

Regulating Competition between Stock Exchanges

Cara Schwarz-Schilling and Mark Wahrenburg

1. Introduction

The last years witnessed an unprecedented wave of new securities exchanges, inhouse trading systems and the increased competition between traditional exchanges by means of cross listings. It is widely believed that the exchange landscape will change considerably in the future, with mergers, the conversion of exchanges to profit maximizing corporations, new entrants, technological innovation and failure of exchanges being the visible signs of change. The European regulatory authorities currently follow a comparatively liberal policy and believe that a 'laissez faire' policy is best suited to promote competition among market places and achieve economic efficiency. At the same time, the United States follow a very different regulatory paradigm of an integrated 'National Market System'. This paper investigates the nature of competition between stock exchanges and alternative trading systems and concludes that a variety of reasons make it unlikely that unregulated competition will yield an efficient market outcome.

The traditional view argues that stock market are natural monopolies. Once an exchange has a certain amount of liquidity, it is likely to attract more trading volume, even if there are more efficient, but less liquid, alternatives. Competition thus does not ensure an efficient trading system to survive. According to the traditional view, competition between exchanges comes at the cost of market fragmentation and a reduction of liquidity. This in turn increases search costs for traders as well as execution costs and threatens the efficiency of the overall trading process. However, the argument is valid only in a world with high barriers between markets. When regulators enforce an effective integration of competing markets, the traditional fragmentation argument breaks down.

Within the press, inconsistent and sometimes opposing views are expressed: on the one side, there is the positive expectation that increased competition on the trading system level through the advent of alternative trading systems helps to tighten spreads.¹ On the other side, concerns have been raised that alternative trading systems in the form of bank owned inhouse trading systems will in the end lead to a monopolization of the trading industry and result in lower li-

¹ Moskowitz (2000).

quidity and higher spreads.² European regulatory bodies have only recently begun to care about the nature of competition between stock markets. However, the European commission has publicly raised concerns that the trend towards vertically integrated trading systems could dampen competition.³

The paper proceeds as follows: sections 2 - 6 provide an overview over the nature of competition between stock exchanges and their current regulation in the US and Europe. Section 7 presents a model that analyzes the effect of in-house trading systems like XetraBest on the equilibrium market spread and argues that inhouse systems may reduce competition between market makers and increase trading costs. Section 8 summarizes and concludes.

2. Competition among traditional exchanges

Historically, stock exchanges have been a regional industry. In the 19th century, financing of publicly traded corporations, ownership, and trading all tended to occur on a localized basis. Stock exchanges thus could be considered to be local monopolies. With the advent of modern information technology in the 20th century, regional exchanges began to serve as auxiliary markets for the leading exchanges such as the NYSE in the US or the Frankfurt Stock Exchange in Germany. As regional exchanges came under increased competitive pressure, the number of regional exchanges registered in the US fell from 18 in 1940 to eight today.⁴ Additional competition came from foreign countries. In Europe, the London Stock Exchange (LSE), after the “big bang” reforms of 1986, started to trade most European blue chips in a specially designed international market segment. In some stocks, London quickly gained significant market share. National stock markets reacted by innovating their market structures. The German response to the London threat was the introduction of Xetra which successfully brought back most trading volume to the home country. Other countries reacted likewise.

Competition between exchanges, in fact, takes place on many grounds, such as the provision of immediacy, low spreads, low volatility, liquidity, efficient price discovery, transparency and low commissions and other transaction costs. The more competition there is, the more likely it is that exchanges themselves will adopt rules that benefit and protect customers. Competition is not restricted to the actions of the exchange itself, i.e. the trading system choice of rule set. A stock exchange in a wider view is a complex organization encompassing intermediaries such as market makers, specialist firms, regulatory bodies

² Munz (2001).

³ Heusinger (2001).

⁴ Today's stock exchanges include the American Stock Exchange, the Boston Stock Exchange, the Chicago Stock Exchange, the Cincinnati Stock Exchange, the International Securities Exchange, the New York Stock Exchange, the Pacific Exchange, Inc. and the Philadelphia Stock Exchange.

and so on. The competitiveness of an exchange is determined by the whole group of interdependent actors. In complex systems, the change in one part of the system often has complex spill overs in other areas. For example, the introduction of Xetra decreased order handling costs substantially. However, it increased the bid-ask-spread in many small stocks because the market maker⁵ of the floor was abandoned and the shift to anonymous trading resulted in increased concerns about trading by informed investors.

