



JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL  
Jönköping University

# Mergers of European Stock Exchanges

Network Externalities and Liquidity

Bachelor's thesis within Economics

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Jönköping January 2009

## **Bachelor's Thesis in Economics**

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**Date:** 2009-01-22

**Subject terms:** Competition of Stock Exchanges, Mergers, Networks, Network Externalities, Liquidity, Bid Ask Spreads, Consolidation

**JEL Codes:** G20, D62, D40, L1

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### **Abstract**

This thesis analyses the advantages and disadvantages of mergers and consolidation of stock exchange networks in Europe, both from the individual exchange's point of view and from welfare point of view. The benefits from the recent mergers are investigated empirically. The following mergers are covered: Euronext-New York Stock Exchange (April 2007), London Stock Exchange-Milan Stock Exchange (October 2007) and NASDAQ-OMX (February 2008). After the mergers, trading activity increased in Euronext, LSE and in the combined LSE Milan exchange. Milan Stock Exchange lost trading activity. Bid ask spreads of six shares traded in OMX are investigated to find out the effects of the merger with NASDAQ. No significant welfare benefits could be seen in the investigated shares, only one share out of the sample, namely Nokia's, experienced a drop in the bid ask spread implying an increase in liquidity. In conclusion, the mergers of the financial exchanges in Europe seem to be beneficial for the exchanges as a competitive strategy. In general, the investigated mergers improved the competitive position of the merged exchanges.

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# 1. INTRODUCTION

The stock exchange industry is in a process of transformation. Technological development, in particular the information and communication technology and globalization have made it possible for investors as well as for firms to search for the best deals when deciding where to trade and where to list. These factors have had a big impact on the traditional stock exchanges, which have seen their market power diminish and are forced to compete for customers and survival harder than before (Ramos, 2003).

Recently observed strategy to cope with the situation of toughened competition has been to merge and form alliances. Lately, we have observed a number of mergers in the European markets. In the last two years, the following mergers took place: New York Stock Exchange (NYSE) and Euronext merged in April 2007, London Stock Exchange (LSE) and Milan Stock Exchange merged in October 2007 and NASDAQ merged with OMX in February 2008.

This thesis will analyze the recently observed trend of mergers of the stock exchanges. Mergers can potentially create both positive and negative welfare effects. A merger can benefit an individual stock exchange because of the positive size externalities and potential increase in liquidity that attracts new agents to the network. The economic surplus may also increase, because the liquidity adds to the utility of market participants and decreases transaction costs. On the other hand mergers and consolidation can lead to welfare inefficiencies if the stock exchange gains too much market power.

This thesis empirically finds that in the recent mergers, the merged stock exchanges attracted new trading and captured market share in the European market. Some evidence is also found suggesting an increase in economic surplus in the market for Nokia's share in OMX after the merger with NASDAQ. However, the other investigated shares do not seem to have gained similar benefits.

The analysis will only concentrate on the trading services aspect of stock exchanges' business. In the analysis, the stock exchanges' product is limited to be the service of accommodating trades, excluding other aspects, such as listing services and information sales.

## 1.1. Purpose of the Study

The thesis will try to explain why merging is a sound strategy for stock exchanges as a competitive strategy and analyze the benefits and potential downsides of the eventual consolidation with European stock exchanges as its main focus. Empirically the thesis will try to find out what were the consequences of the recent mergers in Europe. Both competitive and welfare aspects are taken into consideration.

## 1.2. Outline of the Thesis

Section 2 provides the background and a literature review of the advantages and disadvantages of the mergers, in section 3 the core of financial exchange networks is presented and welfare and competitive consequences of the mergers are evaluated and the empirical questions are provided. In section 4 the mergers' effects are tested empirically and section 5 concludes the study.

## 2. BACKGROUND

### 2.1. A Brief History of Intensified Competition and Mergers

In the past, stock exchanges have been government supported natural monopolies<sup>1</sup>, owned either mutually by the firms and members of the exchange as in the Anglo Saxon countries, or by governments as in continental Europe (Ramos, 2003). In the last two decades, this situation has changed rapidly due to intensified competition. There are two observable trends in the behavior of the stock exchanges to deal with the increased competition: Demutualization<sup>2</sup> and mergers (Shy and Tarkka, 2001). The stock exchanges tend to go public and then merge. Ramos (2006) even finds some evidence that stock exchanges tend to demutualize *in order to* merge.

There are two factors that have had pronounced impacts on competition between European stock exchanges. One factor is the event known as the “big bang”. The big bang was a reform of the London Stock Exchange (LSE) which introduced a change into an electronic trading platform and eliminated barriers of competition (Goodison, 2006). This led to lower transaction costs which made LSE more competitive, attracted trading volume from other European exchanges and forced competitors to respond with similar actions (Ramos, 2003). Thus the big bang essentially started the competition between stock exchanges in Europe (Gehrig, 1998). The other factor that has contributed to the intensified competition is the process of integration of the European economies<sup>3</sup>, which has also made the cross border mergers easier (Ramos, 2003).

In the last ten years, the competitive environment of European stock exchanges has changed rapidly in the wake of series of mergers. These include the creation of the Euronext, where the stock exchanges of Amsterdam, Brussels, Lisbon and Paris merged into one pan- European exchange, the creation of OMX, where seven Nordic and Baltic exchanges merged into one firm, the merger of NYSE and Euronext, the NASDAQ OMX merger and the merger of Milan’s stock exchange and LSE (Nielsson, 2008). Apart from outright mergers, the stock exchanges are also forming alliances, making cooperative agreements and making their platforms compatible to enable cross exchange trading in order to avoid destructive competition (Ramos, 2003).

To the author’s knowledge, the only paper that investigates the consequences of the mergers in Europe, is Nielsson (2008) who finds empirically that the formation of Euronext increased the liquidity in all the Euronext markets (Amsterdam, Brussels, Lisbon and Paris) and that the newly created exchange captured market share of trading flows in Europe. In the U.S. for example Arnold, Hersh, Mulherin and Netter (1998) assess the competition for trading activity of the regional U.S. exchanges. They find that the merged stock exchanges managed to win market share from the non-merged regional exchanges.

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1 The stock exchanges were seen as philanthropic institutions for public interest (Ramos, 2003).

2 Demutualization can be defined as a process of transformation where mutually held company is converted to another legal type of firm, usually to a public corporation (*Investopedia.com, 2009*)

3 Such as introducing the Euro, enabling cross border trading, etc.

## 2.2. Literature Review

Essentially, stock exchanges are networks where the traders connect with one another in order to buy and sell equities. The networks are associated with positive network externalities<sup>4</sup>, and this is why the mergers can be beneficial. There might be many reasons for any single merger, but in general, the stock exchanges will presumably want to exploit the positive size externalities and economies of scale in order to survive in the market and compete. The following literature discusses the positive externalities associated with networks, the potential downsides of the consolidation and the economies of scale associated with the trading activities.

### 2.2.1. *Potential Benefits and Downsides from Mergers and Consolidation*

An early model of network externalities was formulated by Jeffrey Rohlfs (1974), who analyzed the demand for telecommunications networks and found an inverse U-shaped demand function for the size of the network. This could imply that a network associated with network externalities would eventually provide a large network with relatively low price. Nicholas Economides applies the economics of networks to the case of stock exchanges in his paper: “Network economics with application to finance” (1993). He analyses financial exchanges and the network externalities associated with them. According to Economides (1993), there are positive externalities caused by the increase in liquidity that is associated with an expansion in the size of the network. The other kind of externality arises from the ability of the rivals to “free ride” and benefit from the enhanced price discovery (Economides, 1993). A conclusion of the aforementioned paper is that as the size of the exchange increases, the more valuable it becomes to its members because of the increased liquidity. Traders have more opportunities of trading bigger quantities faster and with reduced uncertainty of the price (Economides, 1993).

Economides (1996) analyzes the positive consumption and production externalities. He suggests that a monopoly is not a welfare maximizing market structure, because the profit maximization incentives are stronger than incentives to increase the network size to exploit the network externalities.

