Lund University
Department of Business Administration
28 May 2007

SCHOOL OF ECONOMICS AND MANAGEMENT
Lund University

Trading and Trading Costs:

A study of the OMX30 during 2001–2006

Authors:
Farrukh Fayyaz
Ellinor Fridén

Supervisor:
Göran Andersson

Abstract

Title: Trading and Trading Costs: A study of OMX30 during 2001-2006

Seminar date: 4 June 2007

Course: Master thesis within the field of Finance, 10 academic credits, Lund University, School of Economics and Management (LUSEM)

Authors: Farrukh Fayyaz, Ellinor Fridén

Advisor: Göran Anderson

Key words: Bid ask spread, liquidity, trading volume, OMX, trading costs, trading activity, liquidity variables, trading variables.

Purpose: The purpose of this study is to provide a time series analysis of trading and trading costs for the OMX stock market and investigating if there exists a relation between changes in the bid-ask spread and volume, trade size and number of trades and the macroeconomic variables interest rates, inflation and GDP over a period of five years.

Theoretical perspective: Previous studies show a relationship between the bid ask spread and variables such as volume, number of trades, trade size, interest rate, inflation and GDP which is the foundation of this thesis.

Methodology: This is a quantitative study with a regression analysis of daily data retrieved from DataStream and the OMX website.

Empirical foundation: We have found that there exists a correlation between decreasing spread sizes and volume, trade sizes and the number of trades.

Conclusions: OMX spreads decline from 2001-2006. The average volume and average number of trades / trading frequency increases over this period, whereas the average trade size decreases consistent with greater retail investor activity. Macroeconomic factors such as interest rates, inflation rate and GDP rate do not seem to affect changes in the spreads.

Table of contents

1 Introduction

1.1 Background

Since the bottom recording of the Stockholm stock exchange in March 2003 until today the stock market has increased by over 200% according to Ekonominyheterna on 1 March 2007. On 16 April 2007 newspapers such as Dagens Industri and Realtid reported that the Stockholm stock exchange passed its previous market record from March 2000. The total turnover was 3764 billion for 2005 according to the Bank of Sweden, or around 15 billion a day. This was an increase of 11% from the previous year, a significant increase in volume. A total of 11.8 million transactions were conducted during 2005 with an average value of SEK 320107. The number of active traders, those who make at least 10 trades a month according to Pressman (2007) has increased and the yield spread has decreased during the period according to data from DataStream.

During the same period the National Institute of Economic Research has reported that GDP has increased continuously, the export ratio has developed positively, unemployment has decreased, and wages have gone up while interest rates have stayed low. However, this has also meant increased housing prices and inflation.

At other stock markets around the world the relationship between these factors has been studied closely and the mapping of its correlation. Ness and Warr (2005) as well as Chordia, Roll, and Subrahmanyam (2001) finds significant correlation between these factors that is of importance for investors. However, the correlation between trading and trading costs as well as with certain macroeconomic variables has not been closely studied at the Stockholm Stock exchange why this paper main purpose is to contribute to fill that gap.

1.2 Problem discussion

How attractive an investment in a company is depends on its share price. However, do you know what exactly you are paying for in regards to the actual trading?

First of all you pay for the transaction through the bid - ask spread which from now on will be referred to simply as the spread. The spread size depends according to Roll (1984) and Nikolai (2006) on the cost for the dealer or market maker to accomplish the transaction. The spread is of interest to all investors as it affects the net gain of the investment.

Stocks that are thinly traded suggest higher risks and results in a liquidity costs argues Chen, Lesmond and Wei (2007). Liquidity costs negatively affect the frequency of trading states Lo, Mamaysky, and Wang (2004). In other words there is a correlation between liquidity and the frequency of trading. To hedge the risk associated with illiquid stocks that will trade less frequently they have lower prices and also higher yield spreads reasoned by Lo, Mamaysky, Wang (2007), who thereby suggests that liquidity is priced in the yield spread. Longstaff, Mithal and Neis (2005) and Ericsson and Renault (2002) also find correlation liquidity and yield spreads. Chordia, Roll, and Subrahmanyam (2001) not only find a correlation between the trading activity and spreads but also trade size.

We want to study the Stockholm stock exchange in order to see if the same correlations exist as to earlier findings. To represent the Stockholm stock exchange the index OMX30 has been chosen for data reasons. Well-known companies constitute the OMX 30 and extensive data can be found which means that this study can easily be repeated in the future. This study will be based on daily data only from 1 July 2001 to 30 June 2006. The five year period thereby ends before the last merger of the Nordic stock exchanges when the Stockholm stock exchange became more integrated and restructured.

The intention of this study is to provide a time series analysis of trading and trading costs for the OMX stock market and investigating if there exists a relation between changes in the bid-ask spread (trading cost/liquidity variable) and volume, trade size and number of trades (trading variables). The study will also include determining if certain macroeconomic variables such as interest rates, inflation and GDP can help explain changes in the bid-ask spread (trading cost/liquidity variable). The macroeconomic

factors are included to gain a wider understanding of changed trading in relation to the overall Swedish economy. The results will be analyzed and compared to the findings of earlier studies at other stock exchange. As the stock level transaction data is somewhat complex to carry out because of the data requirements there are relatively few studies of this type according to our research and Ness and Warr (2005), which further underlines the need for this paper.

1.3 Purpose

The purpose of this study is to provide a time series analysis of trading and trading costs for the OMX stock market and investigating if there exists a relation between changes in the bid-ask spread and volume, trade size and number of trades and the macroeconomic variables interest rates, inflation and GDP over a period of five years.

1.4 Limitations

Our study is limited to the OMX Stockholm 30 (OMXS 30) which is the Stockholm Stock Exchange's leading share index due to lack of data for the entire OMX. The index consists of the 30 most actively traded stocks on the Stockholm Stock Exchange according to the OMX group.

The study is limited to five years due to lack of reliable data but we believe that a five year period is sufficient time to conclude whether or not our hypothesis can be supported.

If this study has to be repeated at a later stage it has to be taken into consideration the changed exchange list structures for Sweden, Denmark, and Finland due to the merger of

OMX[1]. The Nordic list will enable Exchange members to execute trades in Copenhagen, Helsinki, and Stockholm with only one membership fee.

1.5 Outline of thesis

CHAPTER 2 – THEORETICAL FRAMEWORK

In the second chapter relevant earlier studies will be presented in order to gain an understanding of previous research and its main findings. It will also include a review on trading theory. Furthermore, the model used in the research is also carefully presented as well as the variables used.

CHAPTER 3 - METHODOLOGY

In the third chapter the data collection and data processing is described in detail to permit precise replication and facilitate the understanding for the reader.

CHAPTER 4 – RESULTS

The fourth chapter contains a throughout presentation of data and the findings from our study.

CHAPTER 5 – ANALYSIS

Chapter five includes a throughout analysis of our results and expectations in regards to previous findings.

CHAPTER 6 – CONCLUSIONS

Chapter six holds our final conclusion and suggestion of further research.

---

[1] The OMX group states on its website that OMX starts a derivatives exchange in 1985, a year after the Helsinki Stock Exchange (HEX) was founded. In 1998 HEX merged with the Stockholm Stock Exchange (OM) to form OMHEX. A joint trading platform initiative was started to include all the Nordic exchanges under the brand name OMX with headquarter in Stockholm. From 2003 and up until 2006 the OMX has continued to merge with different stock exchanges to now include the Helsinki, Stockholm and Copenhagen Stock Exchanges. Through acquisition the OMX also includes Tallinn, Riga and Vilnius and Iceland exchanges. Today the OMX operates around 80% of the Nordic and Baltic stock[1] and operates in Australia, Canada, China, Denmark, Estonia, Finland, Hong Kong, Iceland, Italy, Latvia, Lithuania, Norway, Singapore, Sweden, UAE, UK and the US. The OMX has currently 159 exchange members and lists 805 companies.

2 Theoretical framework

2.1 Previous research

Investigations set out to understand the relationship between various variables in order to better understand the market has been done many times before at different stock exchanges. The most widely studied exchanges are NYSE and NASDAQ where similar studies have been conducted by Chordia, Roll, and Subrahmanyam (2001), Nikolai (2006), Schultz (2000), Ness and Warr (2005) and many more. However, only one similar study regarding the OMX has been found by Niemeyer and Sandås (1994).

