**Association for Information Systems**
## AIS Electronic Library (AISeL)

AMCIS 2009 Proceedings

Americas Conference on Information Systems (AMCIS)

2009

# Organizing Equity Exchanges

Torsten Schaper

*Johann Wolfgang Goethe Universitat Frankfurt am Main,* schaper@wiwi.uni-frankfurt.de

Follow this and additional works at: http://aisel.aisnet.org/amcis2009

# Organizing Equity Exchanges

**Torsten Schaper**
Goethe-University Frankfurt
Chair of e-Finance
schaper@wiwi.uni-frankfurt.de

## ABSTRACT

In the last years equity exchanges have diversified their operations into business areas such as derivatives trading, post-trading services, and software sales. Securities trading and post-trading are subject to economies of scale and scope. The integration of these functions into one institution ensures efficiency by economizing on transactions costs.

Using balanced panel data from major equity exchanges over the period 2005-2007, we examine empirically the presence of economies of scale in securities trading. Moreover, we analyze the impact of vertical integration of trading, clearing, and settlement, the impact of the size of an exchange, and the impact of diversification on the profitability of exchanges. The evidence confirms that a large number of transactions leads to low costs per trade. The evidence shows that the profitability of equity exchanges is highest for vertically integrated exchanges and that diversification and size have a negative impact on their profitability.

### Keywords

Trading and Post-Trading, Economies of Scale, Integration of Securities Trading, Diversification

## INTRODUCTION

Until recently, equity exchanges in Europe used to operate their business facing almost no competition. In most of the markets a domestic consolidation has taken place several years ago and mainly one national exchange has remained. In the last years the exchanges moved towards more consolidation on an international level. The mergers of NYSE / Euronext, London Stock Exchange / Bolsa Italiana, and NASDAQ / OMX are the result of this trend. One of the most stated reasons for this consolidation were economies of scale.

Depending on the choice of statistics, the rankings of equity exchanges are totally different: The largest stock exchange by its own market capitalization is the Deutsche Börse Group, while the NYSE Euronext is the largest exchange by share trading value. The organization of equity exchanges is also very diverging. There are significant differences in governance, covered markets, and range of products. While e.g. the NYSE Euronext is providing equity trading services for different markets, the Hong Kong Stock Exchange is providing trading, clearing, and settlement services for one single market.

The contribution of this paper is to identify the most important factors that affect the organization of efficient securities trading and post-trading. Through a regression analysis the positive effect of the size of an exchange on the per trade costs is shown. Moreover, the positive effect of vertical integration of trading and post-trading and the negative effect of size and diversification on the profitability of equity exchanges is shown. These findings may help industry practitioners to indentify future strategies. They may also help to find the best way to organize trading, clearing, and settlement from a macro-economic view which is heavily discussed by institutions like the European Central Bank or the European Commission since a long time.

This paper is organized as follows. First, the economies of trading, clearing, and settlement are described. It is followed by a review of respective literature. The next section shows the current status of the trading and post-trading industry. Then, economies of scale in securities trading are analyzed empirically. The next section evaluates the impact of size, diversification, and vertical integration on the profitability of an exchange. The paper closes with a conclusion.

## ECONOMIES OF TRADING AND POST-TRADING

### Trade Execution, Clearing, and Settlement

The securities trading value chain consists of a variety of complementary trading, clearing, and settlement activities. The first function is the execution of the transaction. In case of an exchange, the orders to buy or sell a security are directed to a central marketplace. In the dominating electronic exchanges, the orders are routed to a central computer which matches buy and sell orders based on matching algorithms (Pirrong 2008). Clearing and settlement covers all processes that occur after a trade has been executed to finalize the transaction. The actions involve the post-trade transfer of cash and securities (Schwartz and Francioni 2004). The need arises after any trade, regardless of whether the parties trade over an exchange or over the counter, and whether the trade involves domestic or international securities. Clearing of a securities transaction confirms the legal obligation from the trade. Clearing involves the calculation of mutual obligations of market participants and determines what each counterpart receives. Central counterparty (clearing) is not included in the definition of clearing. A central counterparty (CCP) is an entity that interposes itself between the transactions of the counterparties in order to assume their rights and obligations, acting as buyer to every seller and seller to every buyer. The original legal relationship between the buyer and the seller is thus replaced by two new legal relationships: between the CCP and the buyer and between the CCP and the seller. The substitution of the original counterparty by a new contractual counterparty is called a contract novation. The CCP thus bears the counterparty risk and guarantees the clearing and settlement of the trade (Wendt 2006). Following the clearing stage the next operation is settling a trade. Settlement is the exchange of cash or assets in return for other assets or cash and transference of ownership of those assets and cash. A central securities depository (CSD) is the organization that performs this function.

