variable. Earnings are influenced by a number of other factors than simply sales growth, many of them non-cash, such as depreciation and amortization. Cash flow is thus a better proxy for future growth than earnings as it does not include non-cash earnings.

To account for the company's risk of default, a leverage variable, debt-to-equity at the end of the year, was included. Given the cost of information gathering, analyst should find it less attractive to cover companies that have a high risk of default. However, it could also be argued that possessing correct information is more valuable in times of high risk of default. Nonetheless, considering that a large portion of the information gathering are sunk costs in case of default, analysts presumably find it important that the companies covered are expected to persist in the long run. Thus, the negative impact of high default risk is believed to be dominating.

The reasoning behind including beta as an explaining variable is that the higher the volatility, the higher the potential gains from additional information. This was studied by Bhushan (1989) who found that stock return volatility is positively related to the number of analysts following a firm’s stock. We expect this to be true for beta in our sample as well. Using beta and not variance can be motivated by the fact that analyst performance, typically, is measured against market performance. Thus beta gives the comparative as it is a measure of share price volatility in relation to the market. An analyst who correctly predicts whether a stock is over- or under-valued compared to the market has a higher potential to significantly outperform the comparable index if the stock has high beta value. This measure of volatility has also been used in previous research. Fortin and Roth (2007) employed beta as the share price volatility measure and found it to be positively related to the number of analysts that cover a firm.

2.3 Hypotheses and control variables

Hypothesis A: Insiders crowd out analysts, and thus an increase in insider trading leads to a decrease in analyst coverage.

Hypothesis B: Insider trading conveys information to the market.

Furthermore we have included a number of control variables that according to economic theory should have the following effect on analyst coverage:

Sub-hypothesis 1: Size expected to have a positive impact

Sub-hypothesis 2: Liquidity expected to have a positive impact

Sub-hypothesis 3: Price over cash flow expected to have a negative impact

Sub-hypothesis 4: Percentage of tightly held shares expected to have a negative impact

Sub-hypothesis 5: Debt-to-equity expected to have a negative impact

Sub-hypothesis 6: Beta expected to have a positive impact

3. DATA DESCRIPTION

3.1 Proxies

Analyst coverage, *Analysts,* is the dependent variable. The measure of analyst coverage was constructed using the number of analysts following a company during a specific year, where the number of analysts following a company is defined as analysts providing at least one annual earnings forecast for the firm. This data was provided by Factset and covers all companies on the OMX stock exchange.

We have also included a variable called *Rel_Analyst*, which is measured as the percentage of the total number of analysts that follow a firm. This variable will be used in the Tobit regressions, while *Analysts* is used in the ZIP regressions.

The insider trading variable used, *Rel_Insider*, is a relative measure of insider trading incidence. We have aggregated all of the insider trades for all stocks on the OMX Stockholm stock exchange between 1997 and 2007 reported by Finansinspektionen. The variable was then constructed by dividing the number of stocks traded by insiders with the total number of stocks traded over the market in the company. Thus, *Rel_Insider* can be seen as the probability of trading against an insider. Insider trades that were of the exact same size, made by the same insider and within 4 days of each other have been eliminated in an attempt to eliminate trades that are only transfers between insiders' depots or holding companies - and thus have no signaling effect. It should also be noted that, as Finansinspektionen record all trades and Thomson, which provides data for total stocks traded, only records trades made over the market, *Rel_Insider* can in the most extreme examples exceed 100 percent. The extreme values of *Rel_Insider* is clustered within a few companies and the maximum value reaches as high as 2200 per cent. Another potential explanation for the most extreme values could be errors in either of the two databases. Either way, these extreme outliers naturally create problems fitting the model in the very far end – which is why a modified version of *Rel_Insider*, *Mod_Insider*, was deemed necessary. By analyzing a histogram of *Rel_Insider*, and after discussion with a representative of the statistical department[1] percentages exceeding 7.5 were eliminated from *Mod_Insider* and thereby the corresponding regressions. Data for

[1] Per-Olov Edlund

insider trading was provided by Finansinspektionen and also covered all stocks traded on the OMX stock exchange.

The natural logarithm of the average market value during each year is used as the firm size proxy, *Size,* as it is assumed to affect continuously throughout the year. The natural logarithm of the market value was used in order to adjust for the highly positive skew in variable and thus bring outlying data closer to the bulk – as is routinely done.

Liquidity has been included in the model as the percentage of the firm's stocks that has been traded during the year. It is important to note that this relative measure misses out on the size difference in trades between different companies. An alternative measure, in order to capture this aspect, could be the natural logarithm of the value of all traded stocks during the year. However, this variable would then run into multicollinearity problems with the *Size* variable. These problems are circumvented using the above-mentioned relative measure. However, as a natural consequence of this, the value difference in liquidity will primarily be captured by *Size*.

There are several alternative measures for gauging future growth – all of them with their inherited weaknesses. Reasonable measures that have been used in previous research are price-to-cashflow, price-to-earnings and book-to-market. As earnings as well as book values are highly influenced by a number of factors that do not directly correspond to sales growth, many of them non-cash, such as depreciation, amortization and accounting standards, we have used price-to-cashflow, PCF. This measure was also used by Ang and Ciccone (2001) and we believe it to be the economically most relevant variable. Readers concerned with the weakness in this measure of future growth might be comforted by the fact that excluding *PCF* does not significantly alter any of the results.

The impact of concentrated ownership structure was analyzed measuring the percentage of the total stocks that are "tightly held" - defined as stocks owned by non-financial institutions holding more 5 per cent and all stocks held by insiders. Data for this *Owner* variable was provided by Thomson Datastream.