The relationship between the spread and liquidity, which can also be referred to as volume, has been found to have a positive correlation. Studies by Longstaff, Mithal and Neis (2005), Mamaysky, and Wang (2004), Marwan Izzeldin (2007) and Ericsson and Renault (2002) has both found a positive relation between the liquidity and spread. As the liquidity increases the spread decreases on average. The intuition behind this is as the volume increases by more shares in movement it is easier for an investor to buy and sell shares. The broker[2] or market maker[3] therefore takes on less risk why their compensation decreases i.e. the spread, which is declared by Lo, Mamaysky, Wang (2007). This also explains the fact that illiquid stocks, stocks that are thinly traded, have a higher yield spread.

Spread is closely linked to the trading activity according to Chordia, Roll, and Subrahmanyam (2001) and Ness and Warr (2005). They find that over time the number of transactions has gone up while as already stated the volume has increased. This

[2] An individual or firm that charges a fee or commission for executing buy and sell orders submitted by an investor according to investopedia.com 2007-06-06

[3] A brokerage or bank that maintains a firm bid and ask price in a given security by standing ready, willing, and able to buy or sell at publicly quoted prices (called making a market). These firms display bid and offer prices for specific numbers of specific securities, and if these prices are met, they will immediately buy for or sell from their own accounts, according to investorwords.com 2007-06-06.

follows the same logic as the liquidity, that more transactions imply better liquidity and less risk for the broker or market maker which leads to a decreased spread.

Extensive research, for example by Heflin, Shaw / Huang and Stoll (1997) and Lin, Sanger and Booth (1995), suggests that increasing trade size causes an increase in the informed trading (i.e. adverse selection) component of bid ask spread. Since informed traders would like to trade large amounts submission of large trading orders / sizes in the market could signal to a market maker the possible presence of informed traders in the market. Hence in order to protect / compensate itself from suffering potential losses from trading with an informed trader, the market maker increases the bid ask spread.

The most similar study is an investigation by Ness and Warr (2005) that concerns trading activities of NASDAQ stocks during the period of 1993 to 2002. The authors find a steady decline of spreads over the period, increasing volume, decreasing trade size and increased trading frequency. Investigation of spreads on the Stockholm stock exchange can be summarized in a study by Niemeyer and Sandås (1993). They are using cross-sectional and cross-daily data from the Stockholm Stock Exchange to assess the importance of the tick size on the bid/ask spread, on the quoted volume and on traded volume. They find that there is clear support that the tick size is affected by increasing the bid/ask spread and they find evidence that a high tick size is associated with a lower traded volume. This is relevant to our study as this is another factor to explain uncertainties in our results.

Spread in regards to certain macroeconomic factors, Chordia, Roll, and Subrahmanyam (2001) have found evidence for a significant correlation in their study of the NYSE between the years 1988 and 1998. They find that there macroeconomic announcement have an effect on spreads. This is contradictory to Ness and Warr (2005) who in their study of NASDAQ between 1993 and 2002 do not find any evidence for such macroeconomic announcements apart from interest rate changes that directly influence trading volume. According to Ness and Warr (2005) an increase in interest rate leads to disintermediation, where investors tilt their portfolios towards interest paying instruments rather than stocks. Reduced investment in the stock market causes a reduction in the

liquidity position of the market thereby causing an increase in the bid ask spread. In both cases macroeconomic announcements have been studied and not the actual level of variables such as interest rates and unemployment.

2.2 Trading theory

Market makers are individuals/firms that market stocks. Suppose Mr. A is a market maker for firm X and firm Y. It means that at any time during the trading hours, Mr. A is responsible and obligated to buy and sell the stocks of these firms. This involves a lot of risks and costs. Most notable of these is inventory problem. This means that Mr. A sometimes may need to buy stocks in huge quantity at his own expense and at other times, he may need to sell shares that he does not even have. Moreover, he may have to transact with those traders who are more informed about the intrinsic value of the stock concerned than he is. This means that the market maker may, at times be buying stocks at a much higher price than normal and selling at a much lower price than normal and in the process bearing losses. Schmitz (2000)

To compensate for such risks that he runs, the market maker prefers to buy stocks at a lower price and sell at a higher price. The bid-ask spread is, thus a sort of compensation provided to the market maker for the risk of dealing with informed traders and of having inventory imbalances. “The market maker does not set the price of the security being traded. Instead the market maker provides the service of immediacy, i.e., the facility by which buyer and sellers can transact without delays. Thus, the economics of market making concerns the provision of this service and its related costs and only indirectly concerns the demand and supply of securities.” Schmitz (2000)

Revenues of the individual dealer (market maker) attributes to the transactions of three groups of agents. “The first group consists of traders possessing special information. The second group includes liquidity-seeking traders who have no special information but merely want to buy, i.e., convert cash into securities, or sell, i.e., convert securities into cash. The third group of traders believes that security prices have not as yet impounded some residual piece of information, but which, in reality, has already been reflected in

prices." Kumar (2004)

The market maker always losses out on his transactions with the first type of trader. This is because the informed trader knows that the intrinsic value of the stock is higher than the bid price he is quoting (in case he is buying) and lower than the ask price he is quoting (in case he is selling). But the market maker always gains from transactions with liquidity-motivated traders and ill-informed traders. The market-maker sets the spread in such a manner that the losses incurred from trading with informed traders are more than compensated by the gains made from trading with liquidity motivated and ill-informed traders. Kumar (2004)

In markets where there are no specialists/market makers such as the new electronic-based stock markets (e.g. NASDAQ), there are no market makers bid ask spreads. The quotes that are observed on the trading screens of the electronic stock markets are the bid-ask of the buyers and sellers; the unmatched buy-sell orders in the market. Kumar (2004)

2.2.1 Trading at the Stockholm stock Exchange

All trading in stocks for all investors at the Stockholm stock exchange is conducted through one of the exchanges members. As a member certain requirements has to be fulfilled which results in that the members consists of security firms, credit institutions with clearance from the Swedish Financial Supervisory Authority, or by foreign corresponding firms. In total it adds up to 70 members worldwide that results in about 600 authorized traders. (Den Svenska Finansmarknaden, the Bank of Sweden, 2006)

Trading at the Stockholm stock exchange is since 1990 totally automated through matching using an electronic trading system called SAXESS. By using Internet trading instead of using a member's personal trader the cost of the transaction is lowered. The commission for the Stockholm Stock Exchange is stated by Brain Bank (2007-06-05) to be 0.45% up to 500,000 SEK and 0.3% for higher amounts while the minimum charge for domestic transactions are 200 - 300 SEK for an individual investor. However, this does

not affect the spread but simply part of the cost of the physical transaction and possibly research for investment tips.

2.3 Presentation of variables

Previous research has made it clear what variables need to be included in order to establish what effects the yield spread at the Stockholm stock exchange. Below is also the chosen macroeconomic factors explained.

2.3.1 Bid Ask Spread

The bid ask spread is the difference in price between the highest price that a buyer is willing to pay for an asset and the lowest price for which a seller is willing to sell.
The buyer states what price they will pay for the stock – this is the bid price. The seller also has a price – the ask price. It is the role of the stock exchanges and the whole broker/specialist system to facilitate the coordinating of the bid and ask prices. However, this service doesn't come without a price. What this means is if you are buying the stock you pay the ask price (the higher price) and if you are selling the stock you receive the Bid price (the lower price). The difference is the spread and it is kept as profit by the broker/specialist handling the transaction. In truth, the spread goes to pay a number of fees in addition to the broker's commission. Schmitz (2000) and Kumar (2004)

The bid-ask spread is the largest observable and most important component of transaction costs. The concept of bid-ask typically applies in markets that have specialists or market makers. There are many factors that contribute to the difference between the bids and ask prices. The most important factor is a security's liquidity. Liquidity implies how quickly and easily an asset can be converted into cash with minimum loss of value. Liquidity refers to the volume or the total number of stocks that are traded during a given period of time. Some stocks are traded quite often, while others are only traded a few times a day. The stocks and indexes that are frequently traded or have large trading volumes will have narrower bid-ask spreads than those that are infrequently traded. A stock that has a low trading volume is considered illiquid because it is not easily converted to cash. As a result a broker would require more compensation in trading such a stock resulting in a higher

spread for such a stock.

Another important factor that affects the bid-ask spread is volatility. Volatility implies a sudden and sharp rise or fall in the price of a security within a short period of time. In a volatile market the bid ask spread widens, because the market makers want to profit from this volatility. When there is a sudden rise in the price of a stock more and more investors become interested in buying this stock giving the market maker an opportunity to make more profit. Likewise when there is a sudden fall in the price of a stock more and more investors become interested in selling this stock again giving the market maker an opportunity to make more profit. When volatility is low and uncertainty and risk are at a minimum, the bid-ask spread is narrow.