### Network Effects

The execution of orders is subject to network effects due to the nature of liquidity (Domowitz and Steil 1999). Liquidity plays an essential role in financial markets where order flow attracts order flow (Hassan and Schmiedel 2002). It is cheaper to execute orders in markets with large numbers of other orders. There are a variety of formal models that demonstrate that trading of financial instruments is subject to network economies, which cause average implicit trading costs to decline with the number of traders (for more details see Pirrong 2008). These trading costs include the bid-ask spread and the price impact of trades. Clearing and settlement are also subject of network effects. Network effects arise in clearing because the greater the number of transaction counterparties that use the services of a CCP, the greater the probability that a transaction by a given party will be accepted by the CCP, and therefore the greater the utility for that party to buy the CCP services (EU Commission 2006).

### Economies of Scale and Scope

Economies of scale occur when firms achieve per unit costs savings by producing more units of a good or service. Such effects arise when it is possible to spread fixed costs over a higher output. The providers of trading, clearing, and settlement can achieve significant economies of scale, as the set-up costs for a transaction platform have a substantial portion of fixed costs and thus the average costs fall with an increasing transaction volume (Serifsoy and Weiß 2007). For the provision of a trading infrastructure high investments in IT infrastructure are necessary. These investments are largely independent from the number of transactions. Securities clearing services are also subject to economies of scale. In particular the clearing houses have to create the necessary software and IT infrastructure. The maintenance and operation of the clearing systems does not vary strongly with the number of transactions processed. Additionally, there are economies of scale in the main function of a clearing house - the bearing of risk. There are additional costs if there is more than one clearing house. Multiple clearers have to manage the risk between the clearing houses and thus have to maintain costly communication links to the other clearing houses (Chlistalla and Schaper 2008). The costs of settlement are also largely fixed. Like trading and clearing, settlement requires the creation of a software and IT infrastructure which involves a large fixed component (Schmiedel, Malkamäki, and Tarkka 2006). The interlinkage of multiple settlement systems also leads to high costs (Schaper 2008b).

Economies of scope occur when firms achieve cost savings by increasing the variety of goods and services that they produce (joint production). There are strong scope economies in trading, clearing, and settlement. These scope economies influence the efficient organization of trading, clearing, and settlement (Pirrong 2008). If multiple products are cleared within one clearing house the gains and losses can be netted across the customer's positions. Through netting the costs of collateral can be reduced.

**Diversification**

Besides providing trading, clearing, and settlement services some equity exchanges are providing other services and products (Serifsoy 2007). For example Deutsche Börse, Euronext, and OMX Group are achieving significant revenues from the development and operation of IT for other exchanges. They sell their trading systems and sometimes even operate the systems for other exchanges. Beside this, most exchanges are providing trading services for non-equities products. In case of some exchanges the revenues of these services are notable. As for example SIX and the Deutsche Börse Group are operating the European Derivatives Exchange EUREX. Both are achieving larger revenues from derivatives than from equities trading.

## LITERATURE REVIEW AND HYPOTHESIS

**Literature Review**

To date, there are only a small number of studies on the effect of economies of scale on trading and post-trading. There are also only singular studies about the effects of vertical integration and diversification on the profitability of exchanges:

*Malkamäki* (2000) shows empirically the existence of economies of scale in securities trading by estimating the cost function of exchanges for the years 1996-1998. He illustrates that scale economies exist only in the very large stock exchanges but that there are significant scale economies with respect of the processing of trades.

*Schmiedel, Malkamäki, and Tarkka* (2006) investigate the existence of economies of scale in depository and settlement systems. The evidence from 16 settlement institutions for the years 1993-2000 indicates the existence of significant economies of scale. The degree of these economies differs by size of the institution and region. While small settlement service providers reveal a high potential of economies of scale, larger institutions show an increasing trend towards cost effectiveness. For clearing and settlement systems in countries in Europe and Asia substantially larger economies of scale are reported than those in the US system.

*Serifsoy* (2007) analyses technical efficiency and factor productivity of exchanges by analysing 28 stock exchanges from 1999-2003. His findings suggest that exchanges that diversify into related activities are mostly less efficient than exchanges that remain focused on the cash market. Moreover, his findings show no evidence that vertically integrated exchanges are more efficient.

*Pirrong* (2008) analyses the economics of securities trading, clearing, and settlement from a micro analytic perspective. He shows theoretically the existence of economies of scale in trading and post-trading. Moreover, he demonstrates that especially in clearing strong scope economies exist. He also illustrates the impact of economies of scale and scope on the organization of these services and shows that the integration of trading and post-trading is the modal form of organization in financial markets.

In literature mostly isolated factors like the effect of size, diversification, or integration on the efficiency of exchanges where analyzed empirically. The contribution of this paper is the analysis of the most important business drivers of equity exchanges: size, diversification, and vertical integration on the main output of an exchange, the matching of orders. Moreover, we analyze the effects of size, diversification, and vertical integration on the profitability exchanges by means of a regression analysis. These findings may generate recommendations for the organization of equity exchanges.