Measuring the risk of default is complicated – personated by the current widespread financial crisis. The measure used in this paper is debt-to-equity, *DE*. However, this measure naturally does not capture the entire picture when gauging the risk of default. As discussed earlier, even though the impact of high risk of default on analyst coverage is somewhat ambigious, the negative impact is believed to be more prominent.

Volatility was measured using beta, *Beta*. Beta was calculated against the OMX All Share index using daily data. In order to adjust for a reasonable lag in the effect of changing volatility, a lag of one year was used.

In order to adjust for possible time-trends, a simple time dummy, *Time*, was added.

3.2 Descriptives

Table 1

Variable	N	Mean	Std. Dev	25^{th} Percentile	Median	75^{th} percentile
Analysts	1228	7.3192	9.2147	1.0000	4.0000	10.0000
Rel_Analysts	1228	0.0071	0.0093	0.0010	0.0037	0.0091
Rel_Insider	1228	0.1255	1.0007	0.0003	0.0031	0.0233
Mod_Insider	1060	0.0090	0.0151	0.0001	0.0017	0.0104
Size	1228	7.9793	1.9705	6.5089	7.7623	9.2279
Liquidity	1228	0.7365	0.9005	0.2407	0.5209	0.9355
PCF	1228	14.5775	210.6354	5.3700	9.4250	16.1450
Owner	1228	0.3416	0.2090	0.1780	0.3318	0.4822
DE	1228	0.9698	1.9766	0.1072	0.4512	1.0255
Beta	1228	0.6616	0.4166	0.3446	0.6104	0.9149

Table 1 provides descriptive statistics of the variables employed in the regression. The first variable, *Analysts*, is the dependent variable used in the ZIP regression and has a mean of 7.3. Thus, on average a company on the OMX stock exchange was covered by 7.3 analysts during the sample period. This mean is significantly higher than the mean found for analysts' coverage in Gilbert et al (2006) and in Bushman et al (2003) – where the mean was found to be 2.8 and 2.6 respectively. This can primarily be explained by the fact that some explaining variables have missing values for of the smallest companies - where there presumably also is weaker analyst coverage. These companies have thus been removed from the Stata regressions. This also explains why 16.7% of the companies do not have any analyst coverage, compared to 33.2 % in the study made by Gilbert et al. Using only the data for analytical coverage, the mean is 3.4 – bringing the data closer to the means observed in earlier research.

The mean of *Rel_Analysts,* was found to be 0.71%. Once again it should be noted that this does not correspond to the mean of the relative number of analysts covering a company – since analysts covering more than one company will be double counted. However, this measure is nonetheless useful when measuring analyst coverage.

The *Rel_Insider* variable has a mean of 12.6% which should be considered exceptionally high considering the corresponding values for the median and 75th percentile is 0.3% and 2.3%. This is explained by the existence of a few extreme outliers. As proposed earlier, one explanation of values above 1.0 could be that large trades between insiders have been made outside of the market – thus recorded by Finansinspektionen but not accounted for in the Thomson database. A second explanation could be database errors. To mitigate the problems caused by this extreme skew, *Mod_Insider,* has been applied – where insider trading above 7,5% of total liquidity are omitted. *Mod_Insider* has 1060 observations instead of 1228 for all other variables – corresponding to excluding 13.6 per cent of the most extreme values. However, considering the fact that the mean is 0.9 per cent and the median is 0.17 per cent a highly positive skew can still be detected.

In order to reduce the skewness of the data in terms of market size, a log transformation with the natural logarithm has been applied. The untransformed mean corresponds to an average market capitalization of 2.9 bn SEK. The L*iquidity* variable has a mean of 73.7%. However, it should be noted that the sample contains both very liquid and illiquid companies – as indicated by the high standard deviation. The *PCF* variable has a mean of 14.6 and a median of 9.4. The high standard deviation can be explained by the inherited weakness of a measure where the denominator can obtain the value of zero.

The variable *Owner,* carries information about ownership structure but can also be considered a second measure of liquidity. *Owner* has an average of 34.2% and thus indicates that most companies have ownership structure where a significant per cent of outstanding stocks are tightly held. This finding is in line with the fact that a large portion of the Swedish stock market is controlled by family-owned companies. Debt to equity, *DE*, has a median of 97%, although the sample contains firms that are both highly leveraged and firms that use debt very modestly.

Intuitively, the mean of beta should be close to one. However, the fact that the mean has equal weight and the OMX All Share is weighted by market value explains the discrepancy – the mean of beta is 0.66.

Table 2 is a matrix providing cross correlation coefficients and significance levels in italics. Analyzing cross correlations can be useful when exploring whether the variables seem to fit with economic theory and when considering the possible impact of multicollinearity. However, before analyzing in more depth, it should be noted that univariate correlation coefficients can only be seen as indicative and can therefore not be regarded as a statistical test or required to always fit with economic theory.

Table 2.

	Analysts	Rel_Analysts	Rel_Insider	Mod_Insider	Size	Liquidity	PCF	Owner	DE	Beta	Time
Analysts	1										
Rel_Analysts	0.9609	1									
	0.0000										
Rel_Insider	-0.0809	-0.0778	1								
	0.0045	0.0064									
Mod_Insider	-0.2793	-0.2835	1.0000	1							
	0.0000	0.0000	0.0000								
Size	0.7418	0.7105	-0.1369	-0.3061	1						
	0.0000	0.0000	0.0000	0.0000							
Liquidity	0.3136	0.2526	-0.0265	-0.1429	0.2061	1					
	0.0000	0.0000	0.3530	0.0000	0.0000						
PCF	-0.0109	-0.0089	-0.0144	0.0188	-0.0388	0.0298	1				
	0.7027	0.7555	0.6144	0.5404	0.1747	0.2964					
Owner	-0.3298	-0.3227	0.0659	0.1689	-0.2458	-0.3630	0.0133	1			
	0.0000	0.0000	0.0209	0.0000	0.0000	0.0000	0.6423				
DE	0.2308	0.2289	-0.0354	-0.1019	0.2365	0.0521	-0.0012	-0.0976	1		
	0.0000	0.0000	0.2146	0.0009	0.0000	0.0679	0.9676	0.0006			
Beta	0.3747	0.3559	0.0208	-0.0552	0.1929	0.3200	-0.0240	-0.4155	-0.0381	1	
	0.0000	0.0000	0.4674	0.0725	0.0000	0.0000	0.4008	0.0000	0.1826		
Time	-0.0112	-0.1658	-0.0269	0.0628	0.1063	0.1839	0.0052	-0.0388	-0.0412	0.0565	1
	0.6941	0.0000	0.3470	0.0409	0.0002	0.0000	0.8554	0.1741	0.1486	0.0477	