A stock's price also influences the bid-ask spread. If the price of a stock is low it would have a wider bid ask spread and vice versa. The reason for this lies in the liquidity position of a stock. A low priced stock is normally a new entrant into the market having less number of available shares for trading thereby reducing its liquidity. The reduced liquidity thus causes the stock to have a higher bid ask spread.

2.3.2 Volume

Volume refers to the total number of stocks or contracts traded in a security or an entire market during a particular period of time. It is simply the total amount of shares that change hands from sellers to buyers. If a buyer of a stock purchases 100 shares from a seller, then the volume for that period increases by 100 shares based on that transaction. Volume is a good indicator of trading activity and liquidity position of the market. A high trading volume indicates a highly liquid market and vice versa. Marwan Izzeldin (2007)

2.3.3 Trades

It is the total number of times (transactions) a share is bought and sold (traded) in the stock market. The sum of the number of trades of all stocks in the stock market would give us the total number of trades for the entire market for a particular period of time.

The number of trades along with the trading volume is often used as a proxy for market activity. It can also be termed trading frequency. Marwan Izzeldin (2007)

2.3.4 Trade size

Trade size means the total number of shares involved in any particular trading activity (buying or selling) or the number of shares per contract.

2.3.5 Inflation

Inflation means the pace at which the general level of prices for goods and services is increasing thereby decreasing the purchasing power of consumers according to Riksbanken, Bank of Sweden. For every SEK you can by less over time as inflation rises. Inflation is determined by the Consumer Price Index (CPI) and the Producer Price Indexes (PPI), which reflects the prince change from both domestic buyers and sellers.

Inflation not only affects individuals but also companies. There is a widely held view in the academic and research circles that inflation causes the stock prices of a company to decrease states The Wall Street Journal, 2006–05-12. The reason for this is that a rising inflation trend increases the various costs of a firm thereby reducing its current and future earning prospects. As the future earning prospects of a firm decrease, the market price of its stock also decreases. And as mentioned before, a decrease in the stock price causes its liquidity in the stock market to decrease thereby enhancing the bid ask spread.

The influence of inflation for an investor has much to do with how the portfolio is constructed. Stocks are less influenced by inflation than fixed income as a company's revenue increases along with the inflation while fixed income securities are directly dependent on small changes in inflation.

2.3.6 GDP

The monetary value of all the finished goods and services produced within a country in a year. It includes all of private and public goods and services states Centralbyrån, Central

Bureau of Sweden. GDP is a relevant indicator of a country's economic situation that gives a complete picture of the current situation for the country of study.

A significant change in GDP, either positive or negative, usually has a significant effect on the stock market. An economy in bad health usually means lower profits for companies, which in turn means lower stock prices. And as mentioned before a decrease in the stock prices of companies causes a decrease in the liquidity position of the market thereby widening the bid ask spreads.

2.3.7 Interest rates

The monthly effective rate paid on a loan expressed as a percentage of the sum borrowed. The central bank in a country determines the overall interest rate. In the case of Sweden, Riksbanken, sets the interest rates. They normally meet seven or eight times during the year to decide on the level for the interest rates with the aim of not reaching either stagnation or hyperinflation and to maintain stable prices, growth and still keep maximum employment declares Riksbanken, Bank of Sweden. Rate increases try to prevent future inflation and rate decreases aims to stimulate economic growth.

An increase in interest rate affects the bid ask spread by making investors invest in interest paying instruments rather than stocks which leads to a reduction in the liquidity. Also, when interest rates rise, the borrowing costs of companies increase. As a consequence the companies borrow less, which leaves them with less money to spend on growth thereby decreasing their current and future profits. This causes the stock prices to drop in the market, which in turn leads to higher bid ask spreads.

2.4 Hypothesis

Our hypothesis is that the average spread size has decreased at the OMX over time due to three main factors. The three main factors are believed to be increased volume, increased number of trades and smaller average trade size. Further we believe that the analyzed macroeconomic factors would also be a contributing factor towards the reduction in the spread size to some extent.

3 Methodology

To analyze relevant data we are using a quantitative approach to our study. A quantitative approach is a method for analyzing data through mathematical and statistical modeling. In all, a quantitative study seeks to replicate the reality scientifically. Because this study aims to find correlations between variables quantitative analysis will demonstrate any dependence. The opposite approach to quantitative data is qualitative data, which is often necessary in research to get to overall picture, but not the aim of this study.

3.1 Sources of information

This study is a quantitative study where the primary method of finding relevant data has been by using databases. Used databases for financial data are DataStream, OMX website, AffärsData, Central Bureau for statistics and Riksbanken. The main reason for using a number of sources is to ensure its reliability.

Information regarding previous studies and facts has mainly been conducted through ELIN@Lund. However, news articles have been used to complement the study from Dagens Industri, Realtid and The Wall Street Journal.

3.2 Data collection

The daily data regarding the spreads and volume and interest rates has been gathered from DataStream, which is our main source for financial data. The information concerning the number of trades is official OMX figures from the OMX web site. Using the volume and number of trades the average trade size was calculated. All data is daily figures.

The macroeconomic figures were retrieved from the Central Bureau of Statistics and the Bank of Sweden, Riksbanken. The interest rates are daily figures and we have used the most common ones in Swedish economy, the Swedish three-month treasury bills and ten-year government bond. The inflation data is based on monthly data that therefore includes 60 data points. GDP is only measured quarterly, which amounts to 20 data points.

3.3 Data processing

3.3.1 Stationarity

The property of stationarity refers to a time series having a constant mean, constant variance and constant autocovariance (Brooks 2002). Stationarity is very important for time series data since its presence or otherwise can strongly influence its behavior and properties. The use of non-stationary data can lead to spurious regressions. Spurious regression means that if standard regression techniques are applied to non stationary data, then the end result would although look good with significant coefficients and high R2 values, but it would be meaningless (Brooks 2002). We shall check all our variables for stationarity in eviews using Augmented Dickey Fuller Test and if any variable is found to be non-stationary then necessary differencing in the variable would be done to induce stationarity.

3.3.2 Multicollinearity

An implicit assumption that is made when using the OLS estimation technique is that the explanatory/independent variables are not correlated with one another. If some or all of the independent variables are highly correlated with one another then this is termed as multicollinearity. Multicollinearity could result in individual variables having high standard errors along with a high R2, thus giving an impression that the regression looks good. However the individual variables would not be significant (Brooks 2002). We shall check all our variables for correlation by forming a correlation matrix in eviews. If high correlation is found among variables, then one or more of them would be dropped from the regression model.

3.3.3 Linearity

Another implicit assumption made when using OLS is that the model form is linear. Linearity means that the appropriate model is linear in the parameters/coefficients, although it may not be linear in the variables. In the absence of linearity the coefficient values could be biased (Brooks 2002). We shall check our model for linearity in eviews

using the Ramsey Reset Test and if any evidence of non-linearity is found we will try to suitably modify our variables to induce linearity.

3.3.4 Heteroskedasticity

One very important assumption of the classical linear regression model (CLRM) is that the variance of the errors should be constant. This is known as the assumption of Homoskedasticity. If the variance of errors is not constant, then we have Heteroskedasticity. Heteroskedasticity can result in the standard errors taking on wrong values and thus any inference drawn from the results could be misleading (Brooks 2002). We shall check our errors for presence of Heteroskedasticity in eviews using White's Test and if any evidence of Heteroskedasticity is found we will try to use a non-linear model for our regression.

3.3.5 Normality

Another assumption of the CLRM is that the errors should be normally distributed. This means that the distribution should not have skewness (i.e. asymmetry about its mean value) and kurtosis (i.e. fat tails). In the absence of normality the inferences made about the coefficient estimates could be wrong. However in case of a large sample size the consequences of non normality are not severe at all (Brooks 2002). We shall check our errors for Normality in eviews using Bera Jarque Test. If evidence of non-normality is found we shall ignore it as our sample size is quite large.

3.3.6 Simultaneity

If some explanatory variables in the model are endogenous then there is likelihood of their being correlated to the error term. This is known as Simultaneity problem (Pindyck and Rubinfeld 1991). In the presence of Simultaneity problem, using OLS would give inconsistent results and some alternative estimation technique like 2SLS would have to be used to produce consistent results. Hence a test for presence of simultaneity is essential. We shall check our model for presence of simultaneity using the Hausman Specification Error Test in Eviews (Brooks 2002).