**Hypotheses**

From the previous discussion and literature review the following hypotheses are derived and will be challenged in the following sections. The reverences indicate associated literature to related research already stated in the previous sections.

| | | |
|---|---|---|
| H1 | Large exchanges provide securities trading at lower costs per trade than small exchanges. | *Malkamäki (2000); Serifsoy and Weiß 2007* |
| H2 | Vertically integrated exchanges are able to achieve a higher profit ratio than non integrated exchanges. | *Pirrong (2008)* |

| H3 | Large exchanges achieve a lower profit ratio than small exchanges. | *Nielsson (2009)* |

| H4 | Diversified exchanges achieve a lower profit ratio than non diversified exchanges. | *Serifsoy (2007)* |

## CURRENT STATUS OF THE TRADING AND POST-TRADING INDUSTRY

One major trend in the equity trading, clearing, and settlement industry is the consolidation via vertical and horizontal integration. Horizontal integration involves mergers of institutions or systems providing similar services in different markets, such as the merger of trading systems. Vertical integration involves mergers of institutions providing different, but integrated services, which are processed along the securities trading value chain within a single entity or group of entities (Serifsoy and Weiß 2007). The organization of equity exchanges is very diverging. The majority of the listed equity exchanges are operating their captive clearing and settlement entities beside the provision of trading (see Table 1). Eight exchanges of the listed exchanges operate clearing and settlement operation as division or wholly owned subsidiary of the exchange. In three cases (NYSE Euronext, NASDAQ OMX, and London Stock Exchange) the exchange has an ownership stake or governance role, or both, in the clearing and settlement entities. Only two exchanges are exclusively focusing on trading. Two of the exchanges offer their trading services for more than one country. The table also shows the market value of the listed equity exchanges[i].

| Trading | Clearing | Settlement | Market | Market Value 2008 in EUR |
|---|---|---|---|---|
| Deutsche Börse Group | | | Germany | 13,782,600,000 |
| Hong Kong Exchanges and Clearing | | | Hong Kong | 9,816,312,314 |
| NYSE Euronext | National Securities Clearing Corporation (US), LCH.Clearnet (Europe) | Depository Trust Company (US), Euroclear Group (Europe) | US, France, Netherlands, Belgium, Portugal | 5,200,748,596 |
| NASDAQ OMX Group | National Securities Clearing Corporation (US), EMCF (Europe) | Depository Trust Company (US), Nordic CSD (Europe) | US, Sweden, Norway, Finland, Denmark, Iceland, Estonia, Latvia, Lithuania | 4,469,629,459 |
| Australian Securities Exchange | | | Australia | 3,646,297,500 |
| London Stock Exchange | LCH.Clearnet | Euroclear Group | UK | 3,346,071,414 |
| BME Spanish Exchanges | | | Spain | 1,899,745,478 |
| TMX Group | Clearing and Depository Services | | Canada | 1,737,730,531 |
| Singapore Exchange | | | Singapore | 1,669,790,945 |
| Bursa Malaysia | | | Malaysia | 732,998,350 |
| Hellenic Exchanges Group | | | Greece | 562,474,793 |
| Johannesburg Stock Exchange | | | South Africa | 343,893,133 |
| New Zealand Exchange | Austraclear | | New Zealand | 88,846,192 |

Vertically integrated ■

**Table 1: Listed equity exchanges (ordered by market value) and corresponding clearing and settlement institutions**

The two exchanges with the highest market value are vertically integrated exchanges, the Deutsche Börse Group and Hong Kong Exchanges and Clearing (having a higher market value than the other eleven exchanges together).

Beside of the market (shareholder) value, the net profit ratio (= net profit / revenues) is an important goal for a profit oriented company (Groppelli and Nikbakht 2006). The average net profit ratio of equity exchanges over the years 2005-2007 was 44 percent[ii]. The net profit ratio of most of the vertically integrated exchanges is significantly higher than the ratio of the non-(vertically) integrated (see Table 2). If ratios could not be calculated they are marked as 'NA' (not available). Of those exchanges focusing purely on trading services, only the TMX Group and the Istanbul Stock Exchange are performing above

average. While the vertically integrated exchanges had an average net profit ratio of 51 percent, the non- integrated exchanges only had a ratio of 32 percent.

The larger exchanges (handling more than 100 million transactions in 2007) have an average profitability of only 34 percent, while at the same time the smaller exchanges have an average profitability of 49 percent. The largest exchanges, NYSE Euronext and NASDAQ, are showing the lowest profitability with an average ratio of 8 percent.