### 2.2.2. *Economies of Scale*

Hasan and Malkamäki (2001) empirically find the presence of economies of scale in trading activities. The idea of economies of scale in exchange activities is by no means a new one. To the stock exchanges with specialized market makers can be applied a proposition of Adam Smith in his celebrated “Wealth of Nations”:

*“As it is the power of exchanging that gives occasion to the division of labour, so the extent of this division must always be limited by the extent of that power, or, in other words, by the extent of the market”* (1776)

As the liquidity of the market increases, a market maker can attain a higher degree of specialization and thus become more efficient in market making, enabling transactions cheaper than before (Demsetz, 1968).

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4 Network externalities and their importance are explained in detail in section 3.

### 3. THEORETICAL ASSESSMENT AND EMPIRICAL QUESTIONS

#### 3.1. Potential Advantages of Mergers

##### 3.1.1. The Network Externalities

The stock exchanges can benefit from network externalities by merging or connecting their networks<sup>5</sup>. Network externalities are special kinds of externalities arising from the amount of people or units in the network (Varian, 2006 p.658). We can illustrate the principle of how networks exhibit positive network externalities as Economides (1993), with the help of a simple “star network”<sup>6</sup>, as in Figure 1 and Figure 2 which we can interpret as stock exchanges<sup>7</sup>. “S” is the central “switch” that A, B, C, D and E uses to connect with each other. The possibility to connect is the main source of utility and a reason to belong to the network. Consequently, the utility increases with the number of potential connections. The potential connections in the first network are: ASB, ASC, BSC, both ways. When one extra member, D, is added to the first network and counted the potential connections again, we get: ASB, ASC, ASD, BSC, BSD, CSD, both ways. (Anyone can both sell and buy) The number of potential connections doubles every time a new member is added to the network. More generally, if an extra member is added to a network with  $n$  members, it creates  $2n$  potential connections (Economides, 1993). This could also be regarded as an increase in competition. Let us imagine that “S” is an asset that the market makers A, B, C and D want to trade. An increase in the number of possible connections would force the market makers to compete harder (in terms of spreads, execution times, etc.) for the trade (e.g. Harris, 2003).

Figure 1: Star network with ABCS

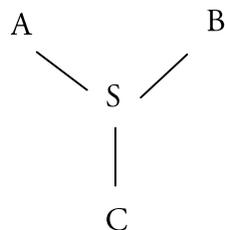
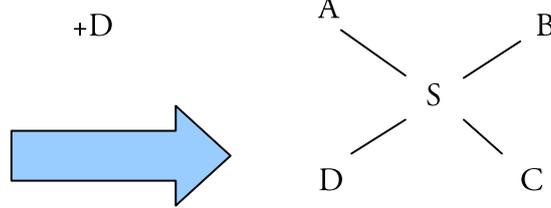


Figure 2: Star network with ABCDS



Source: Economides, 1993 p. 1 for both figures

In order to get an idea of how the liquidity benefits stock exchanges, we can illustrate an “order book network”, in a way similar to Economides (1993). Figure 3 presents the network, where  $B_1, B_2, \dots, B_n$  are the demand side i. e. buyers willing to buy a given

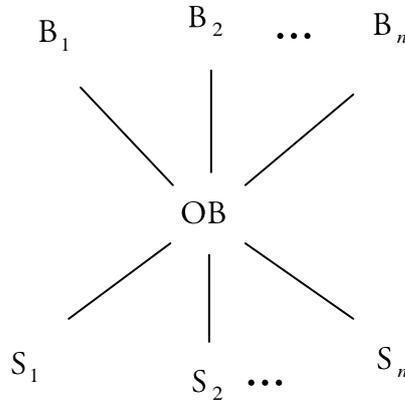
5 Or just by growing.

6 Star network can be understood as a network with a central “switch” that the members of the network use to connect between each other, and where the members of the network are not connected in other way than through the “switch” (*The Free On-line Dictionary of Computing, 2009*)

7 Other examples of networks where the number of participants increases the utility: Faxes, telephones, E-mails, Facebook, etc.

amount of assets at a given time with a given price.  $S_1, S_2, \dots, S_n$  are suppliers, who are willing to sell the given amount of assets at a given time and price. These “orders” are gathered and matched in “OB”, order book.<sup>8</sup>

Figure 3: Illustration of order book, Supply and Demand side orders



Source: Economides (1993), p. 3

As explained in Economides (1993), both B:s and S:s are demanding a “trade”, i.e. an execution of their orders. However the offers from B:s and S:s will only become a trade when the price of the offers matches. Not all of the B:s and S:s “match” and benefit each other directly by becoming a trade, but they do however indirectly benefit the whole opposite side of the order book. Every order to sell benefits the demand side and every order to buy benefits the supply side, because of the added liquidity. After a new offer is posted in either side, the opposite side of the order book will now have more opportunities to trade. Every new order increases the depth of the book and adds a unit to the scale of the prices, making the distances of the prices smaller and thus decreasing the variability of the prices that are on offer in the order book (Economides, 1993).

Furthermore, the increase in liquidity is interesting to traders outside the market that are interested in trading the asset in question. If they can choose where to trade, they will generally prefer, all else equal, to trade in a more liquid market than less (Gehrig, 1998). Thus, the increased liquidity both benefits the market participants and attracts more agents into the network.

### 3.1.2. *The Demand Structure and Economies of Scale*

Rohfls (1974) derives the demand structure of the networks associated with the network externalities and obtains an inverse U-shaped demand curve for the size of the network. A numerical example is presented below to clarify the intuition in a similar fashion (following the same steps) than in Varian (2006) pp 658,659.

Let us first set the number of the people in the market as 1000<sup>9</sup> and index them as  $v = 1, \dots, 1000$ , where “ $v$ ” is the reservation price for the network by the person  $v$ . If the

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<sup>8</sup> It is up to any exchange to decide how they deal with the execution; they can use specialist market makers (e.g. NYSE) or an electronic order book. (e.g. OMX) Regardless of their decision, the same principles apply.

price of the membership in the network equals  $p$ , then  $1000 - p$  equals the number of the people valuing the network worth at least “ $p$ ”. In networks that exhibiting positive network externalities, people derive utility from the number of members in the network. In order to comply with that idea, let us suppose that the value of the network for a person  $v$  equals  $vn$  where “ $n$ ” is the number of people in the network (Varian, 2006).

Let us model the marginal individual who is indifferent of joining the network with the given price. First, let “ $\omega$ ,” be the index to describe the reservation price for that individual and “ $p$ ”, the price. Now, her willingness to pay for the membership equals the price (Varian, 2006):

$$p = \omega n \tag{1}$$

Everyone with higher reservation price than  $\omega$  will pay the price and connect to the network, so the number of people using the network is:

$$n = 1000 - \omega \tag{2}$$

We can add (2) to (1) and get:

$$p = n(1000 - n) \text{ (Varian, 2006)} \tag{3}$$

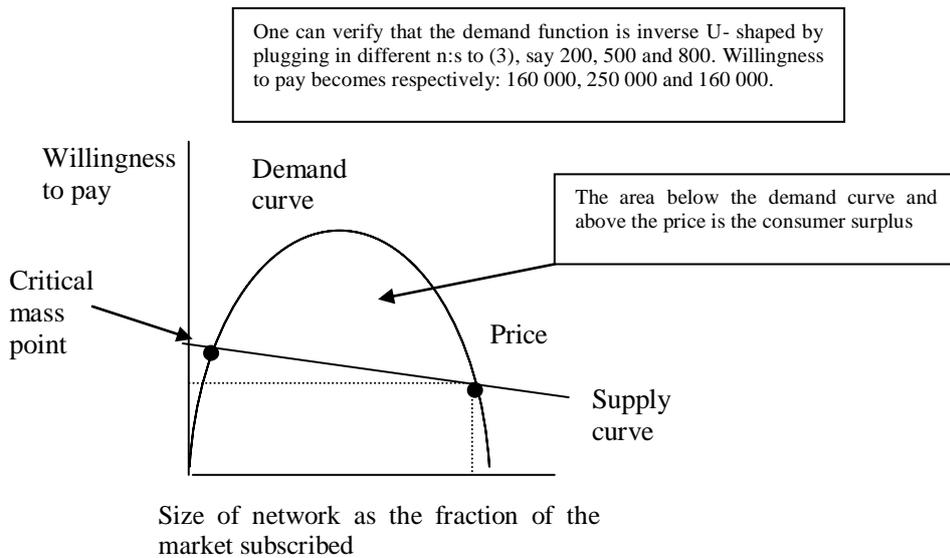
(3) gives an equation describing the demand function for the given network. This is similar to what Rohlfs (1974) obtains in a more general setting. One can observe that the demand function is an inverse U-shaped.