3.3.7 Regression

To analyze the relationship between spreads and our trading variables (volume, average number of trades and average trade size) and macroeconomic variables (3 month interest rates, 10 year interest rates, inflation, GDP) we would perform regression using OLS method in E-Views software. OLS method is the most widely used method for conducting linear regressions. Our choice of OLS method is based on our assumption that our regression model is linear (or if found out not to be linear can be made linear by suitably transforming the variables). Alternatively if our model does not turn out to be linear and cannot be linearized, we will consider the Maximum Likelihood method which is the most popular method used to conduct non-linear regressions. Our regression equation would be of the following type:

$$Y = \alpha + \beta1.X1 + \beta2.X2 + \beta3.X3 + \beta4.X4 + \beta5.X5 + \beta6.X6 + \beta7.X7 + \varepsilon$$

Where:

Y	= average bid ask spread (dependant variable)
α	= constant
X1	= average volume (independent variable 1)
X2	= average number of trades (independent variable 2)
X3	= average trade size (independent variable 3)
X4	= 3 month interest rates – in % (independent variable 4)
X5	= 10 year interest rates – in % (independent variable 5)
X6	= inflation – in % (independent variable 6)
X7	= GDP – in % (independent variable 7)
B1	= beta coefficient for X1
B2	= beta coefficient for X2
B3	= beta coefficient for X3
B4	= beta coefficient for X4
B5	= beta coefficient for X5
B6	= beta coefficient for X6
B7	= beta coefficient for X7
ε	= error term

Ideally we would like to see the following beta coefficient values following our regression (based on our theory given above):

B1 = a negative value signifying that volume is negatively related to spread
B2 = a negative value signifying that no. of trades is negatively related to spread
B3 = a positive value signifying that trade size is positively related to spread
B4 = a positive value signifying that 3 month interest rate is positively related to spread
B5 = a positive value signifying that 10year interest rate is positively related to spread
B6 = a positive value signifying that inflation is positively related to spread
B7 = a negative value signifying that GDP is negatively related to spread

3.4 Reliability and validity

All sources used are national or international databases and must be considered reliable even though only secondary data has been used. As mentioned before our main sources for data are the DataStream database, OMX group's web site, SCB and Riksbanken. To ensure that our data is as accurate as possible we cross checked our figures between all these four sources and additionally also matched with figures from other databases (e.g. Reuters). Human error in processing the data is the only realistic source of error.

Regarding articles, we have tried to consult the best renowned publishers and magazines to ensure its correctness where possible. Magazines such as Dagens Industri and Realtid have been used to a very limited extent.

4 Results

4.1 Changes in liquidity and trading activity

Using the method of Ness and Warr (2005) in Table 1 below we present summary statistics for our main variables for liquidity and trading activity i.e. spread, volume, number of trades and trade size.

Table 4.1 ***(Summary Statistics)***

Variable	**Average**	**Minimum**	**Maximum**
Spread	0.3161	0.0167	0.7883
Volume	7685501	1424769	47731561
No. of Trades	896	352	3076
Trade Size	8481	2099	29314

Table 4.1 presents summary statistics for OMX 30 stocks from 2001 to 2006. Each variable is estimated by first averaging the variable for each stock every day and then taking the average of these averages for each day in the sample. The summary gives the daily averages for the entire sample period. The total sample consists of 1250 days (the number of daily observations).

Over the 5 year period the average spread is SEK 0.3161 while it ranges from a minimum value of SEK 0.0167 to a maximum value of SEK 0.7883. The average volume for the same period is 7685501 shares (approx 7.6 million) while it ranges from a minimum value of 1424769 shares (approx 1.4 million) to a maximum of 47731561 shares (approx 47.7 million). The average number of trades is 896 while it ranges from a minimum of 352 trades to a maximum of 3076 trades. Likewise, the average trade size is 8481 shares while it ranges from a minimum value of 2099 shares to a maximum value of 29314 shares.

In order to analyze the changes in liquidity and trading activity during our five year period, using again the method of Ness and Warr (2005), we divide the period into six-month intervals and test the changes in the liquidity and trading activity between the intervals. The results appear in Table 2.

As can be seen from the table the average spread is SEK 0.4460 during the last six months of 2001 and declines in most of the subsequent six-month periods until the average spread is SEK 0.3371 during the first six months of 2006. Out of a total of nine six-month periods, spread declines in 5 of the periods. It increases in only three of the periods, while in one period the change is not significant. Thus there is a clear overall declining trend in the spread during our sample period.

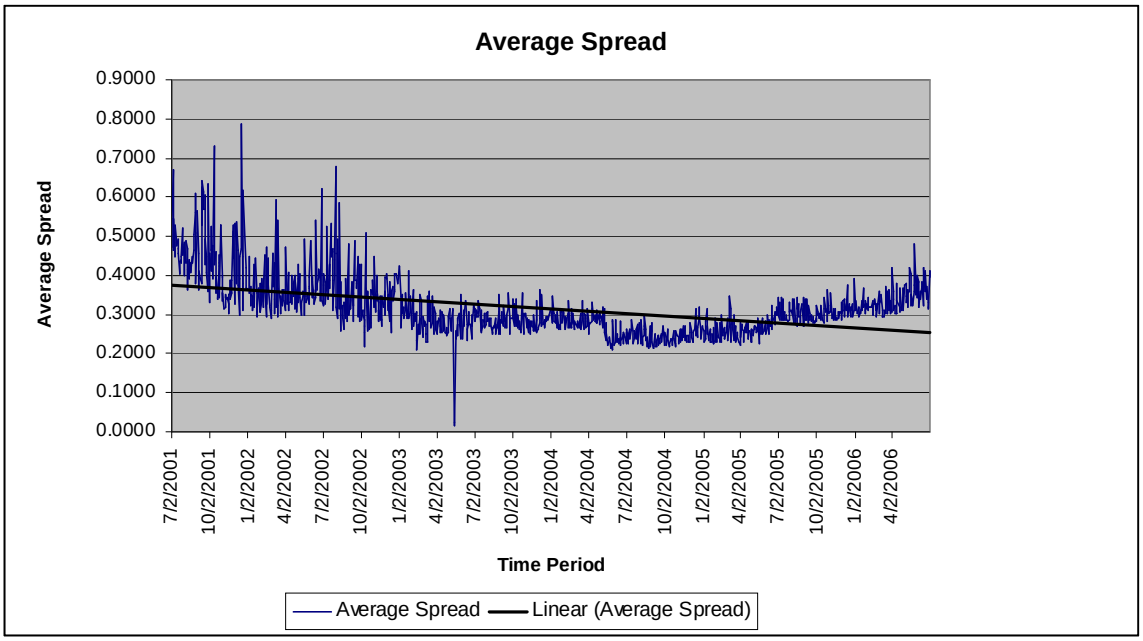

Figure 1: OMX-30S average spreads from July 2001 to June 2006

As far as volume is concerned the average volume during the last six months of 2001 is 4915243 shares (approx 4.9 million). The volume increases in most of the subsequent six-month periods until it reaches an average value of 8987494 shares (approx 8.9 million) during the first six months of 2006. Out of the total nine six-month periods, volume increases in five of the periods. It decreases in only three of the periods, while in one period the change is not significant.