| Exchange | Net Profit Ratio 2005 (Rank) | Net Profit Ratio 2006 (Rank) | Net Profit Ratio 2007 (Rank) | Average Profit Ratio (Rank) |
|---|---|---|---|---|
| Dubai Financial Market | 0.97 (01.) | 1.01 (01.) | 1.17 (01.) | 1.05 (01.) |
| Hong Kong Exchanges and Clearing | 0.58 (05.) | 0.71 (03.) | 0.86 (02.) | 0.72 (02.) |
| Hellenic Exchanges Group | 0.59 (03.) | 0.73 (02.) | NA | 0.66 (03.) |
| Singapore Exchange | 0.49 (09.) | 0.58 (06.) | 0.85 (03.) | 0.64 (04.) |
| Australian Securities Exchange | 0.58 (05.) | 0.59 (05.) | 0.72 (04.) | 0.63 (05.) |
| Bursa Malaysia | 0.59 (03.) | 0.58 (06.) | 0.72 (04.) | 0.63 (05.) |
| TMX Group | 0.54 (07.) | 0.62 (04.) | 0.61 (09.) | 0.59 (07.) |
| Wiener Börse | 0.52 (08.) | 0.48 (10.) | 0.65 (06.) | 0.55 (08.) |
| BME Spanish Exchanges | 0.64 (02.) | 0.45 (11.) | 0.53 (09.) | 0.54 (09.) |
| Philippine Stock Exchange | 0.37 (12.) | 0.52 (09.) | 0.65 (06.) | 0.51 (10.) |
| Istanbul Stock Exchange | 0.26 (15.) | 0.58 (06.) | 0.51 (11.) | 0.45 (11.) |
| Taiwan Stock Exchange | 0.34 (13.) | 0.40 (13.) | 0.57 (08.) | 0.44 (12.) |
| Oslo Børs | 0.40 (10.) | 0.45 (11.) | 0.46 (12.) | 0.44 (12.) |
| New Zealand Exchange | 0.34 (13.) | 0.39 (14.) | 0.42 (15.) | 0.39 (14.) |
| SIX Group | 0.24 (19.) | 0.39 (14.) | 0.46 (12.) | 0.36 (15.) |
| Deutsche Börse Group | 0.26 (15.) | 0.36 (16.) | 0.42 (15.) | 0.35 (16.) |
| London Stock Exchange | 0.38 (11.) | 0.32 (19.) | 0.32 (16.) | 0.34 (17.) |
| Johannesburg Stock Exchange | 0.25 (17.) | 0.33 (17.) | 0.28 (18.) | 0.29 (18.) |
| Euronext | 0.25 (17.) | 0.33 (17.) | NA | 0.29 (18.) |
| Osaka Securities Exchange | 0.20 (20.) | 0.24(22.) | 0.43 (14.) | 0.29 (18.) |
| OMX Group | 0.17 (22.) | 0.25 (21.) | 0.23 (20.) | 0.22 (21.) |
| Tokyo Stock Exchange | 0.09 (23.) | 0.27 (20.) | 0.26 (19.) | 0.21 (22.) |
| Mexican Exchange Group | 0.19 (21.) | 0.18 (23) | 0.15 (21.) | 0.17 (23.) |
| NYSE Euronext | 0.03 (25.) | 0.09 (24.) | 0.15 (20.) | 0.09 (24.) |
| NASDAQ Group | 0.07 (24.) | 0.08 (25.) | NA | 0.07 (25.) |

Vertically integrated

**Table 2: Net profit ratios of equity exchanges from 2005-2007**

## EMPIRICAL EVIDENCE OF ECONOMIES OF SCALE

### The Model and Data Sample

The cost structure of securities trading is significantly depending on the scale of an exchange (Pirrong 2008; Malkamäki 2000). This is due to the large fix costs for the implementation of the trading software and the respective communication infrastructure. The matching of orders is one of the main outputs of an exchange. The costs per trade can be seen as indicator of how efficient the exchange is providing their main services, the matching of orders (Malkamäki 2000). Due to the dominant trading on electronic trading systems the main factor that affects the costs of the exchanges is the number of transactions (X). The value and the number of shares are not affecting the costs directly (Malkamäki 2000). Vertical integration (VER) of an exchange is modeled as a dummy variable (indicating 1 for vertical integration otherwise 0). Some exchanges are diversifying (DIV) and are providing other services than equities processing, such as IT-services, which needs to be considered. DIV is a dummy variable indicating 1 for diversification of an exchange and 0 for no diversification. The following function for the costs per trade (CPT) indicates the main factors of an exchange (i) for the period (t).

$$CPT_{i,t} = \alpha + \beta X_{i,t} + \gamma DIV_{i,t} + \delta VER_{i,t}$$

For the testing of H1 we analyzed 26 exchanges for the years 2005-2007 (78 observations). Some observations could not be used for the regression (marked as not available 'NA' in the tables, single exchanges did not report cost data and are not included in the table 3). There are no direct measures available for inputs of stock exchanges. The two most important input prices for the operation of stock exchanges are the costs of the trading system and labor costs (Malkamäki 2000). As some exchanges do not publish cost information in detail, we use the annual costs of the exchange as proxy for the input of the exchanges. We adjust the costs with a diversification factor. In case of diversified exchange, the output proxy 'number of equities transactions' is only one part of the output of these exchanges. Thus an adjustment of costs data was done. The analysis of the annual reports shows that in average 44.5% of the business is related to equities trading and post-trading (the analysis of the main cost factor of an exchange 'staff' comes to a similar relation). In Table 3 the adjusted costs per trade of the largest equity exchanges for the years 2005 to 2007 are listed, as well as the number of equity transactions[iii].