What about the supply side? As found by Hasan and Malkamäki (2001), stock exchanges exhibit economies of scale in producing trading services, meaning that marginal costs decrease as the network grows. In Figure 4 below, a downwards sloping supply curve is drawn to illustrate the welfare effects of the growing network if it charges competitive prices. According to Andersen (2005), this would be an accurate description of reality. He finds that European stock exchanges are engaged in monopolistic or perfect competition for trading services.

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<sup>9</sup> 1000 is totally a randomly selected number; the size of the network could in principle be any other positive discreet value.

Figure 4: The demand and supply of the exchange network with competition



Source: Author, building on Varian (2006) p.660

The figure 4 presents a case where a stock exchange is forced to charge competitive prices. It is important to note here that there are two intersection points, we can observe, that the network size has to exceed a certain point before it becomes interesting for the people to join it. When the network grows<sup>10</sup> the interest of joining the network increases and eventually when demand equals supply, we have the first equilibrium point with production. This is the so called “critical mass” (Rohfls, 1974). When the network achieves this size; it becomes self sustaining and tends to grow until it reaches the final equilibrium point where the marginal utility of the last person to join equals the price (Rohfls, 1974). This is the production level where a natural monopolist would maximize the welfare and customer surplus. A very large network would be provided with a minimal cost. The welfare could also be maximized in a situation, where the monopolist could efficiently price discriminate (e.g. Economides, 1993). In the real world, perfect first degree discrimination is nearly impossible, but stock exchanges do exercise the second degree price discrimination in similar fashion than in Oi (1971), they charge fixed “entrance fees” from the member brokers and traders and then take separate fees for every executed trade.

If the potential monopolist either charges competitive prices or price discriminates efficiently, there are no “dead weight” losses realized. Either way, a society benefits more with the larger networks because of the economies of scale and positive network externalities. Thus, given the above discussion it can be argued that much of the potential economic surplus is lost due to the competition between exchanges.

<sup>10</sup> The methods of growing the network when the size has not yet reached the “critical mass” are not a subject of analysis here, but one example is to offer the subscription for free and/or to provide some rewards for joining. (Like giving out cellular phones for free if one joins a certain telecommunications network)

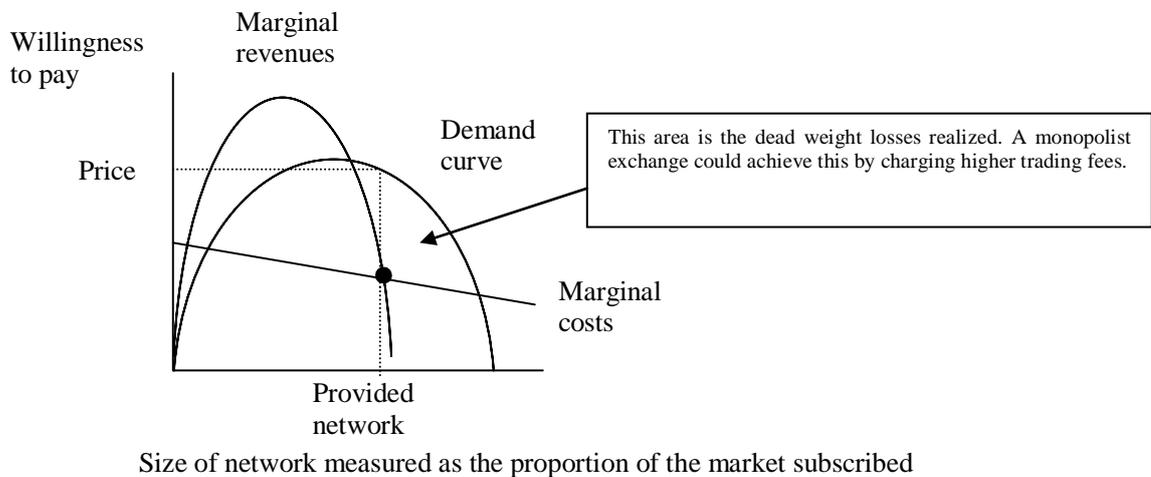
### 3.2. Potential Disadvantages of Mergers: The Monopolist

If the monopolist cannot price discriminate, it has an incentive to cut the production (Economides, 1996) and charge a price where marginal costs equals marginal revenues. This situation can be seen from Figure 5 below. We can continue with our example of a market with 1000 participants and derive the marginal revenues function for the network<sup>11</sup>. Marginal revenues function becomes:

$$n(2000 - 3n) \quad (4)$$

The resulting curve has steeper slopes, rises faster and higher, but also comes down faster and cuts the marginal cost curve at a point where the size of the provided network is much smaller than in the competitive case.

Figure 5: Welfare outcome with a non regulated monopoly



Source: Author, building on Varian (2006) p. 660

The profit maximizing monopolist charges much higher prices of the usage for the network and at the same time provides smaller network. Since we want to maximize welfare, the situation is inferior to the case where the network was charging competitive prices. The monopolist captures only a part of the consumer surplus and dead weight losses are realized.

### 3.3. Remarks and Empirical Questions

In the mergers of financial exchanges, the size of the network grows and the potential connections (i.e. the possibilities to buy and sell) grow in number as was presented in Figures 1 and 2. Since there are more market participants to post buy and sell offers, and to compete for the execution of the trade, the liquidity increases as presented in Figure 3. The utility from the network increases and becomes more attractive to the actors outside the network and thus more people will want to join. Accompanied by the economies of scale, as was presented in Figure 4, increases in the size of the network would lead to increases in economic surplus that can potentially be extracted by the exchange firm. The eventual monopolist will maximize society's welfare if it is forced to

<sup>11</sup> See for example Varian, (2006) p. 279, to see how to find marginal revenues from the demand curve.

charge competitive prices or if it can effectively price discriminate. If the monopolist cannot efficiently price discriminate, it will have an incentive to produce where the marginal revenues equals marginal costs, thus cutting the size of the network as in Figure 5. This would maximize the revenues of the stock exchange, but it would be a welfare inefficient outcome. It can be argued however, that if the monopolist would create economic profits, new competition would emerge, since entry into the market has become relatively easy due to technological development (Ramos, 2003).

Given this background, the empirical part of the thesis will test whether the mergers really improved the competitive standings of the exchanges by attracting new trading activity into the exchanges. Furthermore the welfare effects are investigated in the merger of NASDAQ and OMX. As discussed, an increase in the size of the network should increase trading activity by allowing more connections. Furthermore, more traders would like to trade in the network because of the supposed liquidity increase. The first question is:

1. Did the trading activity, measured as the number exercised trades, increase after the mergers compared to the non merged competitors, thus improving the strategic position in the market?

Increased number of potential connections in the financial network probably increases liquidity in the market. Increased liquidity means cheaper transaction costs and increased economic surplus. Shares traded in the NASDAQ OMX Nordic exchange<sup>12</sup> are investigated in order to find out whether the liquidity increased after the merger. Thus the second question is:

2. Did the liquidity increase in the NASDAQ OMX Nordic exchange traded shares after the merger?

Furthermore, since the merged exchanges can potentially gain some market power and cost benefits, they might have an incentive to either raise the fees per trade in order to maximize profits, or they might have an incentive to cut the fees in order to compete. If the European stock exchanges are engaged in perfect or monopolistic competition as found by Andersen (2005), then the latter is more likely. However, the author did not find<sup>13</sup> any indication for changes in the trading fees charged by the exchanges in European markets.