By construction, the two variables *Rel_Analysts* and *Analysts* as well as *Rel_Insider* and *Mod_Insider* and are highly correlated and using any of the two respective measures, analyst data and insider trading has a strong negative correlation. In line with economic theory, analysts seem to prefer covering companies with a large market capitalization – indicated by the strong positive correlation between *Size* and analyst coverage. This finding, together with the fact that *liquidity* also has a highly significant positive coefficient, gives clear evidence that analysts prefer stocks where large trades easily can be carried out without affecting the stock price – creating room and opportunity for larger gains by more customers. Furthermore, *Size* has a positive correlation with liquidity and a negative correlation with *Owner* indicating that larger firms have less concentrated share holder structures which in turn increases the liquidity measure – which also is in line with expectations.

The variable *Owner* co-varies negatively with A*nalysts* demonstrating that analyst coverage is lower in cases where a large portion of the outstanding stocks are tightly held. This is in line with expectations as a more diversified ownership structure indicates a larger customer base. *Owner* also co-varies positively with insider trading since stocks held by insiders are considered to be tightly held. This finding is perfectly in line with the findings of Bhushan (1989) as it confirms the hypothesis that insider stock ownership could be used as a proxy for insider trading – which also is in line with expectations. Leverage, *DE,* has a positive correlation with *Analysts* – opposite to expectations. However, as the full regression will prove later, this correlation should be considered spurious. More interesting to note however, is the strong negative correlation between *DE* and *Owner,* indicating that powerful owners favor less leverage – which is in line with predictions, as large owners, not being financial institutions, should prefer a lower leverage to compensate for their limited diversification. *Beta* co-varies positively with analyst coverage as well as firm size, which is in line with the fact that the sample has a beta mean below one.

4. METHODOLOGY AND MODEL SPECIFICATION

4.1 ZIP regression

Phenomena where the regressand is of the count type and the underlying variable is discrete, and only taking a finite number of values, such as the number of visits to the doctor per year or the number of cars passing through a toll booth in a span of five minutes, are called count data. For this type of data a regression that is non-linear in the parameters should be employed (Gujarati 2003, p.620). Using a regular OLS regression will result in variables that are not well estimated as count data is highly non-normal (UCLA 1). Due to this the Poisson regression model is preferred and forms the basis of a large portion of the literature on count data. However, in this case a simple Poisson regression is not enough.

As mentioned in the data section there is an excess number of zeros in our sample. This is because a zero outcome can arise from there being no analysts reported for the specific company, as well as from analysts choosing not the follow the company due to excessive insider trading or due to a small size or due to any of the other variables in the sample. Because of this any normal linear model specification would under-predict the zero outcome. In order to account for this fact, we have chosen not to use a regular Poisson regression but employed zero-inflated Poisson regressions (ZIP). A ZIP regression allows for the occurrence of excess zeros in the data sample. It assumes that with probability p the only possible observation is 0, and with probability 1 - p, a Poisson(λ) random variable is observed. This specification in suitable for sample displaying an excess number of zeros as it induces overdispersion and is augmented with a point mass at zero (Greene 1994). It is a modification of the Heilbron/Mullahy WZ model, developed by Diane Lambert (1992), and is a two-component model which combines a point mass at zero with a count distribution, in this case a Poisson. Lambert originally applied this model when studying defects in manufacturing. When manufacturing equipment is properly aligned, defects should be more or less impossible, while when the equipment is misaligned defects occur according to a certain (Poisson) distribution (Lambert 1992).

The model is constructed as follows:

$y_i \sim 0$ with probability q_i [1]

$y_i \sim Poisson(\lambda_i)$ with probability 1-q_i

where $log\lambda_i = \beta' x_{i,t}$

In our specific analysis the two different ZIP-regressions below have been employed:

Model 1 uses the relative insider trading measure:

$$\log(\lambda_{i,t})\, x_{i,t}\beta = \beta_0 + \beta_1 Rel\_Insider_{i,t} + \beta_2 Size_{i,t} + \beta_3 Liquidity_{i,t} + \beta_4 PCF_{i,t} + \beta_5 Owner_{i,t} + \beta_6 DE_{i,t} + \beta_7 Beta_{i,t-1} + \sum_j \beta_{9+j} TimeTrend_{i,t}^j \quad [2]$$

Model 2 employs the modified insider variable:

$$\log(\lambda_{i,t})\, x_{i,t}\beta = \beta_0 + \beta_1 Mod\_Insider_{i,t} + \beta_2 Size_{i,t} + \beta_3 Liquidity_{i,t} + \beta_4 PCF_{i,t} + \beta_5 Owner_{i,t} + \beta_6 DE_{i,t} + \beta_7 Beta_{i,t-1} + \sum_j \beta_{9+j} TimeTrend_{i,t}^j \quad [3]$$

where $\sum_j \beta_{9+j} TimeTrend_{i,t}^j$ is a time dummy employed in order to account for trends over time

4.2 Tobit regression

Another regression model that is suitable for these types of datasets is the Tobit regression. Tobit models are designed to make improved estimates where there are either left- or right – censoring (UCLA 2). This censoring means that there is a fixed number on either side of the scale that cannot be exceeded / cannot go below. If we have a sample where information on the regressand is only available for some observation there will be to a larger grouping of "unequals" on that end of the scale (Gujarati 2003).