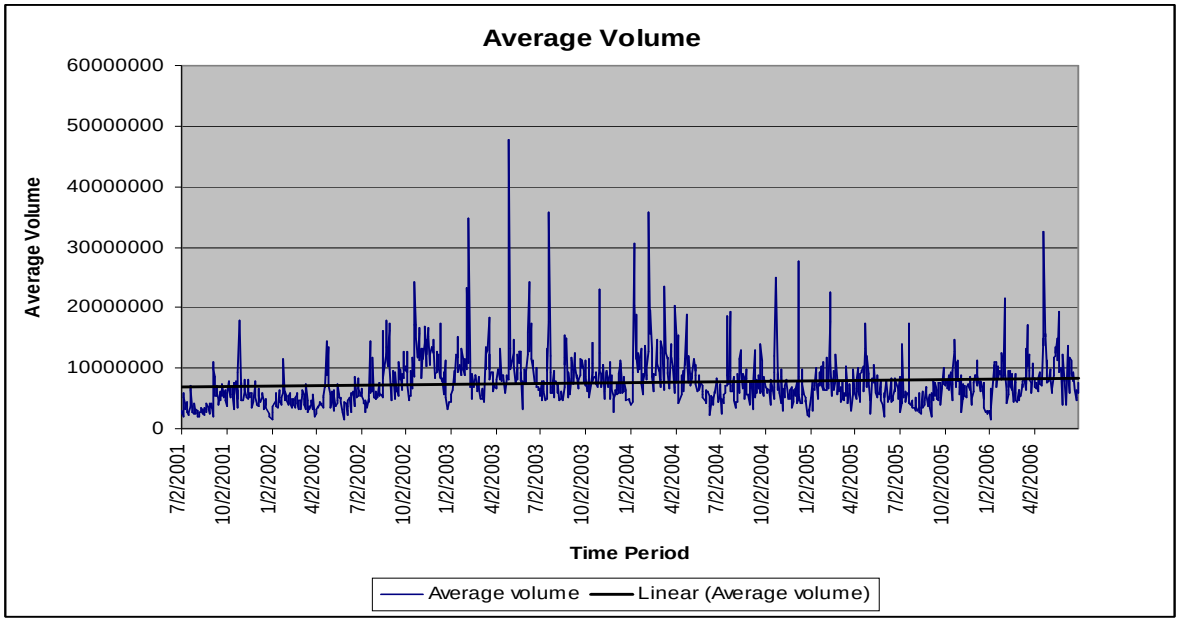

Figure 2: OMX-30S average volume from July 2001 to June 2006

In case of number of trades the average number of trades during the last six months of 2001 is 807. The number of trades increases in most of the subsequent six-month periods until it reaches an average value of 1343 during the first six months of 2006. Out of the total nine six-month periods, number of trades increases in five of the periods while it decreases in four of the periods.

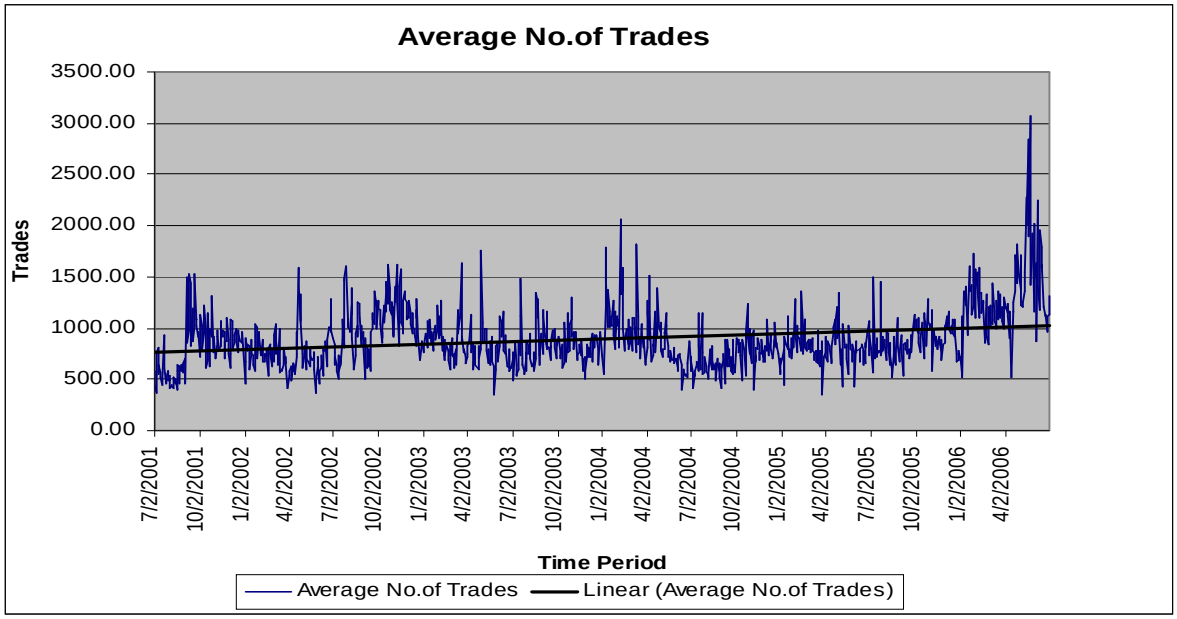

Figure 3: OMX-30S average no. of trades from July 2001 to June 2006

Looking at the trade size column of the table reveals that the average trade size during the last six months of 2001 is 6047 shares. The trade size then shows an increasing trend in the next three six-month periods reaching a level of 11599 shares in the first six months of 2003. After this period it starts declining again until it reaches an average value of 6698 shares during the first six months of 2006. Out of the total nine six-month periods trade size decreases in five of the periods while it increases in four of the periods.

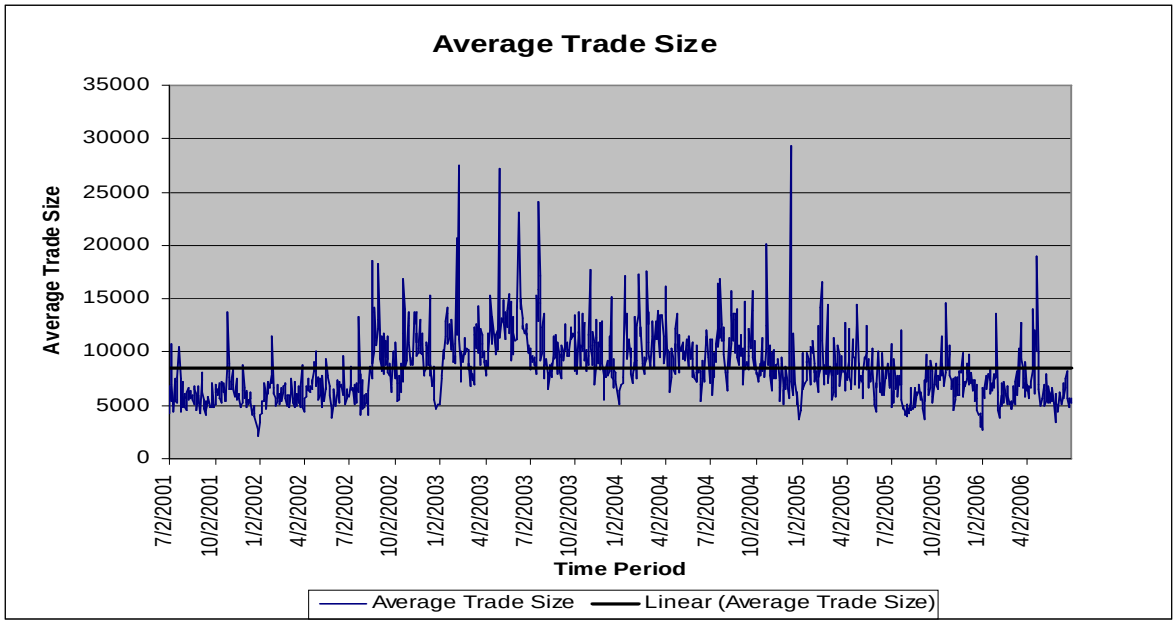

Figure 4: OMX-30S average trade size from July 2001 to June 2006

Table 4.2 *(Semi annual changes in Spread and Trading Variables, July 2001–June 2006)*

Year and six month period	Spread (Average)	Diff. from Previous Six Months	Volume (Average)	Diff. from Previous Six Months	No. of Trades (Average)	Diff. from Previous Six Months	Trade size (Average)	Diff. from Previous Six Months
2001 2	0.4460	0	4915243	0	807	0	6047	0
2002 1	0.3648	-0.0811	4906231	-9012	756	-51	6338	291
2002 2	0.3576	-0.0073	9405717	4499486	1033	276	9001	2663
2003 1	0.2846	-0.0730	10119887	714170	849	-184	11599	2599
2003 2	0.2856	0.0010	8462089	-1657798	823	-26	10084	-1515
2004 1	0.2747	-0.0109	9773641	1311552	921	98	10228	144
2004 2	0.2452	-0.0295	7065116	-2708525	727	-194	9553	-675
2005 1	0.2622	0.0171	7161841	96725	834	107	8435	-1118
2005 2	0.3052	0.0429	6180222	-981618	879	44	6846	-1589
2006 1	0.3371	0.0319	8987494	2807272	1343	464	6698	-148

4.2 Determinants of Bid Ask Spread

In order to analyze what factors might determine changes in bid ask spread (liquidity variable) we carry out a regression. The regression consists of taking the spreads as the dependant variable and the volume, number of trades, trade size, three month interest rate, ten year interest rate, inflation and GDP as independent variables in a regression equation of the type mentioned under the ***methodology*** heading. However before conducting our regression we need to carry out all the data processing steps mentioned earlier in order for our regression results to be robust.