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12 Because the author can only access the liquidity data in OMX Nordic exchange.

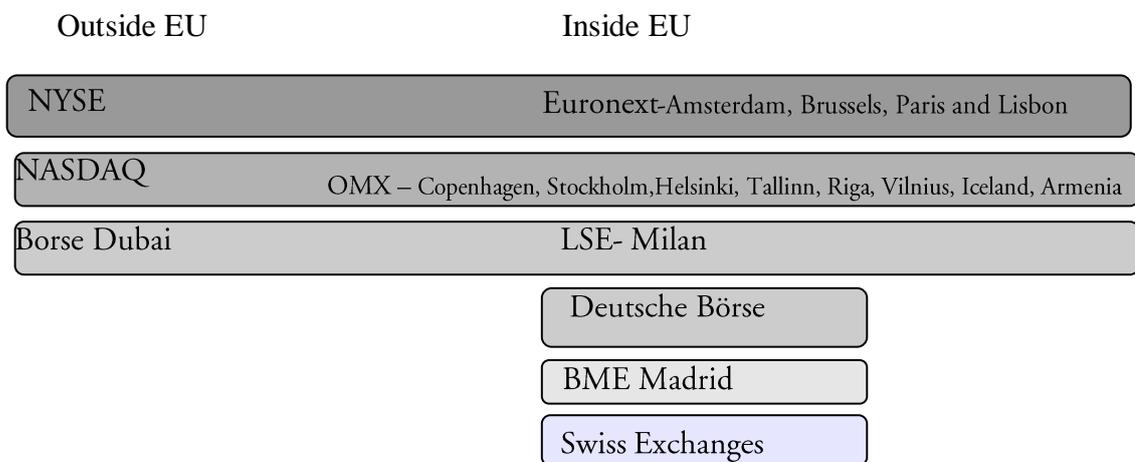
13 The author searched for indication about changes in the fees from the respective exchanges' websites in "press releases" sections and by searching in Google.

#### 4. EMPIRICAL ASSESSMENT OF THE MERGERS

Figure 7 presents the alliances and rivalries of the exchanges in order to understand the competitive relations in Europe. The mergers that are covered in this section are listed below:

- NYSE-Euronext, April 2007
- LSE-Milan, October 2007
- NASDAQ-OMX merger, February 2008

*Figure 7: The alliances of the European stock exchanges: the boxes are separate entities and rivals belong to different boxes. The exchanges are not in any order of importance, but the figure serves to give an overview of the competitive relations.*



Source: Depicted from website of FESE

The empirical tests are concerned with the effects of the mergers in the last two years. As said above we want to find out whether the trading activity and the liquidity increased because of the mergers. The number of executed trades is used to measure trading activity. The measure allows seeing the possible changes in the trading activity and it is less affected by the recent financial turmoil than a measure with monetary value. Furthermore the data was readily available in the website of the Federation of the European Securities Exchanges. Bid ask spread is used as a proxy for liquidity, it has been found to correlate strongly with more accurate measures of liquidity (Fleming, 2003). Bid ask spreads are also essentially transaction costs (Harris, 2003) and the measure allows us to draw conclusions about the welfare effects of the mergers. If consumer surplus is the area between the demand curve and the price, then a decrease in the cost of the execution increases the economic surplus. The bid ask spreads are measured only from the NASDAQ OMX Nordic shares because the author has no access to the liquidity data in other exchanges.

A further remark is in order: In the merger of LSE and Milan, more information is available, because the effects to the new network as a whole can be measured. In the mergers involving American exchanges, the author does not have the data to measure the effects on the whole networks, and it can be the case that the trading merely "shifts around" from other counterpart to the other. Either way, it is informative to test the oth-

er mergers as well, because any increase in trading activity is likely to be associated with an increase in liquidity and welfare, as well as with an enhanced competitive position in European market.

Table 1 presents the results from Wilcoxon signed rank test of whether there is a significant difference between the average market shares of executed trades before and after the mergers. Figure 8 below presents the development of the market shares of executed trades for the exchanges (Euronext, LSE, Milan and OMX) that recently engaged in mergers.

The hypothesis:

$H_0$ : The merger had no effect on the market share

$H_A$ : The merger affected the market share

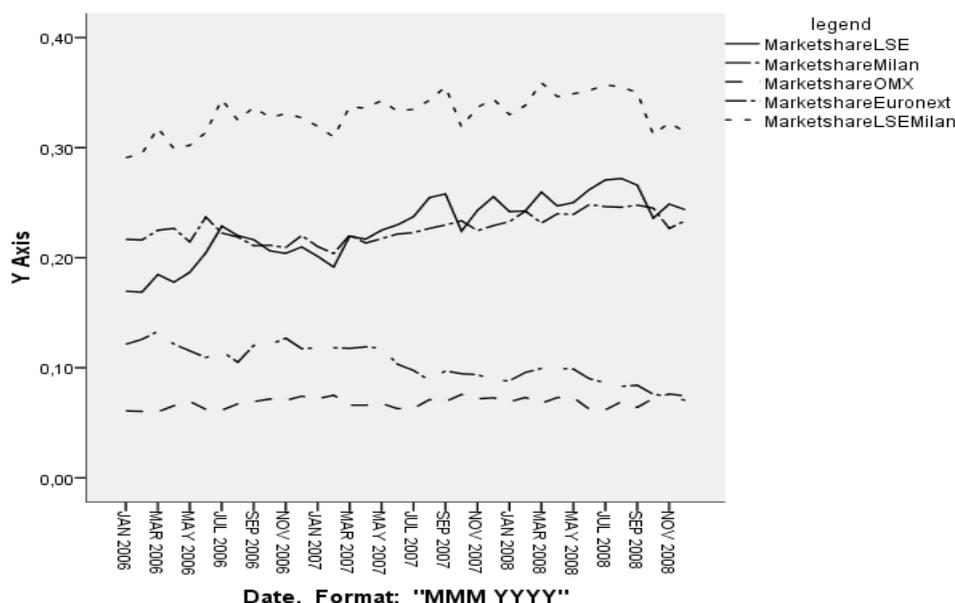
*Table 1: Wilcoxon signed rank test to compare means of market shares of trading before and after the mergers.*

<b>Exchange</b>	<b>Market share before</b>		<b>Market share after</b>		
London Stock Exchange	0.2100		0.2508		
Euronext	0.2175		0.2332		
Milan	0.1147		0.0881		
OMX	0.0679		0.0693		
LSE+Milan	0.3248		0.3390		
<b>Test Statistics<sup>c</sup></b>					
	<b>Euronext</b>	<b>LSE</b>	<b>Milan</b>	<b>OMX</b>	<b>LSE+Milan</b>
	<b>after-before</b>	<b>after-before</b>	<b>after-before</b>	<b>after-before</b>	<b>after-before</b>
Z	-2.556 <sup>a</sup>	-3.408 <sup>a</sup>	-3.408 <sup>b</sup>	-1.682 <sup>a</sup>	-2.953 <sup>a</sup>
Asymp. Sig. (2-tailed)	0.011	0.001	0.001	0.093	0.003
a. Based on negative ranks.					
b. Based on positive ranks.					
c. Wilcoxon Signed Ranks Test					

Source: Author, data from FESE

The market share seems to have increased for Euronext, LSE and the combined LSE Milan with significance levels of 0.01, 0.001 and 0.003 respectively. Milan seems to have lost market share with significance level of 0.001. For OMX, the test suggests that the market share has increased, but with a quite high significance level of 0.09.

Figure 8: The market shares of the merged exchanges 2006-2008, measured by number of trades executed



Source: Author, data from FESE

The market shares are presented to give an idea of the exchanges' importance in the market. The bigger exchanges, Euronext and LSE seem to have gained relatively more market share when compared to the smaller ones, as can be seen from the Figure 8 above.