| Exchange | Costs per Trade 2005 in EUR | Number of Trades 2005 | Costs per Trade 2006 in EUR | Number of Trades 2006 | Costs per Trade 2007 in EUR | Number of Trades 2007 |
|---|---|---|---|---|---|---|
| Australian Securities Exchange | 4.01 | 25,214,700 | 2.65 | 37,037,600 | 1.33 | 65,933,000 |
| BME Spanish Exchanges | 5.22 | 17,352,719 | 4.05 | 23,792,036 | 2.81 | 34,862,613 |
| Borsa Italiana | 2.39 | 47,318,500 | 3.74 | 57,594,000 | NA | NA |
| Bursa Malaysia | 2.19 | 14,667,694 | 1.56 | 20,453,305 | 0.96 | 36,981,597 |
| Deutsche Börse Group | 7.25 | 87,736,373 | 5.56 | 109,018,187 | 5.07 | 145,019,545 |
| Euronext | 4.65 | 78,275,700 | 3.65 | 105,258,000 | NA | 155,036,400 |
| HELENIC Exchanges Group | 2.46 | 9,153,685 | 3.07 | 11,128,589 | NA | 11,615,994 |
| Hong Kong Exchanges and Clearing | 5.05 | 24,701,110 | 2.62 | 45,020,850 | 1,03 | 118,842,305 |
| Istanbul Stock Exchange | 1.46 | 44,802,600 | 0.81 | 45,937,800 | 0.80 | 48,538,400 |
| Johannesburg Stock Exchange | 10.41 | 5,064,042 | 7.80 | 7,953,510 | 6.17 | 11,553,803 |
| London Stock Exchange | 3.66 | 66,289,209 | 1.25 | 94,799,532 | 1.60 | 160,989,634 |
| Mexican Exchange Group | 6.11 | 1,710,300 | 7.26 | 2,476,200 | 2.26 | 3,562,027 |
| NASDAQ OMX Group | 0.32 | 1,076,715,321 | 0.27 | 1,317,633,583 | NA | 1,644,895,464 |
| New Zealand Exchange | 13.17 | 606,256 | 15.73 | 542,233 | 16.72 | 577,316 |
| NYSE Euronext | 1.47 | 912,855,200 | 1.30 | 1,264,244,400 | 0.57 | 2,320,574,400 |
| OMX | 6.13 | 5,457,700 | 4.73 | 8,825,600 | 3.69 | 12,108,600 |
| Oslo Børs | 4.98 | 21,514,890 | 3.79 | 31,666,924 | 3.76 | 48,505,407 |
| Philippine Stock Exchange | 4.45 | 871,499 | 3.27 | 1,286,760 | 2.15 | 2,634,729 |
| SIX Group | 8.87 | 17,954,199 | 3.66 | 24,475,270 | 2.74 | 35,339,296 |
| Taiwan Stock Exchange | 0.59 | 134,955,600 | 0.47 | 162,924,000 | 0.19 | 213,203,300 |
| TMX Group | 1.72 | 58,635,400 | 1.05 | 92,139,085 | 0.99 | 127,253,300 |
| Wiener Börse | 2.02 | 3,306,620 | 4.28 | 6,500,000 | 5.23 | 11,300,000 |

Vertically integrated ▮

**Table 3: Costs per trade and number of trades of selected equity exchanges**

Though vertically integrated exchanges are providing a different scope of services the average costs per trade of the vertically integrated exchanges are five percent lower than the expenses from the other exchanges: 3.84 EUR per trade versus 4.05

EUR per trade. If there were economies of scale as stated in section 0 one should expect decreasing costs per trade when the number of transactions is increasing. This seems to be the case as the number of transactions leads to a reduction of costs per trade (see Figure 1). The effect is stronger for the vertically integrated exchanges.
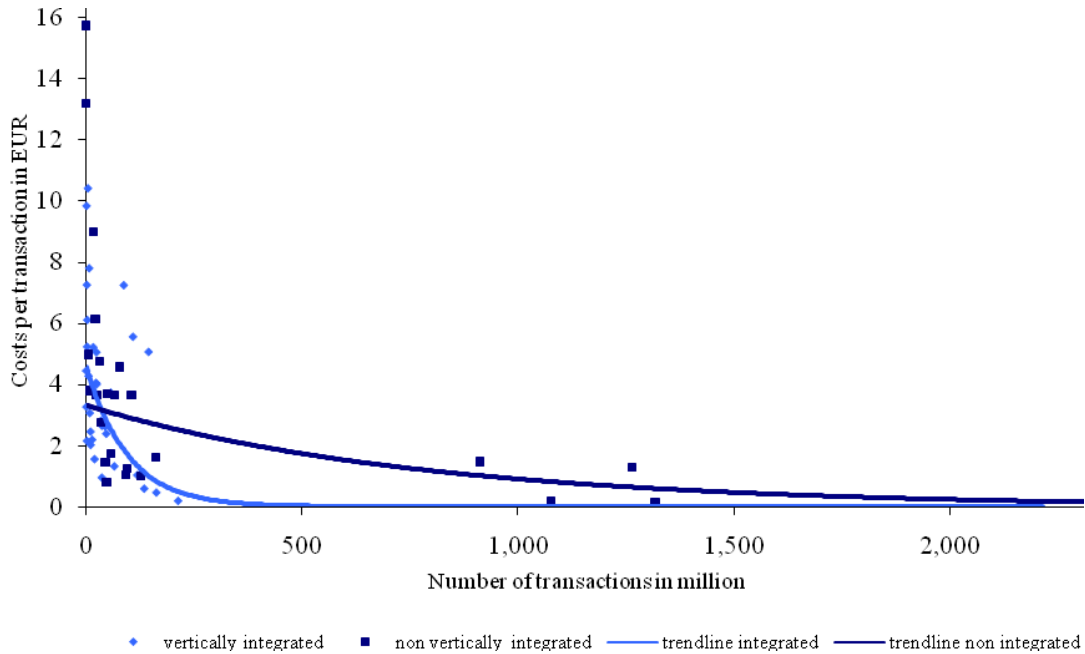