4.2.1 Stationarity

We run the *Augmented Dickey Fuller Test (ADF)* to check for stationarity in our variables. The results are as shown in Table 4.3 below:

Table 4.3 ***Results of Augmented Dickey Fuller Test (ADF)***

Variable	**Test Critical Values (5% level)**	**T – Statistic**	**Prob.**
Spread	-2.863653	-5.398832	0.0000
Volume	-2.863653	-8.976101	0.0000
Trades	-2.863653	-6.253802	0.0000
Trade size	-2.863653	-7.240078	0.0000
3 month interest rate	-2.863672	-1.576566	0.4943
10 year interest rate	-2.863646	-1.421978	0.5728
Inflation	-2.863646	-1.840115	0.3611
GDP	-2.863646	-2.455859	0.1268

Spreads, volume, trades and trade size (i.e. liquidity and trading variables) are all stationary since the test statistics are less than the critical values (Brooks 2002). However three month interest rate, ten year interest rate, inflation and GDP (i.e. macroeconomic variables) are all non-stationary since their test statistics exceed the critical values (Brooks 2002). Hence in order to induce stationarity in these variables we take their first differences and again check for stationarity. The results are shown in Table 4.4 below:

Table 4.4 ***Results of Augmented Dickey Fuller Test (ADF)***

Variable	**Test Critical Values (5% level)**	**T – Statistic**	**Prob.**
3 month interest rate (first difference)	-2.863670	-14.39455	0.0000
10 year interest rate (first difference)	-2.863646	-33.95053	0.0000
Inflation (first difference)	-2.863646	-35.31871	0.0000
GDP (first difference)	-2.863646	-35.33175	0.0000

As can be seen after taking their first differences the variables have become stationary as their test statistics are now less than the critical values.

4.2.2 Multicollinearity

In order to check for multicollinearity in our independent variables we construct a correlation matrix shown below:

Table 4.5 ***Correlation Matrix of all explanatory variables***

	VOLUME	*TRADES*	*TRADESIZE*	*_3MD*	*_10YD*	*INFLATIOND*	*GDPD*
VOLUME	1.000000	0.635510	0.794098	-0.049731	-0.005306	0.008092	-0.039030
TRADES	0.635510	1.000000	0.105470	0.010113	0.046797	0.033055	-0.030529
TRADESIZE	0.794098	0.105470	1.000000	-0.075692	-0.050486	-0.020380	-0.040254
_3MD	-0.049731	0.010113	-0.075692	1.000000	0.316396	0.015995	-0.021550
_10YD	-0.005306	0.046797	-0.050486	0.316396	1.000000	0.052391	-0.033839
INFLATIOND	0.008092	0.033055	-0.020380	0.015995	0.052391	1.000000	-0.136123
GDPD	-0.039030	-0.030529	-0.040254	-0.021550	-0.033839	-0.136123	1.000000

Volume and trade size have a high correlation of 0.79, hence we drop trade size from our regression.

4.2.3 Linearity

In order to check if our regression model is linear we run the *Ramsey Reset test* on our model. Results are shown below in Table 4.6:

Table 4.6 ***Results of Ramsey Reset Test***

F-statistic	28.94533	Prob. F(1,1236)	0.000000
Log likelihood ratio	28.79679	Prob. Chi-Square(1)	0.000000

This shows our model suffers from non-linearity since the F-statistic is highly significant at 5% level (Brooks 2002). In order to induce linearity we make the following transformations in our variables and then run the Ramsey Reset Test again:

Spreads = log(spreads)
Volume = log(volume)
Trades = log(trades)

Table 4.7 ***Results of Ramsey Reset Test***

F-statistic	1.583837	Prob. F(1,1236)	0.208447
Log likelihood ratio	1.593068	Prob. Chi-Square(1)	0.206888

The F-statistic is now non-significant meaning the model has now become linear.

4.2.4 Normality

To check for normality in our residuals we run the *Jarque Bera Test.* Results appear below in Table 4.8:

Table 4.8 ***Results of Jarque Bera Test***

MEAN	-5.43e-16
MEDIAN	-0.020850
MINIMUM	-2.740316
MAXIMUM	0.771634
STANDARD DEVIATION	0.213851
SKEWNESS	-2.195675
KURTOSIS	36.81835
JARQUE BERA	60280.35
PROBABILITY	0.000000

Our residuals suffer from non-normality since our Jarque Bera statistic is highly significant at the 5% level (Brooks 2002). However since our sample size is quite large, presence of non-normality is inconsequential (Brooks 2002).

4.2.5 Heteroskedasticity

To check for Heteroskedasticity we run the *White's Test* on our model. Results appear in Table 4.9 below:

Table 4.9 ***Results of White's Test***

F-statistic	1.117880	Prob. F(12,1231)	0.340921
Obs*R-squared	13.41009	Prob. Chi-Square(12)	0.339951

The F-statistic is non-significant hence we do not reject the null hypothesis that there is no heteroskedasticity (Brooks 2002).

4.2.6 Simultaneity

To check for simultaneity problem we test our two most suspect variables i.e. volume and trades using *Hausman's Test:*

Volume

1. First we regress the variable volume on all other explanatory variables and save the value of residuals/errors obtained (res_volume)
2. Next we carry out our normal regression using all the dependant and independent variables but this time adding the residuals saved from the previous step (res_volume) as an additional variable. The result is shown below in Table 4.10

Table 4.10 ***Results of Hausman's Test***

Dependant Variable: LOG (SPREADS)				
Independent Variable	***Coefficient***	***Standard Error***	***T-Statistic***	***Probability***
C	1.069907	3.915161	0.273273	0.7847
LOG(VOLUME)	-0.351561	0.488095	-0.720272	0.4715
LOG(TRADES)	0.486750	0.558575	0.871413	0.3837
_3MD	-0.075971	0.625722	-0.121413	0.9034
INFLATIOND	-0.047673	0.103188	-0.462002	0.6442
GDPD	-0.096354	0.169600	-0.568125	0.5701
RES_VOLUME	0.063010	0.488440	0.129003	0.8974

The coefficient of res_volume is non-significant at 5% level hence we do not reject the null hypothesis of no simultaneity (Brooks 2002).

Trades

1. Just as before, first we regress the variable trades on all other explanatory variables and save the value of residuals/errors obtained (res_trades)
2. Next we carry out our normal regression using all the dependant and independent variables but this time adding the residuals saved from the previous step (res_trades) as an additional variable. The result is shown below in Table 4.11:

Table 4.11 ***Results of Hausman's Test***

Dependant Variable: LOG (SPREADS)				
Independent Variable	***Coefficient***	***Standard Error***	***T-Statistic***	***Probability***
C	0.579252	0.229207	2.527193	0.0116
LOG(VOLUME)	-0.315420	0.208401	-1.513522	0.1304
LOG(TRADES)	0.475167	0.468937	1.013286	0.3111
_3MD	-0.036089	0.378435	-0.095363	0.9240
INFLATIOND	-0.045681	0.093368	-0.489259	0.6247
GDPD	-0.081214	0.126487	-0.642075	0.5209
RES_TRADES	-0.060614	0.469865	-0.129003	0.8974

The coefficient of res_trades is non-significant at 5% level hence we do not reject the null hypothesis of no simultaneity (Brooks 2002).

It is important to mention here that during the second step of Hausman Tests mentioned above, we encountered a "near singular matrix" error in eviews. According to eviews manual this error occurs when the explanatory variables are exactly collinear and the remedy is to drop either the constant or one of the variables. However checking our variables we could not find any evidence of exact collinearity, but in order to proceed

forward we dropped one variable (_10 yd) from the equation. We are not sure if this would have affected the results of Hausman Test in a significant manner. However if the results had been affected significantly then it is possible that our model suffers from a simultaneity problem and the OLS estimates may not be consistent.

4.2.7 Regression

Our actual regression output is as shown below in Table 4.12:

Table 4.12 ***Regression Output***

Dependant Variable: LOG (SPREADS)				
Independent Variable	***Coefficent***	***Standard Error***	***T-Statistic***	***Probability***
C	0.565735	0.202991	2.786993	0.0054
LOG(VOLUME)	-0.288551	0.018366	-15.71156	0.0000
LOG(TRADES)	0.414553	0.029527	14.03985	0.0000
_3MD	-0.016411	0.301863	-0.054366	0.9567
_10YD	0.019437	0.150668	0.129003	0.8974
INFLATIOND	-0.039041	0.075682	-0.515854	0.606
GDPD	-0.081421	0.126443	-0.643932	0.5197
R-squared	0.176756	Mean dependent var		-1.176756
Adjusted R-squared	0.172763	S.D. dependent var		0.235693
S.E. of regression	0.214369	Akaike info criterion		-0.236627
Sum squared resid	56.84506	Schwarz criterion		-0.207782
Log likelihood	154.1819	F-statistic		44.26538
Durbin-Watson stat	0.83303	Prob(F-statistic)		0.0000

As can be seen that both the trading variables (volume and trades) are statistically significant at 5% level which means they explain changes in spread (dependant variable) quite well.