The total trading activity in Europe appears to have increased after the mergers. Table 2 below presents the results from Wilcoxon signed rank test of whether there is a significant change in the overall trading activity before and after the mergers. By the trading activity before, we mean the time before the merger of Euronext and NYSE in April 2007 and by the trading activity after, we mean the time after the merger of NASDAQ and OMX in February 2008.

The hypothesis:

$H_0$ : The trading activity was not affected

$H_A$ : The trading activity was affected

Table 2: The Wilcoxon signed rank test to compare monthly trading activity in Europe before and after the mergers

	Totalafter - Totalbefore
Z	-2.803 <sup>a</sup>
Asymp. Sig. (2-tailed)	0.005
a. Based on negative ranks.	

Source: Author, data from FESE

The significance level is as low as 0.005 in favor of increase in trading activity, which means that we have evidence that the trading activity has increased after the mergers at 0.5% significance level. The mergers took place too close to each other to find out the separate effects that each merger had on the trading activity.

#### 4.1. Data and OLS Models

The data of executed trades in the exchanges was retrieved from the website of Federation of the European Securities Exchanges, FESE. Six large cap stocks were chosen from the NASDAQ OMX Nordic exchange. The chosen shares are relatively liquid and appear often in the list of highest turnovers per trading day. Furthermore, the chosen companies all have international activities and can therefore be assumed to be relatively widely followed by potential investors. The increased trading activity is most likely to show in these types of shares (Nielsson, 2008). Data for ABB, Electrolux, Sony Ericsson, Stora Enso, Nordea and Nokia was retrieved from OMX NASDAQ website. Reuters Ecwin database was used to retrieve the monthly average closing prices of the shares and the data of the Swedish funds' equity value.

##### 4.1.1. The Models

In order to test whether the mergers were accompanied by an overall increase in trading activity relative to its competitors, we can use the following model and employ "ordinary least squares regressions".

$$Trades_{it} = \alpha_1 + \beta_1 Dummymerger_{it} + \chi_1 TradesEurope_t + \varepsilon_{it} \quad (5)$$

Where: " $Trades_{it}$ " is the trades executed in the individual stock exchange  $i$  at month  $t$ ,

" $Dummymerger_{it}$ " takes the value of 1 after the merger  $i$  at time  $t$  and 0 before, " $TradesEurope_t$ " is the overall executed trades in European exchanges at month  $t$  and

" $\varepsilon_{it}$ " is the error term.

In order to test whether the merger increased liquidity and reduced the trading costs in NASDAQ OMX traded shares we employ again OLS regressions and use the following model:

$$Spread_{it} \% = \alpha_2 + \beta_2 DummyNASDAQOMX + \chi_2 Shareprice_{it} + \delta_2 FundAsset_t + \gamma_2 Spread_{it-1} \% + e_{it} \quad (6)$$

Where " $Spread_{it} \%$ " is the average spread of share  $i$  at month  $t$  in per mills of the exercise price, " $DummyNASDAQOMX$ " takes the value of 1 after the merger of NASDAQ OMX and 0 before. " $Shareprice_{it}$ " is the average price of the share  $i$  at month  $t$ , " $FundAsset_t$ " is the average total asset value of Swedish funds in month  $t$  and " $Spread_{it-1} \%$ " is the average spread of the share  $i$  lagged by one month. The lagged value of the spread is included in order eliminate the problem with autocorrelation. In Sweden, market participants with the largest influence on trading activity are the funds. We can use the value of their assets to control for the general trading activity and for the

financial crisis to extract the effects of the merger. The share price is included because the spread is measured as percents of the exercise price and because the price reveals the “health” and presumably the overall interest towards the company.

## 4.2. The Results

The results from the regressions with model (5) are presented in Table 4 below. The dummy variable captures the effects of the mergers. If the slope parameter of the dummy variable is significant enough, we have reason to believe that the merger affected the trading activity, either positively or negatively. The monthly data was gathered from January 2006 to December 2008.

The hypothesis:

$H_0$ : The merger had no effect on trading activity

$H_A$ : The merger had an effect on trading activity

*Table 4: The Regression results: Dummies, Exchanges and Significance levels.*

<b>Merged Exchange</b>	<b>Slope parameter</b>	<b>Significance</b>
Euronext	535278.774	0.054
LSE	1716603.594	0.000
Milan	-1025675.203	0.000
OMX	1888.483	0.986
LSE+Milan	690928.390	0.067

Source: Author, data from FESE.

### 4.2.1. The LSE-Milan Merger

London Stock Exchange merged with the Milan Stock Exchange in October 2007. The merger is especially interesting for our analysis, because both of the merged exchanges are European, and an estimate of the overall change in trading activity in the whole network can be acquired. In the presence of positive network externalities, the new network should gain trading activity after the merger as a whole.

For LSE, the slope of the dummy variable is 1716604 and strongly significant with p-value less than 0.001. We have evidence that London gained trading flows because of the merger at 0.1% significance level. For Milan, the result is the opposite. The slope of the dummy is -1025675 with p-value of less than 0.001. We have evidence that Milan lost trading flows because of the merger at 0.1% significance level.

The total trading activity in the new LSE-Milan exchange is calculated by adding the trades in Milan and the trades in LSE together. The slope of the dummy measuring the change after the merger for the whole entity is 690928 and with p-value of 0.069, which is in the author’s opinion low enough p-value to draw careful conclusions. We have evidence that the newly combined exchange attracted new trading after the merger at 6.9% significance level.

#### 4.2.2. *The Euronext-NYSE Merger*

The merger was finalized in April 2007, and created an exchange of formidable size stretching over two continents. We observe from Table 4 that the dummy variable gets a slope parameter of 535279 and p-value of 0.054. In the author's opinion, this is low enough significance level to draw conclusions. Merger seems to have had a positive impact in the trading activity. According to the test, the trading increased at 5.4% significance level.

#### 4.2.3. *The NASDAQ - OMX Merger*

The merger was finalized in February 2008. NASDAQ, an American stock exchange acquired Nordic OMX. The slope parameter for the dummy variable of interest is very insignificant (0.9). We cannot draw any conclusions based on our test and it seems that the trading activity was not affected by the merger.

#### 4.2.4. *The Liquidity and Welfare in NASDAQ OMX Nordic Exchange*

Table 5 below presents the results from the regressions when the model (6) is utilized. The monthly data was gathered from January 2007 to December 2008. The dummy variable aims to capture the changes in the bid ask spreads after the merger.

The hypothesis:

H<sub>0</sub>: The spread was not affected by the merger

H<sub>A</sub>: The spread was affected by the merger

The only share with a significant decrease in average spreads is Nokia. In the other regressions we receive quite low  $R^2$  values (less than 0.5), and thus fail to explain the variation in the spreads very well. There is also a substantial correlation between the variable indicating the fund's assets and the share price, which could explain why the other slope parameters get so high p-values (because of too large standard errors). On the other hand, in the case of Nokia, the regression model gets a quite high  $R^2$  value (0.89), implying a good predictive power. The slope parameter for Nokia is -0.323 per mills and with significance level of 0.006 implies decreased transaction costs and increased economic surplus in the market for Nokia's share at 0.6% significance level. The spreads do not seem to have changed significantly for the other investigated shares, since the significance levels are very high.

*Table 5: The Regression results: The Liquidity Effects in NASDAQ OMX after the merger, the spreads are in per mills*

<b>The Share</b>	<b>Slope parameter</b>	<b>Significance</b>
ABB	0.092	0.831
Electrolux	-0.204	0.718
Sony Ericsson	-0.296	0.542
Stora Enso	-0.054	0.904
Nokia	-0.323	0.006
Nordea	0.020	0.954

Source: Author, data from NASDAQ OMX and Ecwin Reuters

#### **4.2.5. Robustness checks**

Shapiro Wilks test for normality is performed on the residuals from all the regressions. All but one of the regressions with the model (5) seem to have normally distributed variables with 5 % critical level (significance from Shapiro Wilks). The regressions with model (6) produce also normally distributed variables, except for one case. In the regression where the spread of Stora enso is the dependant variable, the residuals are not normally distributed.