**Figure 1: Average costs per trade of equities exchanges (2005-2007)**

Considering the size of the exchanges and the integration of trading, clearing, and settlement is not sufficient to explain the costs per trade. Additionally, the diversification has a dominant impact on the costs per trade. Therefore we introduce the dummy variable for the diversification of an exchange (DIV).

**Empirical Results**

The analyzed data supports the hypotheses that the size of the exchanges leads to lower costs per trade. It also shows that diversification and vertical integration lead to higher costs per trade. Table 4 provides estimates for the variables number of transactions (X), diversification of an exchange (DIV), and vertical integration of an exchange (VER). The dependant variable in the regression is costs per trade of the exchanges. It shows that the regression with X, DIV, and VER (see column 4) has a higher coefficient of determination than the regression with either only X (column 1), DIV (column 2), or VER (column 3).

| Independent Variables | (1) Parameter (t-statistics) | (2) Parameter (t-statistics) | (3) Parameter (t-statistics) | (4) Parameter (t-statistics) |
|---|---|---|---|---|
| Intercept | 3.764 $(11.650)^{***}$ | 2.758 $(8.332)^{***}$ | 2.711 $(5.662)^{***}$ | 2.252 $(4.607)^{***}$ |
| X | -0.0000022 $(-2.946)^{***}$ | | | -0.000002 $(-2.823)^{***}$ |
| DIV | | 2.555 $(3.891)^{***}$ | | 2.948 $(5.019)^{***}$ |
| VER | | | 1.208 $(1.915)^{*}$ | 1.229 $(2.236)^{**}$ |
| Adjusted R² | 0.117 | 0.196 | 0.044 | 0.384 |
| F-Statistics | $8.681^{***}$ | $15144^{***}$ | $3.668^{*}$ | $13.075^{***}$ |
| N | 58 | 58 | 58 | 58 |

*** Significant at the 1 percent level    ** Significant at the 5 percent level    * Significant at the 10 percent level

**Table 4: Regression on cost per trade**

The results support hypotheses H1 that the number of transactions has a negative effect on the costs per trade. This means that large exchanges are providing their services at lower costs per trade. Moreover, we see that diversification and vertical integration lead to higher costs per trade.

**ORGANIZATION OF EXCHANGES**

**The Model and Data Sample**

For the organization of an exchange not only economies of scale need to be considered. As most of the exchanges are profit oriented and some even listed companies, the net profit ratio (NPR) is an important indicator for the success of the management of an exchange (see Table 1 and Table 2). In the following figure the net profit ratio in relation to the size of the exchanges is plotted.
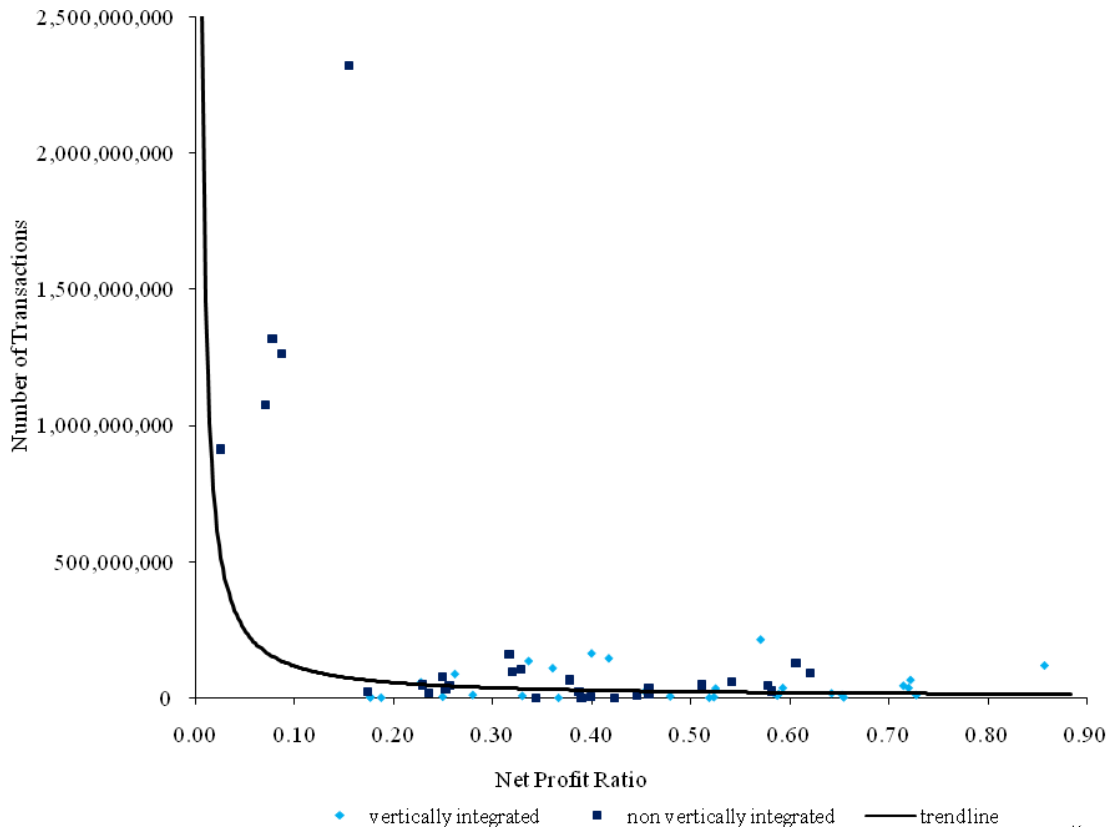