Volume has a negative coefficient of -0.288551 signifying that it is negatively related to spread. This result is according to our expectation as an increase in volume signifies an increase in the liquidity position of the stock market which results in a reduction in the bid ask spread.

Number of trades has a positive coefficient of 0.414553 signifying that it is positively related to spread. This result is not in accordance with our expectation since increase in the number of trades / trading frequency signifies greater retail investor activity that should cause an increase in the volume traded on the stock market. Since volume is negatively related to spread, an increase in the number of trades should decrease the bid ask spread i.e. should be negatively related to spread.

It can also be seen that all the macroeconomic variables are statistically non-significant at 5% level which means they do not explain changes in spread (dependant variable).

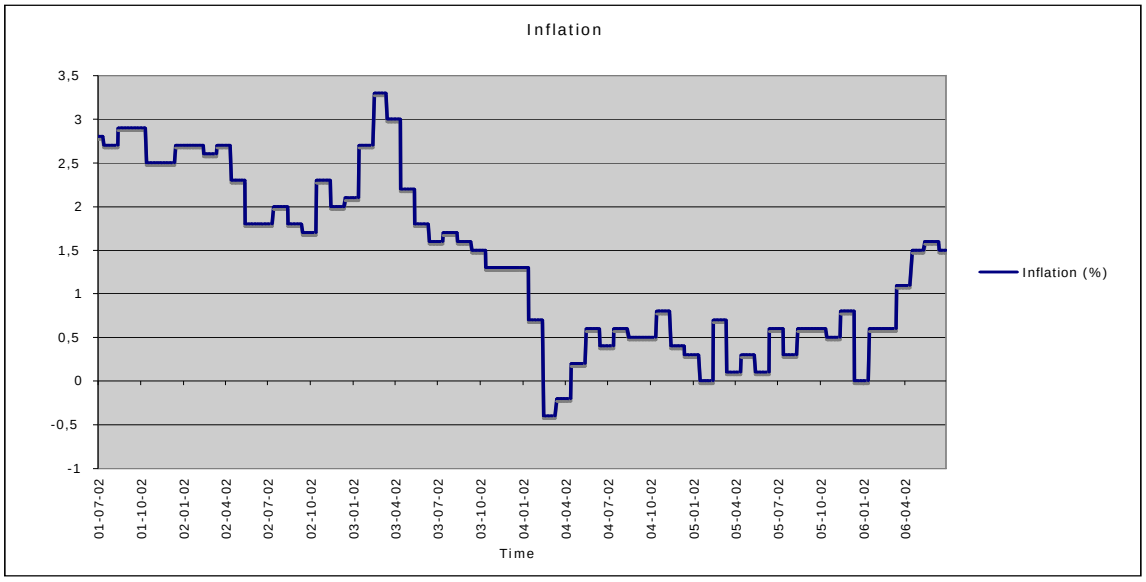

Figure 5: Swedish inflation rates from July 2001 to June 2006. Data is based on monthly figures (Riksbanken Sweden)

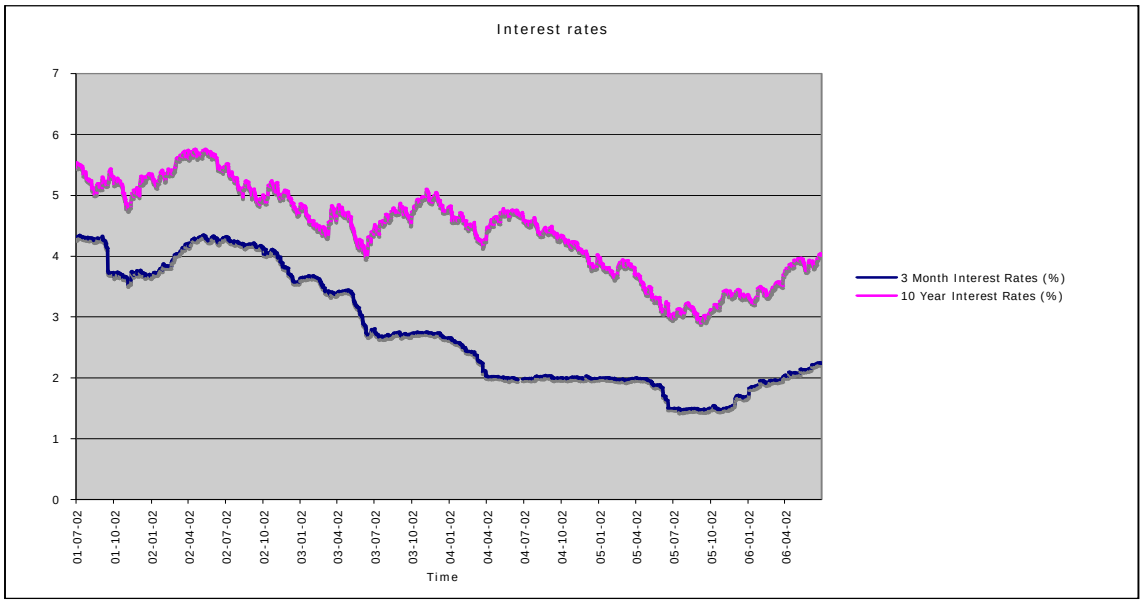

Figure 6: Swedish three months treasury bills and ten year government bond interest rates from July 2001 to June 2006. Data is based on daily figures (Riksbanken Sweden)

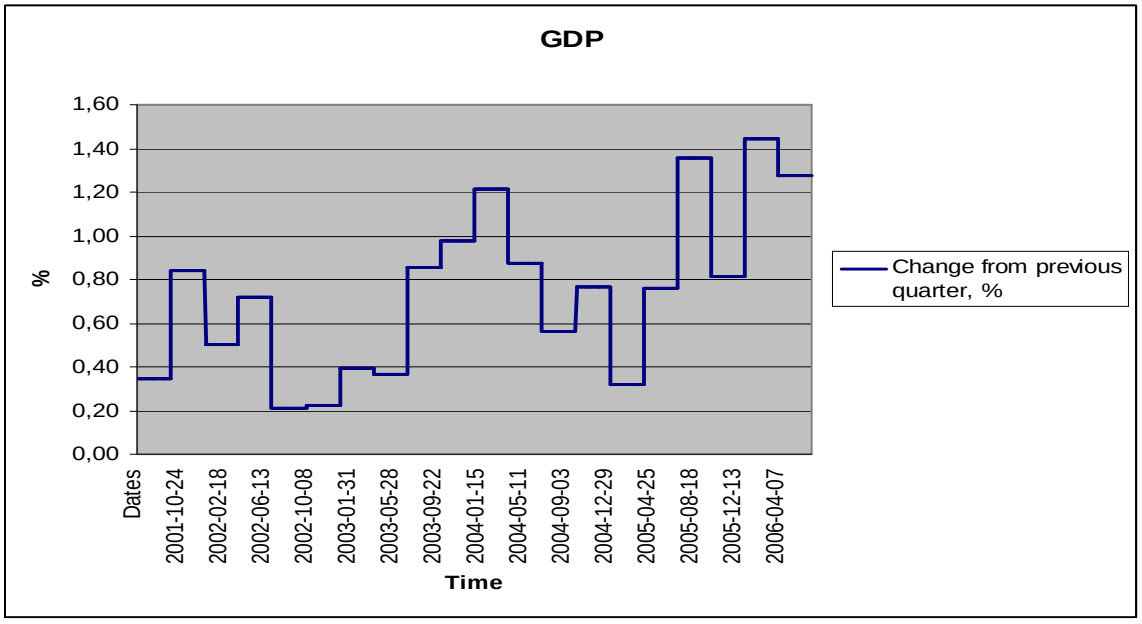

Figure 7: Swedish GDP rates from July 2001 to June 2006. Data is based on quarterly figures (SCB Sweden)

5 Analysis

After having determined the trends in all variables one by one we have concluded that there is a declining trend for the spread and average trade size whilst it is an increasing trend for volume and number of trades. These trends are all according to prior research and what we expected to find. However, for none of the variables has the decrease been apparent in all of the nine different six months periods used. This suggests that there are contrary episodes during limited time periods but the overall trend is still clear during the five year. If a longer time frame was used we believe that we would still see the same trends.