In this case we have a mixture between continuous and discrete distributions as the analysts have been expressed as a percentage of the total number of analysts in a specific year and therefore, by definition, can only be in the range between zero and one. A regular regression does not take this difference between non-limit and limit observations into account (Anemiya 1973).

The Tobit model was constructed by James Tobin (1958) to describe the relationship between a dependent variable y_i which cannot take on values smaller than zero and an independent variable, or vector, x_i. What the Tobit model does is that it assumes an unobservable variable, y_i^* that linearly depends on x_i, as in a normal linear model. In the Tobit model, however, the observable variable, y_i is defined to be equal to the unobservable (or latent) variable whenever the latent variable is above zero, and zero in all other cases. This only takes into account censoring on one side, and therefore we need an adapted model that is suitable for the double limits of our variable and thus we use a doubly censored Tobit regression, which is defined as:

$$Analysts_{i,j} = Min\left[Max\left[0, Analysts^{*}_{i,j}\right], 1\right] \quad [5]$$
$$Analysts^{*}_{i,j} = x_{i,j}\gamma + \varepsilon$$
$$\varepsilon \sim N(\,0, \sigma^{2}\,)$$

where $Analysts^{*}_{i,j}$ is a latent variable and the regressors in $x_{i,j}$ are the same as in the three equation$s$ $[2, 3,4]$ above in the ZIP section. (Tobin 1958)

As with the ZIP models, Model 1 for Tobit uses the relative measure of analyst coverage and Model 2 the relative analyst variable.

The instant appeal of the ZIP regression model in comparison with the Tobit is that the results of the regression are more intuitively understandable and easier interpreted as it uses the relative analyst variable and not the relative, which is measured as a percentage of the total number of analysts that follow a firm.

5. EMPIRICAL RESULTS AND ANALYSIS

This section will first present the findings of the two regression methods employed, Zero-inflated Poisson and Tobit. The findings presented will then be put in the context of economic theory. Finally, a discussion on the implications of the findings and the conclusions that could be drawn from them will be presented.

5.1 ZIP Results

Table 3 presents the results from the two models using a Zero-Inflated Poisson (ZIP) regression. The difference between the two models is the insider trading variable. Model 1 employs the non-adjusted variable, *Rel_Insider*. However, as earlier discussed, this variable contains a number of extreme values, which creates problems fitting the model in the far end. Model 2 tries to mitigate this problem by employing the adjusted *Mod_Insider* – which excludes extreme values and enhance model fit. Both models employ *Analysts* as the dependent variable.

Table 3 ZIP Regressions

	Model 1				Model 2			
	Coefficient	Std. Error	Z	Sig.	Coefficient	Std. Error	Z	Sig.
_Cons	-1.1017	0.1163	-9.4700	***	-1.0078	0.1245	-8.1000	***
Rel_Insider	-0.0305	0.0340	-0.9000					
Mod_Insider					-8.2025	2.0860	-3.9300	***
Size	0.3666	0.0111	32.9700	***	0.3558	0.0119	29.7900	***
Liquidity	0.0504	0.0228	2.2100	**	0.0357	0.0210	1.7000	*
PCF	0.0001	0.0003	0.4900		0.0002	0.0002	0.6400	
Owner	-0.2799	0.1022	-2.7400	***	-0.2257	0.1030	-2.1900	**
DE	-0.0014	0.0036	-0.4000		-0.0017	0.0035	-0.5000	
Beta	0.2344	0.0424	5.5200	***	0.2405	0.0444	5.4100	***
Time	-0.0184	0.0062	-2.9900	***	-0.0130	0.0062	-2.0900	**

Note: Significance levels – 10% [*], 5% [**], 1% [***]. Standard errors are shown in cursive below each coefficient. The dependent variable in all 3 model s is *Analysts*.

Both models had significant Vuong test scores (1.729 for Model 1 and 2.604 for Model 2) that indicates that the two models are better than standard Poisson regressions.

5.1.1 Insider trading

The hypothesis, that insider trading crowds out analysts is strongly confirmed in Model 2. The finding is significant on a 1 per cent significance level and robust to significant model changes. Moreover, the coefficient is significant, on the conventional 5 per cent level, for exclusion of anywhere from 5 to 45 per cent of the highest values. Thus the model seems correctly specified and robust. In terms of absolute value, the coefficient indicates that an increase of 5 percent in *Mod_Insider* would, on average, decrease the number of analysts covering the specific company by 0.4. Thus, the impact on analyst coverage from changes in insider trading is within reasonable limits – nonetheless, notable. Although the coefficient has the expected sign in Model 1, where the non-adjusted insider trading variable, *Rel_Insider*, is employed, the hypothesis cannot be confirmed on a 10% confidence level. This is explained by the problems created when trying to fit this variable's extreme skew.

The negative and significant coefficient is well in line with earlier research on the impact of insider trading on analyst coverage. Both Bushman et al's (2003) and Bhushan's (1989) research implied that insider trading could have a negative impact on analyst coverage on a firm level. However, with the exception of Gilbert et al.(2006), the testing of this hypothesis has been limited. This study confirmed the hypothesis by employing all major variables previously shown having impact on analyst coverage. By combining this finding with economic theory, a discussion on the economic implications regarding insider regulation and market efficiency will be presented in section 5.3 Analysis.