The residuals were plotted against time and dependant variables to check for heteroscedasticity. There does not seem (visible to the eye) to be any spreading out in the residuals and we have a reason to believe that the variances of our residuals are constant.

In order to check for autocorrelation, the autocorrelation plots of the residuals are examined. There is often autocorrelation in the regressions when model (5) is employed. The problem does not disappear, when a lagged value of the dependant variable is added to the regression. Even if some autocorrelation is present, the results are not biased and we can believe the results from the OLS regressions. In model (6), the value of the funds' assets correlates with the share prices. When the either of the two variables is removed, the explanatory power often decreases and the slope for the merger dummy remains insignificant in all the cases. Therefore the original model is utilized in the regressions.

#### **4.3. The Analysis of the Empirical Findings**

The OLS test finds an increase of 535279 executed trades in Euronext and an increase of 1716604 executed trades in LSE. The total trading in the newly created network composed of LSE and Milan, increased by 690929 trades per month. The Milan stock exchange lost 1025675 executed trades per month and OMX did not seem to gain or lose significantly. The finding that the combined LSE-Milan attracted more trading is important, because we can draw a conclusion that the trading activity increased in the network when it is treated as a whole. However, Milan lost trading activity when it is treated individually. In the other cases, the counterparts were American and we lack the data to measure the effects on to the entire networks and it can be the case that the increased trading was caused by the trades shifting from one counterpart to the other.

In NASDAQ OMX, Nokia was the only share from the tested sample that experienced significant reductions in the monthly average bid ask spreads. This might be explained by the fact that Nokia is the largest and probably most well known corporation in the sample. It has been found before (Nielsson, 2008) that the largest corporations (and more liquid) benefit the most from the mergers.

We can draw the conclusion that the recent mergers were beneficial to LSE and Euronext individually, because they gained trading activity. Milan Stock Exchange seems to have lost trading activity significantly after the merger and we cannot say that the merger with LSE was beneficial to it. However, as a part of the merged company, Milan could benefit from the total increase in trading activity. We do not get a definite evidence for increase in welfare in the merger of NASDAQ-OMX, but at least we can say that the investors in the market for Nokia's share probably experienced an increase in utility, and reductions in the transaction costs.

## 5. CONCLUSIONS

This thesis has been assessing the mergers of the stock exchanges from the welfare point of view and as a competitive strategy. It has been suggested that a natural monopoly could be a welfare maximizing market structure in Europe. It was also established that for an individual exchange it is a sound strategy to merge because of the positive network externalities and economies of scale. A further consolidation can also lead to some unpleasant outcomes from the society's point of view, such as in the abuse of market power.

Empirically, the merged stock exchanges usually captured market shares from the competitors and thus improved their position in the market. Euronext's merger with NYSE increased trading activity in Euronext. The merger between LSE and Milan increased trading in LSE, but decreased trading in Milan. However, if LSE and Milan are treated as a single network, the combined amount of trading increased, providing support for the proposition that a larger network induces and attracts more trading. The OMX exchange did not experience an increase in trading activity after the merger with NASDAQ.

The consumer surplus increased in the market for Nokia's share in the NASDAQ OMX Nordic exchange. The bid ask spread was significantly reduced, thus implying that liquidity increased and transaction costs decreased. Investors trading Nokia's shares are better off without anyone being worse off (that we know of). The other investigated shares (ABB, Electrolux, Sony Ericsson, Stora Enso and Nordea) did not experience similar liquidity improvements; therefore we cannot draw any definite conclusions about general welfare improvements in OMX after the merger with NASDAQ.

Given the above, we can conclude that in the face of intensified competition, the trend of consolidation of financial exchanges is likely to continue in Europe. From an individual stock exchange's point of view, a merger might be the best survival strategy and a way to compete. Especially, if the larger exchanges benefit relatively more from the mergers, they can have incentives to acquire the smaller ones.

### 5.1. Suggestions for Further Research

Further research is warranted for a number of questions the current paper does not answer. Firstly the dynamics of the trading flows in cross listed shares could be an interesting further test. Secondly the cost benefits could be researched in the merged exchanges. Thirdly the American counterparts should be researched in terms of liquidity development and trading activity.

## 6. REFERENCES

### 6.1. Scientific publications

1. Andersen, A (2005) Essays of stock exchange competition and pricing. Acta Universitatis Oeconomicae Helsingiensis, A-252, Helsinki School of Economics.
2. Arnold, T, Hersh, P. J. Mulherin H and Netter, J (1999) Merging Markets, *Journal of Finance*. 54, 1083-1107.
3. Demsetz, H (1968) The Cost of transacting. *The Quarterly Journal of Economics*. 82, 33-53.
4. Economides, N (1996) The Economics of networks. *International Journal of Industrial Organization*. 14, 673-699.
5. Economides, N (1993) Network economics with application to finance, *Financial Markets, Institutions & Instruments*. 2, 89-97.
6. Fleming, M.J (2003) Measuring treasury market liquidity. *Economic Policy Review*. 9, 83-108.
7. Gehrig, T (1998).Competing markets. *European Economic Review*. 42, 277-310.
8. Harris, L (2003) *Trading and exchanges: Market micro structure for practitioners*. New York, N.Y.: Oxford University Press.
9. Hasan, I. and Malkamäki, M. (2001) Are expansions cost effective for stock exchanges? A Global perspective. *Journal of Banking and Finance*. 25, 2339–2366.
10. Nielsson, U (2008) Stock exchange merger and liquidity: The case of Euronext. *Journal of Financial Markets*.[doi:10.1016/j.finmar.2008.07.002](https://doi.org/10.1016/j.finmar.2008.07.002)
11. Oi, W.Y. (1971) A Disneyland dilemma: Two-part tariffs for the Mickey Mouse monopoly. *The Quarterly Journal of Economics*. 85, 77-96.
12. Ramos, S.B. (2006) Why do stock exchanges demutualize and go public? *Swiss Finance Institute Research Paper* No. 06-10. Available at SSRN: <http://ssrn.com/abstract=890268>
13. Ramos, S.B. (2003) Competition between stock exchanges: A Survey *FAME Research Paper* No. 77. Available at SSRN: <http://ssrn.com/abstract=410727> or DOI: 10.2139/ssrn.410727
14. Rohlfs, J. (1974) A Theory of interdependent demand for a communications service. *Bell Journal of Economics*. 5, 16-37.
15. Shy, O and Tarkka, J. (2001). Stock exchange alliances, Access fees and competition. *Bank of Finland Working Paper* No. 22/2001. Available at SSRN: <http://ssrn.com/abstract=288296> or DOI: 10.2139/ssrn.288296

16. Smith, A (1776). *The Wealth of nations*. London, U.K: W. Strahan and T. Cadell.
17. Varian, H.R. (2006). *Intermediate microeconomics: A modern approach*. United States of America: W.W.Norton & Company, New York, London.