3. US regulation of stock exchanges: NYSE, regionals and the ITS

The NYSE has become the dominant exchange in the US. The strong market position is in part due to rules that prevented competition from other trading venues. One early measure was to reduce the information available to outsiders. For a long time, telephones were not permitted on the trading floor and hindered the crowd from trading in the street outside the exchange.⁶ As a result, the flow of buy and sell orders for each stock concentrated into a single location. The most famous anticompetitive rule was Rule 390, which prohibited NYSE members from dealing in listed securities outside the NYSE. Since most large US banks and securities firms are members of the NYSE, the rule made it very difficult for competing exchanges to attract trading volume. Rule 390 was widely believed to be the major impediment for ECNs to trade NYSE stocks. For years, proponents have argued that Rule 390 prevents fragmentation by forcing all orders to be executed within the NYSE. Others contend that the rule is an anticompetitive use of market power by a dominant market player. The rule was dismissed in 1999 after the former SEC chairman Arthur Levitt had publicly argued that Rule 390 was outdated and unacceptable in terms of anti-competitive effects.

The NYSE trades stocks using a unique market model: an auction process managed by a single specialist for every stock. The specialist collects all orders and assembles them in the order book. He has the right to place own orders in the order book, acting as a dealer. Since he used to have exclusive insight into the order book, he was able to trade profitably on this information. The specialist also has the “public” function of determining fair market prices and matching orders at these prices. In order to prevent price fluctuation deriving from order imbalances, the specialist also has an obligation to stabilize prices by trading on his own account. Traditionally, specialist firms used to be private corporations or partnerships. Today, it has become an activity of the major investment banks. The specialist business is highly profitable: 440 specialists made

⁵ Amtlicher Kursmakler.

⁶ Angel (1998).

gross revenues of \$2.14 billion in 2000.⁷ This is presumably due to the fact that a specialist has sole access to the exchange's limit order book which provides valuable information about the supply and demand for a share. Overall, NYSE members make close to 90% of their income from proprietary trading rather than from commissions.⁸ Any transaction on the floor must involve either a specialist or a floor broker. Given this structure, it is not surprising that the NYSE is lagging behind in implementing new technology that would reduce trading volume of their member firms.

In 1975, the "National Market System" amendments to the Securities Exchange Act led to the institution of the Intermarket Trading System (ITS). The ITS aimed at building a nationwide integrated market place. Angel (1998) argues that the ITS was necessary in order to maintain competition from the regional exchanges which were threatened with extinction due to the demise of fixed commissions at the NYSE. The ITS gave regional exchanges access to NYSE's quotes and the ability to route orders to any of the US stock exchanges in search of the best price. The regionals could now offer order execution at least as good as the posted quotes on New York. Brokerage firms quickly discovered that they could profitably use regional exchanges in order to internalize their own customer order flow, i.e. matching customer buy and sell orders without paying commissions to the NYSE. The broker firms thus earned the bid-ask-spread on their order flow instead of leaving this income to the NYSE specialist.

In January 2002, the NYSE in a revolutionary change opened its limit order book to the public. But in doing so, it risks sacrificing those who are said to have made NYSE what it is today: the specialists. According to official NYSE quotes, specialists are supportive of NYSE OpenBook, viewing it as a way to fight the perception that as the once exclusive keepers of the limit order books they held unique advantages.⁹ A more likely explanation is that regulators convinced the NYSE to limit the monopoly power of specialist firms. While OpenBook is a great step forward in terms of transparency, analysts still criticize that the NYSE does not allow full transparency by not allowing vendors to commingle OpenBook with the order books of regional stock exchanges and electronic communications networks. This prevents investors from gaining a consolidated view of all bids and offers for a given NYSE stock from all competing trading systems.¹⁰

The nature of competition between NYSE and NASDAQ has historically been a competition for listings. NYSE tried to convince larger NASDAQ listed firms to migrate to the NYSE. Since many large companies like Microsoft and

⁷ Fan et al (2002), 117.

⁸ Fan et al (2002), 123.

⁹ "NYSE OpenBook to Launch This Month", www.nyse.com.

¹⁰ Robert Sales, NYSE Launches OpenBook In Quest for Improved Price Transparency, Wall Street and Technology online, 24.1.2002.