5.1.2 Control variables

In accordance with predictions and previous research, the coefficient of Size is positive and significant at a 1% level. Thus, sub-hypothesis 1 can be confirmed. The high Z-values of 33 and 30, for the two models, indicate that the Size variable captures a large portion of the variance in analyst coverage – which also was found being the case in the research conducted by Bhushan (1988). It might also be noted that the usage of the natural logarithm on Size greatly enhances the significance of this variable – indicating the aptness of this modification.

The variable *Liquidity* also has a positive coefficient and is statistically significant on a 5% confidence level – thereby confirming sub-hypothesis 2. The positive coefficients of *Liquidity* and *Size* confirm the findings of earlier studies made on analyst coverage (Atiase (1985), Freeman (1987), Bushman et al (2003), Dahlquist et al (2003)) and thus further validates that analysts prefer large companies with high liquidity, in line with economic theory.

PCF is not significant and does not seem to have any significant effect on analyst coverage. Sub-hypothesis 3 could thereby not be confirmed. Considering the high variance in *PCF*, which creates problems fitting this variable in the regression, this is result is not surprising. *Owner* is defined as the per cent of outstanding shares that are tightly held. This variable has a negative coefficient and is significant on the conventional 5% significance level. This is in line with expectations and confirms sub-hypothesis 4; analysts should prefer covering companies with a less converged share holder structure, where their analysis can be of interest for a broader public. This result is also in line with analysis of the univariate correlations and confirms the hypothesis proposed in the study made by Gilbert et al, - where it was proposed that the negative correlation found between high insider ownership and analyst coverage, though not then significant, could partly stem from a higher incidence of insider trading. Furthermore this could be compared to the insider variable in Bhushan's paper, which is constructed as the number of shares owned by insiders. Bhushan for this variable got a negative coefficient of -0.04 and found it to be significant on a 5% significance level.

This paper incorporated *DE* as a proxy for default. The ZIP regression could not confirm sub-hypothesis 5, that the coefficient of *DE* would be negative. Since this measure of default risk has its inherited weaknesses and since the impact on analyst coverage is somewhat ambiguous, this result comes as no shock. However, as excluding *DE* does not significantly alter any of the other results, this matter is not further elaborated on.

In line with predictions and earlier research, the coefficient for *Beta* proved to be positive and significant. Thereby indicating that analysts prefer covering stocks where the volatility against a comparable benchmark, is higher.

5.2 Tobit Results

The results from the Tobit method are, in all important aspects, the same as the results from the ZIP regression method. Examining the sign and significance levels of the coefficients, using the Tobit method, and comparing them to the results obtain using the ZIP regression provides valuable insights concerning the robustness of the results. However, it is important to note that, since the dependent variable used is *Rel_Analysts* and this variables mean is far from the mean of *Analysts*, comparing the two methods' coefficients in terms of absolute values is difficult. In addition, the construction of *Rel_Analysts* makes it difficult to interpret the results from the Tobit regression in terms of absolute numbers.

Table 4 Tobit Regressions

	Model 1				Model 2			
	Coeff.	Std. Error	Z	Sig.	Coeff.	Std. Error	Z	Sig.
_Cons	-0.0188	0.0014	-13.4200	***	-0.0185	0.0015	-12.4800	***
Rel_Insider	-0.0003	0.0002	-1.5200					
Mod_Insider					-0.0306	0.0125	-2.4500	**
Size	0.0037	0.0001	24.6900	***	0.0037	0.0002	23.6500	***
Liquidity	0.0009	0.0003	2.7800	***	0.0007	0.0003	2.4000	**
PCF	0.0000	0.0000	0.6800		0.0000	0.0000	1.0800	
Owner	-0.0030	0.0010	-3.0300	***	-0.0027	0.0011	-2.4800	**
DE	0.0002	0.0001	2.8800	(***)	0.0002	0.0001	2.6600	(***)
Beta	0.0054	0.0007	7.8200	***	0.0055	0.0008	7.2100	***
Time	-0.0009	0.0001	-12.3100	***	-0.0009	0.0001	-11.6000	***

Note: Significance levels – 10% [*], 5% [**], 1% [***]. In cases where the coefficient does not correspond to expectations, a parenthesis is added. Standard errors are shown in cursive below each coefficient. The dependent variable in all 3 model is Rel_*Analysts*.

5.2.1 Insider trading

The conclusion is once again that insider trading crowds out analysts. Using the Tobit regression model, even the unadjusted insider trading variable, *Rel_Insider*, in Model 1 is close to being significant at the 10 per cent confidence level. The *Mod_Insider* variable is, as when using the ZIP regression, significant. It is also worth mentioning that *Mod_Insider* is close to being significant at a 1 per cent significance level. Thus, the usage of Tobit regression provide further support for robustness of the conclusion already made – that insider trading does have a crowding out effect on analyst coverage – and give further support for the main hypothesis.

5.2.2 Control variables

As already been stated, all major finding stemming from the ZIP regression are confirmed using the Tobit regression. Variables that was predicted to have the most impact, and proved to have so using the ZIP model, Size, Liquidity, Owner and Beta, have the predicted coefficient signs and are significant. Thereby, sub-hypotheses 1, 2, 4 and 6 are confirmed once again. The most important conclusion from using Tobit, as an alternative model, is thus the verification of robustness to the use of method and the model specified.