## 6.2. Websites

1. Borsa Italiana, (2009). Press Releases 2009-Borsa Italiana. Retrieved February 5, 2009, from Borsa Italiana Web site: <http://www.borsaitaliana.it/chisiamo/ufficiostampa/comunicatistampa/comunicati-stampa-2009.en.htm>
2. Demutualization. (n.d.). *Investopedia.com*. Retrieved January 22, 2009, from Dictionary.com website: <http://dictionary.reference.com/browse/demutualization>
3. Division of Market Regulation, (2000, June). Special Study: Electronic Communication Networks and After-Hours Trading. Retrieved December 8, 2008, from U.S. Securities and Exchange Commission Web site: <http://www.sec.gov/news/studies/ecnafter.htm#pt2i>
4. Federation of European securities exchange, (2008). FESE Statistics and market research. Retrieved January 11, 2009, from Federation of European Securities Exchange Web site: <http://www.fese.be/en/?inc=art&id=4>
5. Goodison, Nicholas (2006 October 26). How London can remain in the top league. *Financial Times/In depth*, Retrieved December 7, 2008, from [http://www.ft.com/cms/s/2/a490c13e-6515-11db-90fd-0000779e2340.dwp\\_uuid=c9e908ca-6375-11db-bc82-0000779e2340.html](http://www.ft.com/cms/s/2/a490c13e-6515-11db-90fd-0000779e2340.dwp_uuid=c9e908ca-6375-11db-bc82-0000779e2340.html)
6. London Stock Exchange, (2009). Press releases. Retrieved February 5, 2009, from London Stock Exchange Web site: <http://www.londonstockexchange.com/en-gb/about/Newsroom/pressreleases/>
7. NASDAQ OMX, (2009). Newsroom. Retrieved February 5, 2009, from NASDAQ OMX Web site: <http://www.nasdaqomx.com/whoweare/newsroom/>
8. NASDAQ OMX, (2008). Monthly report – Equity trading by company and instrument. Retrieved January 11, 2009, from NASDAQ OMX Web site: <http://www.omxnordicexchange.com/newsandstatistics/statisticsanalysis/Equities/monthlyreportshareturnoverbycompany/>
9. NYSE Euronext, (2009). NYSE Euronext news. Retrieved February 5, 2009, from NYSE Euronext Web site: [http://www.euronext.com/news/press\\_releases/pressReleases-1731-EN.html](http://www.euronext.com/news/press_releases/pressReleases-1731-EN.html)
10. Star network. (n.d.). *The Free On-line Dictionary of Computing*. Retrieved February 11, 2009, from Dictionary.com website: [http://dictionary.reference.com/browse/star network](http://dictionary.reference.com/browse/star%20network)

## 6.3. Databases

1. Ecowin Reuters

## 7. APPENDIX

### 7.1. Summary Statistics

Table 3: Trades in the merged exchanges and the spreads of the shares in per mills

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Trades Milan	36	3615380	7591519	5540452,69	1051292,020
Trades LSE	36	6231486	22951987	12709761,77	4413325,045
Trades Euronext	36	7231160	23841237	12553213,08	3803189,736
Trades OMX	36	1998114	7027095	3773435,22	1090615,478
LSEMILAN Trades	36	10491245,00	30336416,00	18250214,4658	5147178,61353
Total trades	33	32514622,00	97291406,00	52778554,6667	13149687,71091
Stora Enso permille	24	1,07	2,89	1,7816	,54791
Nokia permille	24	,41	1,38	,6737	,24223
ABB permille	24	1,88	3,14	2,6974	,38676
Electrolux permille	24	2,26	4,37	3,1640	,46796
SonyEricsson promille	24	,84	2,25	1,4718	,44366
Nordea promille	24	,96	2,37	1,4646	,33823
Valid N (listwise)	23				

Source: Author, data from OMX Nordic Exchange and FESE

### 7.2. Regression Outputs

#### 7.2.1. Regression Output: Euronext NYSE Merger's Effects on Euronext No. of trades

##### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,989 <sup>a</sup>	,978	,977	576025,802	,885

a. Predictors: (Constant), DummyNYSEmerger, Totaltrades

b. Dependent Variable: TradesEuronext

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,953E14	2	2,476E14	746,369	,000 <sup>a</sup>
	Residual	1,095E13	33	3,318E11		
	Total	5,062E14	35			

a. Predictors: (Constant), DummyNYSEmerger, Totaltrades

b. Dependent Variable: TradesEuronext

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-1146285,025	421680,234		-2,718	,010	-2004199,912	-288370,138
	Totaltrades	,244	,009	,939	26,672	,000	,225	,262
	DummyNYSEmerger	535278,774	267919,751	,070	1,998	,054	-9808,058	1080365,607

a. Dependent Variable: TradesEuronext

## 7.2.2. *Regression Output of NASDAQ OMX Merger's effects on Trading in OMX*

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,971 <sup>a</sup>	,943	,940	268136,097	1,258

a. Predictors: (Constant), Totaltrades, Dummynasdaqmerger

b. Dependent Variable: TradesOMX

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,926E13	2	1,963E13	273,015	,000 <sup>a</sup>
	Residual	2,373E12	33	71896966494,587		
	Total	4,163E13	35			

a. Predictors: (Constant), Totaltrades, Dummysdaqmerger

b. Dependent Variable: TradesOMX

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-193891,627	182276,386		-1,064	,295	-564735,722	176952,468
	Dummysdaqmerger	1888,483	110163,144	,001	,017	,986	-222240,119	226017,085
	Totaltrades	,072	,003	,971	21,156	,000	,065	,079

a. Dependent Variable: TradesOMX

### 7.2.3. Regression Output LSE Milan Merger's effects on Trading in LSE

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,974 <sup>a</sup>	,949	,945	1031241,112	1,109

a. Predictors: (Constant), DummyLSEMILANmerger, Totaltrades

b. Dependent Variable: TradesLSE

#### ANOVA<sup>b</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,466E14	2	3,233E14	304,016	,000 <sup>a</sup>
	Residual	3,509E13	33	1,063E12		
	Total	6,817E14	35			

a. Predictors: (Constant), DummyLSEMILANmerger, Totaltrades

b. Dependent Variable: TradesLSE

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-1952018,994	745978,187		-2,617	,013	-3469723,027	-434314,961
	Totaltrades	,254	,015	,843	16,959	,000	,223	,284
	DummyLSEMILANmerger	1716603,594	438975,432	,194	3,910	,000	823501,362	2609705,825

a. Dependent Variable: TradesLSE

### 7.2.4. Regression Output: LSE Milan Merger's effects on Milan trading activity

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,866 <sup>a</sup>	,750	,735	541371,786	,750

a. Predictors: (Constant), DummyLSEMILANmerger, Totaltrades

b. Dependent Variable: TradesMilan

#### ANOVA<sup>b</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,901E13	2	1,451E13	49,492	,000 <sup>a</sup>
	Residual	9,672E12	33	2,931E11		
	Total	3,868E13	35			

a. Predictors: (Constant), DummyLSEMILANmerger, Totaltrades

b. Dependent Variable: TradesMilan

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	1749317,334	391616,993		4,467	,000	952566,571	2546068,098
	Totaltrades	,077	,008	1,071	9,771	,000	,061	,093
	DummyLSEMILANmerger	-1025675,203	230449,418	-,488	-4,451	,000	-1494528,068	-556822,338

a. Dependent Variable: TradesMilan

**7.2.5. Regression Output: LSE Milan Merger's effects on Total Combined trading in LSE+Milan**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,984 <sup>a</sup>	,969	,967	940500,46850

a. Predictors: (Constant), Totaltrades, DummyLSEMILANmerger

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-202701,660	680338,309		-,298	,768
	DummyLSEMILANmerger	690928,390	400349,244	,067	1,726	,094
	Totaltrades	,330	,014	,942	24,220	,000

a. Dependent Variable: LSEMILANTrades

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8,981E14	2	4,490E14	507,654	,000 <sup>a</sup>
	Residual	2,919E13	33	8,845E11		
	Total	9,273E14	35			

a. Predictors: (Constant), Totaltrades, DummyLSEMILANmerger

b. Dependent Variable: LSEMILANtrades

### 7.2.6. Regression Output: Bid Ask Spread of Nokia after Merger

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,948 <sup>a</sup>	,898	,877	,08504	1,612

a. Predictors: (Constant), Nokiashareprice, LaggedSpreadsNokia, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: Nokiapermille

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,212	4	,303	41,901	,000 <sup>a</sup>
	Residual	,137	19	,007		
	Total	1,350	23			

a. Predictors: (Constant), Nokiashareprice, LaggedSpreadsNokia, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: Nokiapermille