The main reason for increased volume and number of trades is the increasing investment taking place in the Stockholm Stock Exchange during the study period. According to OMX the value of Stockholm Stock Exchange has increased with 52 % since 1996 (i.e. from 198 Billion Euros in 1996 to 301 Billion Euros in 2004). Moreover the Stock Market turnover (trades) at Stockholm Stock Exchange has increased from 107 Billion Euros in 1996 to 372 Billion Euros in 2004. The increasing investment in the stock exchange in turn can be attributed to the favorable state the Swedish economy has been in during the study time period (according to SCB the annual GDP growth in Sweden has increased from approx 1.1% in 2001 to approx 4.0% in 2006). Trading behavior is also likely to have changed during this time as the study starts soon after a major crash in the market. We suggest that as time passed the number of investors that got affrighted away from the market in 2000 are returning along with new investors which inevitably leads to higher liquidity and increased number of trades as well as reduced spread and trade size.

The study reveals a statistically significant dependence between the dependent variable spread and independent variables volume and trades. It means that volume and number of trades can explain the size of the spread at the Stockholm stock exchange during this period. When the liquidity increases the spread decreases. This is what we expected to find and in accordance to prior research by Longstaff, Mithal and Neis (2005), Mamaysky and Wang (2004), Marwan Izzeldin (2007) and Ericsson and Renault (2002).

If an investment is more liquid it is more attractive for an investor and it will cost less for the broker or market maker to take the risk of the transaction. This is normal behavior of investors and its intermediaries.
However, the regression analyses also suggest that there is a positive relation between the number of trades and the spread, meaning that as the number of trades increases the spread should also increase. This was not expected nor found in previous research that found the opposite correlation. When studying the variables by itself it was found that the number of trades has increased during the same period as the spread decreased. Our understanding of other research shows that the number of trades goes hand in hand with the liquidity and decreased spread that is why we are unable to explain this relation. We are surprised by the results and suggest further studies in order to establish whether it is a positive, negative or insignificant correlation.

The macroeconomic variables were statistically non-significant at 5% level and therefore found not to explain changes in the spread. This is in agreement with the study of Ness and Warr (2005) who did not find macroeconomic variables significant except for the interest rate, though it needs to be taken into consideration that their study concerned announcements of the changes in macroeconomic factors and not the actual changes. This is contradictory to Chordia, Roll, and Subrahmanyam (2001) who did find a significant correlation between macroeconomic variables and spread. We believe that the macroeconomic variables studied do influence the market behavior, however the influence my not be reflecting in changes in the spread. Again, we suggest further research to unanimously conclude the dependence for the Stockholm stock exchange.

6 Conclusion

We provide a time series analysis of trading and trading costs over a five year period (2001-2006) on the OMX stock market somewhat similar to the one conducted by Van Ness and Warr (2005) on the NASDAQ stock market. Our main focus is on the bid ask spread which is the largest component of trading cost.

Our findings are mostly in consonance with the findings of Ness and Warr (2005). The composition of OMX trades and trading behavior has been changing. The average volume and trading frequency has been increasing steadily over time, whereas the average trade size has been decreasing over the same period. We speculate that these changes are a result of greater retail participation and investment in the market.

We find that the spreads have been declining steadily over this period. The factors that seem responsible for this decline are increasing volume through increased investor activity and decreased average trade size. However, the study also finds that there is a positive relation between the spread and number of trades which is unexpected and that cannot be supported by previous research.

As regards to the macroeconomic factors interest rates, inflation rate and GDP rate, we find that these factors do not seem to affect changes in the spread. This is in consonance to some earlier findings regarding macroeconomic announcements not affecting the spreads.

6.1 Further studies

We believe that there would be other factors that would be influencing the changes in the bid ask spread other than the ones we analyzed which require further research to be identified. One example is the tick size in accordance to the study of Niemeyer and Sandås (1994).

Further studies can be conducted in order to try to provide evidence for a general conclusion on the relationship between the factors determining trading and trading costs. We suggest further investigation at other exchanges as well as during other periods.

We also suggest further studies in regards to trading behavior and its relationship with trading activity and trading costs.

7 Sources

7.1 Literature

- Copeland, T and V Antikarov (2003), *Real Options. A Practitioner's Guide*, Thomson.
- Frank Heflin, Kenneth W. Shaw / Huang and Stoll (1997) / Lin, Sanger and Booth (1995), *Trade size and the adverse selection component of the spread: which trades are big* ?, Journal of Financial Research 28 (4), 621–625
- Koller, T, M Goedhart, and D Wessels (2005*), Valuation. Measuring and Managing the Value of Companies*, Wiley
- Chris Brooks (2002), *Introductory Econometrics for Finance*
- Robert S. Pindyck and Daniel L. Rubinfeld (1991), *Econometric Models and Economic Forecasts*

7.2 Articles

- Bessembinder, H., 1999, *Trade execution costs on NASDAQ and the NYSE: A post-reform comparison,* Journal of Financial and Quantitative Analysis
- Bessembinder, H., 2003. *Trade Execution Costs and Market Quality after Decimalization*, Journal of Financial and Quantitative Analysis 38, 747 – 777
- Chen Long; Lesmond David A; Wei Jason (2007), *Corporate Yield Spreads and Bond Liquidity,* The Journal of Finance, 62, pages 119
- Chordia, Roll, Subrahmanyam, *Market Liquidity and Trading Activity*, 2001, Journal of Finance, Blackwell Publishers, 56, 2, 501-530
- Ericsson, J., and O. Renault (2002), *Liquidity and credit risk*, Working paper, McGill University
- Jonas Niemeyer and Patrik Sandås (1993), *An Empirical Analysis of the Trading Structure at the Stockholm Stock Exchange*, Journal of Multinational Financial Management, 63-101,

- Kumar, P.C (2004*), Bid ask spreads in US Equity markets (Study of elements of transaction costs)*, Quarterly Journal of Business and Economics
- Longstaff, F., S. Mithal, and E. Neis (2005), *Corporate yield spreads: Default risk or liquidity? New evidence from the credit-default swap market*, Journal of Finance 60, 2213–2253.
- Marwan Izzeldin (2007), *Trading Volume and the number of trades: A comparative study using high frequency data*, Lancaster University Management School, Economics Department
- Nikolai Zaitsev (2006), *Trend arbitrage, bid-ask spread and market dynamics*, Quantitative Finance, pages 21 – 42
- Oxelheim, L and C Wihlborg (2005), *Corporate Performance and Exposure to Macroeconomic Fluctuations*, Norstedts Academic Publishers
- Pankaj (2005), *Do Tracking Stocks Reduce Information Asymmetries? An Analysis of Liquidity and Adverse Selection*, The Journal of Financial, 28, pages 197 – 213
- Pressman Aaron (2007), *Fidelity's Trade School*, Business Week, pages 116
- R.Roll (1984), *A simple implicit measure of the effective bid-ask spread in an efficient market*, Journal of Finance, Vol. 39, No. 4, pages 1127-1139
- Sandås (2000), *Trading volume and autocorrelation: Empirical evidence from the Stockholm Stock Exchange*, Journal of Banking and Finance, pages 1275 – 1287
- Stefan W Schmitz (2000), *The Effects of Electronic Commerce on the Structure of Intermediation*, Journal of Computer-Mediated Communication, JCMC
- Van Ness, Van Ness and Warr (2005), *NASDAQ Trading and Trading Costs 1993*-2002, The Financial Review 40, 281—304

7.3 Internet sources

- ADVFN, http://www.advfn.com
- Business Line, www.blonnet.com
- Central Bureau of Statistics, www.scb.se
- Ekonominyheterna, http://ekonominyheterna.se
- Investopedia, www.investopedia.com

- Investor home, http://www.investorhome.com/daytrade/spread.htm
- Konjunktur institutet, http://www.konj.se
- OMX official website, http://www.omxgroup.com/omxcorp/
- Realtid, http://www.realtid.se
- Riksbanken, http://www.riksbank.se/
- The Wall Street Journal, www.wsj.com

7.4 Databases

- DataStream
- ELIN@Lund (Electronic Library Information Navigator)
- SCB (Statistiska Centralbyrån)
- LIBRIS (National database for library services)
- Affärsdata (www.ad.se)