One variable that differs from the ZIP model is *DE*, which attempts to capture the risk of default. The prediction is that the variable would be negative, as the probability of default poses a risk that the analysts efforts and conclusions will be impossible to exploit. As the coefficient is positive and significant, sub-hypothesis 5 cannot be confirmed. However, there are at least three potential reasons for this observation. Firstly, there are significant problems in measuring the risk of default and *DE* is certainly not capturing the full picture. Possibly, *DE* is rather capturing industry differences. Secondly, economic theory predict that beta should increase linearly with leverage – thus the impact of leverage on analyst coverage could be expected have the same positive effect on analyst coverage as beta. Thirdly, in accordance with what was earlier proposed, as the probability of default increases, so does the value of independent and correct information and thus of analyst coverage.

5.3 Analysis

The confirmation of our primary hypothesis provides evidence that there is competition between analysts and insiders. However, earlier research has only swiftly touched on the topic of the nature of this competition, a topic upon which we will now further elaborate. The analysis will then provide further support to the hypothesis that insider trading contains information that is passed on to the market. Thus, hopefully the findings presented in this section can add valuable insight concerning the role of insider trading on efficient markets.

Competition between insiders and analysts can stem from two distinctly different sources. Firstly, higher incidence of insider trading increases the risk for investors to trade against a more informed counterpart. Several studies have previously shown that insider trading creates excess returns. Thus, insider trading induces a cost on the non-informed investors when they trade against an informed insider. This cost, induced on the customers of analysts' reports, should be expected to reduce the analyst coverage of stocks in which high levels of insider trading have been observed. Thereby, insider trading, indirectly, has a negative impact on analyst coverage. Secondly, it is reasonable to assume that the information provided by analysts concerning future profitability in a way competes with the information provided by the signaling effect from insider trading. Thus, insider trading can also directly increase the competition between analysts and insiders on the market for providing stock information.

The confirmation of the hypothesis that insider trading creates excess return provides evidence that insiders have valuable information. Criticism to this conclusion has been put forward, stressing that an alternative reason for insider trading excess return could be a faulty market belief of the information content. However, as prices are believed to eventually reach the real value, a faulty information belief would at the same time provide an opportunity for excess return – by capturing this inefficiency. Thus, the evidence that insider trading, in different markets and over a long time period, creates excess return strongly suggests that insiders hold valuable information. Yet, it does only partly suggest that this valuable information is passed on to the market – the excess return could also be explained by prices gradually reaching their real value. Earlier research give some support for this theory: Kyle showed that value maximizing behavior by an informed insider is to let information gradually be incorporated in the market, and he also discusses the possibility that even insiders could try to make noise trading – in order to increase their return – although his model is not able to capture that.

As suggested earlier in this paper, the crowding out effect of insider trading on analyst coverage can be explained both by an indirect and a direct effect. If the crowding out of analysts through the indirect path could be excluded, insider trading effects through the direct competition with analysts, in providing information to the market, could be tested – thus pose an opportunity for a more direct test of the information content of insider trading, which, as already been stated, has been widely debated – and also provide the main argument for permitting regulated insider trading.

In order to decrease the probability of trading against an insider as much as possible while still maintaining a total sample of statistically significant size, we have performed two regressions with constraints on certain variables that are closely related to the risk of trading against an insider.

By putting a constraint on *Owner and Mod_Insider*, which is done by omitting observations where the owner variable exceeds 15 per cent, and where *Mod_Insider* are above 0.5 per cent, both the risk and the probability of investors trading against an insider is reduced to a minimum. The results from this regression are shown in Table 5 using ZIP regression.

Table 5 ZIP regression with restrictions on Owner and Modified insider

	Coefficient	Std. Error	Z	Sig.
_Cons	-0,0888	0,2600	-0,3400	***
Rel_Insider				
Mod_Insider	-114,3463	44,4498	-2,5700	***
Size	0,2645	0,0248	10,6700	***
Liquidity	0,0501	0,0293	1,7100	**
PCF	0,0004	0,0002	1,5800	
Owner	-0,9938	0,4315	-2,3000	**
DE	0,0059	0,0059	1,0100	
Beta	0,2897	0,0633	4,5800	***
Time	-0,0079	0,0107	-0,7400	

Note: N = 239, significance levels – 10% [*], 5% [**], 1% [***]. In cases where the coefficient does not correspond to expectations, a parenthesis is added to the significance level. Standard errors are shown in cursive below each coefficient. The dependent variable in ZIP is *Analyst.*

Table 6 ZIP regression with restrictions on Size and Modified insider

	Coefficient	Std. Error	Z	Sig.
_Cons	-0.399	0.2461	-1.62	
Rel_Insider				
Mod_Insider	-198.7978	164.3707	-1.21	
Size	0.3018	0.0229	13.17	***
Liquidity	0.0682	0.0336	2.03	**
PCF	0.0003	0.0002	1.29	
Owner	0.0026	0.1245	0.02	
DE	0.0006	0.0042	0.15	
Beta	0.2476	0.0567	4.37	***
Time	-0.0216	0.0082	-2.64	***

Note: N = 321, significance levels – 10% [*], 5% [**], 1% [***]. In cases where the coefficient does not correspond to expectations, a parenthesis is added to the significance level. Standard errors are shown in cursive below each coefficient. The dependent variable in ZIP is *Analyst.*

Tables 5 and 6 demonstrate that the negative correlation between insider trading and analyst coverage persist despite the strict constraints imposed and using a far smaller data set. Other important conclusion that can be drawn for tables 5 and 6 is that, even though some minor changes in the control variables can be detected, nearly all coefficients have the expected sign and are significant. This further confirms that the model is correctly specified. Moreover, it is important to note that the negative relation between insider trading and analyst coverage is robust to even harder constraints. It is also important to note that the higher insider coefficient, using this sample set, cannot be directly compared to the coefficient for the original sample. The reason behind this is that a similar increase of insider trading in these companies and low incidence of insider trading, would imply that unreasonable insider trades would take place - creating a complete shock to the market. The new coefficient is rather explained by insider trading providing signaling effect on much lower trading volumes for this sample set.