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	<b>2,917</b>	<b>,764</b>		<b>3,819</b>	<b>,001</b>	<b>1,319</b>	<b>4,516</b>
	Dummysnasdaqmerger	<b>-,323</b>	<b>,106</b>	<b>-,672</b>	<b>-3,060</b>	<b>,006</b>	<b>-,544</b>	<b>-,102</b>
	FundAssetsinbillions	<b>-,008</b>	<b>,003</b>	<b>-,642</b>	<b>-2,780</b>	<b>,012</b>	<b>-,015</b>	<b>-,002</b>
	LaggedSpreadsNokia	<b>,470</b>	<b>,089</b>	<b>,541</b>	<b>5,302</b>	<b>,000</b>	<b>,285</b>	<b>,656</b>
	Nokiashareprice	<b>-,022</b>	<b>,005</b>	<b>-,467</b>	<b>-4,246</b>	<b>,000</b>	<b>-,034</b>	<b>-,011</b>

a. Dependent Variable: Nokiapermille

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	2,917	,764		3,819	,001	1,319	4,516
	Dummysnasdaqmerger	-,323	,106	-,672	-3,060	,006	-,544	-,102
	FundAssetsinbillions	-,008	,003	-,642	-2,780	,012	-,015	-,002
	LaggedSpreadsNokia	,470	,089	,541	5,302	,000	,285	,656
	Nokiashareprice	-,022	,005	-,467	-4,246	,000	-,034	-,011

### 7.2.7. Regression Output: Bid Ask Spread of ABB after Merger

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,641 <sup>a</sup>	,411	,287	,32657	1,789

a. Predictors: (Constant), LaggspreadABB, FundAssetsinbillions, ABBshareprice, Dummynasdaqmerger

b. Dependent Variable: ABBpermille

#### ANOVA<sup>b</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,414	4	,354	3,315	,032 <sup>a</sup>
	Residual	2,026	19	,107		
	Total	3,440	23			

a. Predictors: (Constant), LaggspreadABB, FundAssetsinbillions, ABBshareprice, Dummynasdaqmerger

b. Dependent Variable: ABBpermille

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	1,327	2,835		,468	,645	-4,606	7,261
	Dummysdaqmerger	,092	,426	,120	,216	,831	-,799	,983
	FundAssetsinbillions	,000	,012	,011	,019	,985	-,025	,025
	ABBshareprice	,005	,003	,346	1,486	,154	-,002	,012
	LaggedspreadABB	,212	,129	,368	1,644	,117	-,058	,481

a. Dependent Variable: ABBpermille

**7.2.8. Regression Output: Bid Ask Spread of Electrolux after Merger**

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,568 <sup>a</sup>	,323	,181	,42362	2,113

a. Predictors: (Constant), FundAssetsinbillions, LaggedSpreadElectrolux, Electroluxshareprice, Dummysdaqmerger

b. Dependent Variable: Electroluxpermille

**ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	<b>1,627</b>	<b>4</b>	<b>,407</b>	<b>2,267</b>	<b>,100<sup>a</sup></b>
	Residual	<b>3,410</b>	<b>19</b>	<b>,179</b>		
	Total	<b>5,037</b>	<b>23</b>			

a. Predictors: (Constant), FundAssetsinbillions, LaggedSpreadElectrolux, Electroluxshareprice, Dummysdaqmerger

b. Dependent Variable: Electroluxpermille

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	<b>6,507</b>	<b>4,238</b>		<b>1,536</b>	<b>,141</b>	<b>-2,362</b>	<b>15,377</b>
	Electroluxshareprice	<b>,004</b>	<b>,005</b>	<b>,368</b>	<b>,890</b>	<b>,385</b>	<b>-,006</b>	<b>,015</b>
	LaggedSpreadElectrolux	<b>,269</b>	<b>,121</b>	<b>,449</b>	<b>2,220</b>	<b>,039</b>	<b>,015</b>	<b>,522</b>
	Dummysdaqmerger	<b>-,204</b>	<b>,557</b>	<b>-,220</b>	<b>-,366</b>	<b>,718</b>	<b>-1,371</b>	<b>,963</b>
	FundAssetsinbillions	<b>-,020</b>	<b>,019</b>	<b>-,771</b>	<b>-1,034</b>	<b>,314</b>	<b>-,059</b>	<b>,020</b>

a. Dependent Variable: Electroluxpermille

## 7.2.9. Regression Output: Bid Ask Spread of Ericsson after Merger

### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,605 <sup>a</sup>	,367	,233	,38036	1,233

a. Predictors: (Constant), Ericssonsharepricechange, laggedSpreadsEric, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: SonyEricssonpromille

### ANOVA<sup>b</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,591	4	,398	2,749	,059 <sup>a</sup>
	Residual	2,749	19	,145		
	Total	4,339	23			

a. Predictors: (Constant), Ericssonsharepricechange, laggedSpreadsEric, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: SonyEricssonpromille

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	6,298	3,879		1,623	,121	-1,822	14,417
	Dummysdaqmerger	-,296	,478	-,344	-,621	,542	-1,296	,703
	FundAssetsinbillions	-,021	,015	-,900	-1,379	,184	-,053	,011
	laggedSpreadsEtric	,423	,157	,495	2,698	,014	,095	,751
	Ericssonsharepricechange	,010	,006	,540	1,653	,115	-,003	,023

a. Dependent Variable: SonyEricssonpromille

### 7.2.10. Regression Output: Bid Ask Spread of Stora Enso

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,814 <sup>a</sup>	,662	,591	,35029	2,524

a. Predictors: (Constant), StoraEnsoshareprice, LaggedSpreadStoraEnso, Dummysdaqmerger, FundAssetsinbillions

b. Dependent Variable: StoraEnsopermille

**ANOVA<sup>b</sup>**

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,573	4	1,143	9,318	,000 <sup>a</sup>
	Residual	2,331	19	,123		
	Total	6,905	23			

a. Predictors: (Constant), StoraEnsoshareprice, LaggedSpreadStoraEnso, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: StoraEnsopermille

**Coefficients<sup>a</sup>**

	Model	Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	9,639	3,787		2,545	,020	1,713	17,566
	Dummynasdaqmerger	-,054	,439	-,049	-,123	,904	-,973	,865
	FundAssetsinbillions	-,037	,018	-,1237	-2,055	,054	-,074	,001
	LaggedSpreadStoraEnso	-,001	,155	-,002	-,009	,993	-,325	,322
	StoraEnsoshareprice	,008	,009	,404	,925	,367	-,010	,027

a. Dependent Variable: StoraEnsopermille

### 7.2.11. Regression Output: Bid Ask Spread of Nordea after Merger

#### Model Summary<sup>b</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,626 <sup>a</sup>	,391	,263	,25834	1,776

a. Predictors: (Constant), Nordeashareprice, LaggedSpreadNordea, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: Nordeapromille

#### ANOVA<sup>b</sup>

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	,816	4	,204	3,055	,042 <sup>a</sup>
Residual	1,268	19	,067		
Total	2,084	23			

a. Predictors: (Constant), Nordeashareprice, LaggedSpreadNordea, Dummynasdaqmerger, FundAssetsinbillions

b. Dependent Variable: Nordeapromille

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error				Lower Bound	Upper Bound
1	(Constant)	1,856	2,407		,771	,450	-3,181	6,894
	Dummysdaq-merger	,020	,345	,034	,059	,954	-,701	,742
	FundAssetsinbillions	,002	,011	,093	,136	,893	-,022	,025
	LaggedSpreadNordea	,122	,174	,143	,697	,494	-,243	,487
	Nordeashareprice	-,010	,006	-,612	-1,806	,087	-,022	,002

a. Dependent Variable: Nordeapromille

### 7.2.12. THE WSR test, total before and after

#### Ranks

		N	Mean Rank	Sum of Ranks
Totalafter - Totalbefore	Negative Ranks	0 <sup>a</sup>	,00	,00
	Positive Ranks	10 <sup>b</sup>	5,50	55,00
	Ties	0 <sup>c</sup>		
	Total	10		

a. Totalafter < Totalbefore

b. Totalafter > Totalbefore

c. Totalafter = Totalbefore

#### Test Statistics<sup>c</sup>

	Totalafter - Totalbefore	NokiaFRAafter - NokiaFRAbefore
Z	-2,803 <sup>a</sup>	-3,516 <sup>b</sup>
Asymp. Sig. (2-tailed)	,005	,000

a. Based on negative ranks.

b. Based on positive ranks.

c. Wilcoxon Signed Ranks Test