**Figure 2: Net profit ratio of equities exchanges (2005-2007)**

The net profit ratio of the exchanges shows that the vertically integrated exchanges are the most profitable exchanges. Vertical integration is modeled as a dummy variable (VER) indicating 1 for vertical integration and 0 for no integration. At the same time the large exchanges seem to be less profitable than the smaller ones. The size of the exchange is measured by the number of transactions (X). The core competence of an exchange are trading and post-trading services. Additional services, like IT-services, do not belong to the core competence of an exchange (Serifsoy 2007). One could therefore expect a negative effect of diversification (DIV, modeled as a dummy variable) on the profitability of the exchanges. The relation is matter of the next equation.

$$NPR_{i,t} = \alpha + \beta X_{i,t} + \gamma VER_{i,t} + \delta DIV_{i,t}$$

**Empirical Result**

In the following the hypotheses H2, H3, and H4 are tested. Table 5 provides estimates for the variables number of transactions (X), vertically integration (VER), and diversification (DIV). The dependant variable in the regression is the net profit ratio. The table shows that the regression with X, DIV, and VER (see column 4) has a higher coefficient of determination than the regression with only X, DIV, and VER (see column 1, 2, and 3).

| Independent Variables | (1) Parameter (t-statistics) | (2) Parameter (t-statistics) | (3) Parameter (t-statistics) | (4) Parameter (t-statistics) |
|---|---|---|---|---|
| Intercept | 0,452 | 0.334 | 0.477 | 0,429 |
|  | $(20.087)^{***}$ | $(8.312)^{***}$ | $(17.014)^{***}$ | $(12.533)^{***}$ |
| X | -0.00000022 |  |  | -0.00000018 |
|  | $(-4.163)^{***}$ |  |  | $(-3.525)^{***}$ |
| DIV |  | -0.186 |  | -0.139 |
|  |  | $(-2.989)^{***}$ |  | $(-3.142)^{***}$ |
| VER |  |  | 0.169 | 0.091 |
|  |  |  | $(3.329)^{***}$ | $(2.286)^{**}$ |
| Adjusted R² | 0.211 | 0.098 | 0.121 | 0.375 |
| F-Statistics | $17.333^{***}$ | $8.931^{***}$ | $11.085^{***}$ | $13.209^{***}$ |
| N | 61 | 73 | 73 | 61 |

$^{***}$Significant at the 1 percent level      $^{**}$Significant at the 5 percent level

**Table 5: Regression on profit ratio**

The results support the hypotheses that larger exchanges are less profitable than smaller ones (H3). They also support the positive effect of vertical integration for the profitability of exchanges (H2). The negative effect of diversification for the profitability is supported as well (H4).

**CONCLUSION AND OUTLOOK**

Equity exchanges have been diversifying their operations into related business areas. Securities trading and post-trading are subject to scale and scope economies. The integration of these functions in one institution ensures efficiency by economizing on transactions costs. Our analysis confirms that large exchanges are providing trading services at lower costs per trade than smaller ones. Whereas integration of trading and post-trading and diversification lead to higher average costs per trade.

Size and diversification have a negative influence on the profit ratio of equity exchanges, while vertical integration has a positive impact. This is supported by the market capitalization of the exchanges that seem to be higher in case of vertical integration (see table 1). Reasons for this effect might be among others economies of scope, the reduction of technical and organizational interfaces, and the market power.

We see that large exchanges provide trading at the lowest per trade costs, but vertically integrated exchanges realize the highest profits. These results are also confirmed by the current strategies of the exchanges which show a trend towards more verticalization of securities trading, with for example the merger of the LSE with the Bora Italiana (which includes post-trade services) in 2007 and the integration of trading and post-trading at the SIX Group in 2008.