Since this was an attempt to isolate the effect of the direct competition between insiders and analysts in providing information to the market, the confirmation of the main hypothesis using this model add to the findings of previous research – claiming that insider trading provides information to the market based on the excess return created in these trades. In other words, our findings give further indication that insider trading actually provide valuable information to the market – something that has been widely debated.

Considering this papers' conclusions regarding the information content of insider trades and that this study was conducted using Swedish data, it might also add to the current debate regarding the legal loophole which makes it possible for insiders to trade without registering their trades, by using a endowment insurance.

The primary argument for regulating insider trading has been to prohibit insiders from earning excess return at the expense of uninformed investors. Several reasons have been put forward as to why insider trading should not be completely banned. One argument has been enhanced market efficiency. Researchers have primarily tried to confirm this hypothesis by studying the excess return created by insider trading. The negative relationship found in our ZIP regressions further establishes that insider trading conveys or is believed to convey information. Thus, as economic theory predicts that markets require all information to be incorporated in prices in order to be fully efficient, the conclusion from this is that insider trading is a source of information and, as such, enhances market efficiency. However, the negative effect on analyst coverage, must be carefully balanced in order to obtain an optimum. How to reach this optimum is, however, beyond the scope of this paper.

6. CONCLUSIONS

This section will provide a short summary that refers to our initial hypothesis and consequently review the most essential empirical findings of the thesis. Furthermore we will make suggestions on further research opportunities within this area.

Researchers' interest in analyzing what determines analyst coverage stems from the notion that analysts' process of information gathering is crucial for ensuring efficient and smooth financial markets and in the end contributes to better capital allocation and economic growth. Earlier research has concluded that analyst coverage is influenced by a number of different variables – most importantly size, liquidity, ownership structure, volatility and growth prospects. Within this paper it has been shown that insider trading is another important variable affecting analyst coverage. It also discusses how insiders can have a positive effect on market efficiency by reducing the extent of informational asymmetry and thus why insider trading should be allowed, though regulated and registered, despite its negative impact on analyst coverage.

Insiders' impact on analyst coverage has been studied in earlier research. Bhushan's (1989) work demonstrated that an increase in insiders' stock ownership has a negative impact on analyst coverage and decreases the number of analysts. However, even though insider ownership should be expected to have a positive correlation with insider trading – the connection between insider trading and analyst coverage was never proposed by Bhushan. Instead, this hypothesis was studied by Bushman et al who in their 2003 paper studied how changes in insider regulations affected aggregated insider trading in different countries.

By employing yearly data for insider trading and analyst coverage for companies traded on the OMX stock exchange, and controlling for variables that previously have been proven to affect analyst coverage, this paper has provided further support for the hypothesis of insider trading crowding out analysts. These results also confirm the findings of Gilbert et al. who used data on the New Zealand stock market. However, comparing the coefficient from the two studies reveals that the impact of insider trading is more prominent than what was predicted within that paper. In the Gilbert et al. study a 5 per cent increase in insider trading was found to decrease analyst coverage by 0.24 analysts, while it within this thesis was shown to decrease coverage by 0.4 analysts.

This paper also provides a theoretical reasoning on how to dismantle the cause of negative impact on analyst coverage by insider trading into two distinctly different sources of competition. Firstly, insider trading increases the probability for all investors to trade against a more informed counterpart – thus decreasing the expected return for non-informed investors. As this will have a negative impact on the analysts' customers, analyst coverage is expected to decrease. Secondly, if there is an overlap in the information provided to the market by insiders and analysts, there is a competitive relationship. In that case, since the analysts' information gathering is costly whereas the information gathered by insiders can rather be seen as a side effect of their profession, analysts are expected to avoid companies where there is frequent insider trading. By putting restrictions on firm size and insider trading, we present a method of isolating the direct effect of insider trading on analyst coverage – in essence providing an opportunity to test whether the information content of insider trading is competing with the information provided by analysts. This analysis provided complementary evidence to earlier research that insiders' trading activities reveal information to the market.

This paper also stresses that even though the information provided by insiders and analysts is partly overlapping – causing the competition – there is reason to believe it might partly be complementary. The main reason for believing so is that the insider regulations make it illegal, and thus risky, for insiders to trade on near-time firm events and reports. In these instances, the market has to use the estimates provided by analysts. However, insiders can more easily disguise trades based on firm specific information lying further in the future – such as potential product innovations or market entries. On the other hand, it can be reasonable to expect analysts to be more informed regarding valuation theory and firm value relative to the rest of the stock market and competitors.

The main conclusion made in this paper, that insider trading has an ability to convey information to the market, and the notion that the information content of insider trading and analyst reports are, at least partly, complementary, has important implications. Firstly, it implies that a fully efficient market must try to effectively capture both the information provided by the insider and analysts, which is in line with Kyle's (1985) conclusions. This provides an argument as to why insider trading should be reported, thereby providing information to the market, though not necessarily an argument for regulated insider trading. Secondly, considering the support provided for insider trading having a negative impact on analyst coverage, this paper also support arguments for regulating insider trading. Thus, in order to reach maximum market efficiency, both the positive and the negative effects of insider trading needs to be considered. Combined, these findings support the existence of an optimum, where these effects are balanced. Hopefully this paper can inspire further research in this area, aiming at understanding more of this intricate balance and how it is affected by

insider trading regulations.

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APPENDICES

Appendix A: Comparison with the results obtained by Gilbert et al. (2006)

In order to make a more detailed comparison between our results and the results obtained by Gilbert et al., this appendix provides a replica of their model. Thus, the same setup of variables as Gilbert et al. employed in their “Model 2” – only using OMX data.

Consequently, the two measures of volatility, *variance* and *beta*, will now be excluded and instead of the simple time dummy, *time*, three macro variables will be used – real growth of GDP, *Real_GDP*, market value of OMX, *Market_Size*, and Konjukturinstitutets broad, seasonal adjusted confidence index, *Conf_*. The only difference between the models setup is the absence of the *Indep* variable used by Gilbert et al.. This variable was used by Gilbert et al. as an attempt to capture the impact of a more developed board structure. However, since this variable was far from significant, there is every reason to believe that the exclusion of this variable does not significantly alter any of the major conclusions and therefore a direct comparison is still viable.

Table 1 Mimicking Model 2 in Gilbert et al study

	Model 2a	Sig.	Model 2b	Sig.	Model 2*	Sig.
_Cons	1.5578	**	1.0969		-23.4162	***
	0.7204		0.7261		3.8047	
Rel_Insider	-0.008				-4.721	**
	0.0253				1.8804	
Mod_Insider			-6.5256	***		
			2.1074			
Size	0.3954	***	0.3839	***	0.2723	***
	0.0102		0.0105		0.016	
Liquidity	0.0563	**	0.0487	**	0.2726	***
	0.0232		0.0231		0.084	
PCF	0.0002		0.0002		0.0014	
	0.0003		0.0002		0.0013	
Owner	-0.4265	***	-0.3795	***	0.0003	
	0.1		0.1016		0.0016	
DE	-0.0082	**	-0.0082	**	-0.0088	
	0.0039		0.0038		0.0201	
Real_GDP	0.0477		0.043		0.034	
	0.0327		0.0328		2.3303	
Market_Size	-0.1299	(**)	-0.0969	(*)	1.9644	***
	0.0559		0.0557		0.3529	
Conf_	-0.0105	(**)	-0.0094	(**)	0.0165	***
	0.0044		0.0045		0.002	

Note: Significance levels – 10% [*], 5% [**], 1% [***]. In cases where the coefficient sign does not correspond to expectations, the value is shown in parenthesis. Bellow each coefficient, the standard deviations are presented in italics. Model 2a) and b) uses OMX data and differs only considering the choice of insider trading variable. Model 2* uses the data obtained by the study made by Gilbert et al.. Analysts is the dependent variable in all models and all models employ a ZIP regression.

The most important finding when comparing the result obtained using Model 2a, compared to Gilbert et al. data in Model 2*, is the significance level for the *Rel_Insider* coefficient. As can be seen in Table 1, *Rel_Insider* is significant in Gilbert et al. case but is far from being so using the values obtained in Model 2a. The most likely reason for this is that the data used in Gilbert et al. study has less frequency of extreme values – which is causing problems fitting the model in the case of OMX data. If, instead, comparing the data from the Gilbert et al. Study with Model 2b, where the *Mod_Insider* is used, the results are consistent and the even the absolute values lies in the same range.

The second notable difference between the results obtained is the significance level for *Owner* and *DE.* This, quite substantial difference in significance is somewhat surprising. The only difference between the definition of the O*wner* variable used in the two studies is that the Gilbert et al. study does not include shares held by insiders in cases where these holdings are less than 5 percentage. This minor difference is not likely to be the explanation for the observed difference. However, as discussed earlier, the coefficient sign corresponds to what is expected using economic theory. Thus, the observed difference could simply be explained by the larger sample set employed in this paper. Concerning *DE,* the high significance level for the OMX data compared to Gilbert et al.'s data, the difference is most likely not robust – as *DE* changes sign when the Tobit regression is used.

There is also a notable difference for the coefficients and significance levels for two of the three macro variables – *Market_Size* and *Conf_*. When using the OMX data, these variables' coefficients do not correspond to expectations. When examining this spurious finding, using OMX data, it is quite obvious that multicollinearity could provide an explanation. As we know from earlier, *Time* correlates negatively and significantly with analysts using both ZIP and Tobit regression. Thus, considering that both *Market_Size* and *Conf_* correlates positively and significantly with time, as shown in Table 2 – it is quite apparent that these macro variables are likely to correlate negatively with *Analysts* when making the regression. Considering this obvious problem, and the high correlation between the macro variables resulting in even more spurious results, we conclude that the usage of a simple time dummy is the best way of capturing possible time trends.

Table 2 Correlation matrix

	Real_GDP	Market_Size	Conf_	Time
Real_GDP	1			
Market_Size	0.2231	1		
	0			
Conf_	0.8288	0.4753	1	
	0	0		
Time	0.0277	0.7618	0.253	1
	0.3321	0	0	

To sum up, despite minor differences between the results, this comparison provides overwhelming evidence on the robustness of the hypothesis that insider trading does compete with analyst coverage.

Appendix B ZIP example

Example :

The state wildlife biologists want to model how many fish are being caught by fishermen at a state park. Visitors are asked how long they stayed, how many people were in the group, were there children in the group and how many fish were caught. Some visitors do not fish, but there is no data on whether a person fished or not. Some visitors who did fish did not catch any fish so there are excess zeros in the data because of the people that did not fish.

Data description:

We have data on 250 groups that went to a park. Each group was questioned about how many fish they caught (**count**), how many children were in the group (**child**), how many people were in the group (**persons**), and whether or not they brought a camper to the park (**camper**).

In addition to predicting the number of fish caught, there is interest in predicting the existence of excess zeros, i.e. the zeroes that were not simply a result of bad luck fishing. If we here assume that the excess zeros arose from the variable **persons**, the following stata command would be used:

```
zip count child camper, inflate(persons)
```

In the ZIP regressions of this paper all explaining variables have been inflated in order to account for the fact that a zero analyst following could arise from any of the variables.

Example from UCLA's tutorial on ZIP regressions in STATA (UCLA 1 in REFERENCES)