The organization of exchanges is important for the different stakeholders: The users, the operators, the shareholders, and the regulators. Especially in Europe the vertical integration of trading, clearing, and settlement is discussed controversially (EU Commission 2006; Schaper 2008). Our findings show, that the largest exchanges are providing trading at the lowest costs per trade. This means that from a macroeconomic perspective horizontal consolidation has to be considered as a suitable approach to improve the explicit costs per trade. On the other side competition is important for the development of innovations in the area of trading, clearing, and settlement. As for example new trading venues like Chi-X established the trading of European securities using the existing domestic infrastructures for the settlement instead of using links or agent banks (Chlistalla and Schaper 2008).

From the shareholders perspective the best way to maximize the profit of the exchange seems to be the integration of the securities trading value chain and to focus on single markets rather than providing trading services for different markets.

Naturally, the potential for monopoly behavior of vertically integrated exchanges needs to be considered properly which possibly is one of the most difficult issues and deserves a dedicated monitoring.

**REFERENCES**

1.  Annual Reports (2005-2007). Annual Reports of 22 Equity Stock Exchanges.

2.  Chlistalla, M. and Schaper, T. (2008). 'Deriving a holistic Performance Measurement System for the European Clearing Industry', Proceedings of the *14th Americas Conference in Information Systems*, Toronto, Canada August 14th -17th 2008.

3.  Domowitz, I. and Steil, B. (1999). 'Automation, Trading Costs, and the Structure of the Trading Services Industry', Brookings-Wharton Papers on Financial Services.

4.  Dow Jones Indexes (2007). 'Dow Jones Global Exchanges Index - Factsheet', http://www.djindexes.com/mdsidx/downloads/fact_info/Global_Exchg_Facts.pdf (accessed 2008-10-28).

5.  EU Commission (2006). 'Draft Working Document on Post-Trading'. http://ec.europa.eu/internal_market/financial-markets/docs/clearing/draft/draft_en.pdf (accessed 2008-10-28)

6.  Groppelli, A. and Nikbakht, E. (2006). 'Finance', Barron's Educational Series.

7.  Hassan, I. and Schmiedel, H. (2003). 'Do networks in the stock exchange industry pay off? European evidence', Bank of Finland Discussion Papers 2/2003.

8.  Malkamäki, M. (2000). 'Economies of Scale and Implicit Merger in Stock Exchange Activities?' http://fmg.lse.ac.uk/upload_file/40_malkamaki.pdf (accessed 2008-10-08).

9.  Nielsson, U. (2009). 'Stock exchange merger and liquidity: The case of Euronext', Journal of Financial Markets Volume 12, Issue 2, 229-267.

10. Pirrong, C. (2008). 'The Industrial Organization of Execution, Clearing and Settlement in Financial Markets', *CFS, DBAG and EFL Research Conference*, Frankfurt, 13th – 14th June 2008.

11. Schaper, T. (2008). 'Trends in European Cross-Border Securities Settlement – TARGET2-Securities and the Code of Conduct', *FinanceCom 2007 LNBIP 4*, Ed: Veit, D.J., 50-65. Berlin: Springer.

12. Schaper, T. (2008b). 'Elimination of Technical Barriers in Securities Settlement', *Journal Competition and Regulation in Network Industries*.

13. Schmiedel, H. (2001). 'Technological development and concentration of stock exchanges in Europe', Bank of Finland Discussion Paper, 21.

14. Schmiedel, H., Malkamaki, M. and Tarkka, J. (2006). 'Economics of Scale and Technological Developments in Securities Depository and Settlement Systems', *Journal of Banking and Finance* 30, 1783–1806.

15. Schwartz, R., A. and Francioni, R (2004). 'Equity Markets in Action', Wiley Hoboken.

16. Serifsoy, B. (2007). 'Stock exchange business models and their operative performance', *Journal of Banking & Finance* 31, 2978-3012.

17. Serifsoy, B. and Weiß, M. (2007). 'Settling for efficiency – A framework for the European securities transaction industry', *Journal of Banking & Finance* 31, 3034 - 3057.

18. Wendt, F. (2006). 'Intraday Margining of Central Counterparties: EU Practice and a Theoretical Evaluation of Benefits and Costs', Amsterdam: Netherlands Central Bank.

19. World    Federation    of    Exchanges    (2007).    'Cost    &    Revenue    Survey    2006',    http://www.world-exchanges.org/publications/2006%20Cost%20&%20Revenue%20Survey.pdf (accessed 2008-10-08).

---

[i] The markets where selected according to the Dow Jones Global Exchanges Index (Dow Jones Indexes 2007). Only exchanges primary focussing on equities where selected. The market value is calculated on the basis of the equity prices from Reuters from 2008-08-11.

[ii] The data derives from the annual reports of the exchanges. In the table listed exchanges as well as not listed but for profit exchanges are included. The exchanges Euronext and OMX are listed separately as recent mergers are not reflected in all analysed annual reports.

[iii] The largest equity exchanges were selected according to the World Federation of Exchanges (2008) report. Only exchanges which published these informations are listed. The costs and number of trades are from the annual reports of the exchanges or from the World Federation of Exchanges report (2008).