Intel refrain from doing so, the NYSE in 1999 announced a new competitive strategy: dual trading of NASDAQ stocks. This has the potential to introduce a strong competitor for NASDAQ stocks. However, it is yet open whether the plans are indeed carried out.

4. US regulation of NASDAQ and ECNs

Historically, NASDAQ stocks traded in a little regulated over the counter market. While NASDAQ is still often called an OTC market in contrast to the New York Stock 'Exchange', the SEC has harmonized regulation substantially. NASDAQ has been designed as a dealer market. Customer orders are only matched against dealer orders and are not matched internally. Competition among dealers shall ensure that the bid-ask-spread is reduced to the competitive level. Currently, more than 500 market making firms provide capital support for NASDAQ-listed stocks.

Market makers make profits by buying and selling stocks with their own capital, taking in the spread between the bid price and the ask price. The spread is the main source of income for market makers. In order to attract order flow, the best bid and ask quotes are displayed in the NASDAQ Level 2 screen to all NASDAQ members. One inherent NASDAQ problem is the danger of collusion between market makers. Although NASD rules are in place to detect and prevent collusion, these rules have not always been effective. In 1994, the Department of Justice (DOJ) started investigations after an academic study by Christie and Schultz (1994) found that NASDAQ market makers avoided odd-eights quotes. The U.S. DOJ obtained a US\$ 1 billion antitrust settlement for public investors against the involved securities firms. The SEC investigations resulted in NASDAQ's agreement to adopt a series of Order Handling Rule changes on January 1997.¹¹ The most significant of these changes was to include ECN quotes in the NASDAQ national best bid and offer (NBBO) quote montage.¹² ECNs are a special kind of alternative trading systems that collect and execute limit orders of traders very much like the German Xetra system.

The effect of these changes was a dramatic success of ECNs and a dramatic decrease in trading costs on NASDAQ. Barclay et al. (1999) examined the impact of the market reform on spreads and concluded that round trip costs (the cost of buying a security and selling it immediately) fell on average by 30%.¹³ Cost reductions materialized across all trade-size categories. Another effect of these rule changes was to give rise to a spectacular increase in the volume of NASDAQ shares traded on electronic communication networks (ECNs). In 1998 the SEC finally decided to link the markets and promote innovation and

¹¹ For an overview, see Blume (2002).

¹² Busato (2001).

¹³ Similar results are reported in Barclay et al (2001).

competition in the National Market System (NMS) for securities, and promulgated Regulation ATS. The SEC ruling allowed ECNs to quickly gain substantial market share in NASDAQ stock trading. In 1994, the only ECN of any prominence was Instinet, owned and operated by Reuters. In 1999, nine ECNs had been approved by the SEC. Except Instinet, these ECNs were small companies with employees in the range between 15 and 140.¹⁴ In 2001, it was reported that approximately 50% of all NASDAQ transactions involved an ECN.¹⁵ In June 2002, Instinet and Island alone were responsible for 15% and 15.2% of overall trading volume.¹⁶

The SEC ruling made it possible even for small start up firms to operate a trading system. ECNs are not treated as an exchange but rather as a broker-dealer, i.e. a financial service firm. In order to register, the firm must submit some forms, report material changes, permit SEC inspections, maintain certain records, ensure the protection of subscribers' confidential trading information, and promise to refrain from calling oneself an "exchange". The SEC also requires sufficient computer and network capacity, security, and integrity standards. ECNs with more than five percent of the volume in any security must make all their best-priced orders in those securities available to the public quote stream and accessible to non-subscribers. This is realized by inputting the best bid and ask quotes into the NASDAQ Level II screen which is accessible by all NASD members. Since every broker has the legal obligation to execute customer orders at the best available price, every investor profits from decreasing spreads due to ECN orders. Since all bid and ask quotes of both ECNs and dealer firms are assembled in the Level II screen, this system effectively serves like a central consolidated order book encompassing all traders and trading systems active in NASDAQ stocks. Allowing ECNs to access the Level II screen market was a crucial change. Previously, ECNs were required to attract both buyers and sellers in order to match trades. By forcing Instinet into the public marketplace, the SEC opened the public market to ECNs. Over 140 broker-dealer firms have informed the SEC that they operate some kind of alternative trading system. Some of these systems are run completely inhouse, while others are accessible by customers or by market participants generally.

Crucial for the success of ECNs are access rights of the ECN to the NASDAQ system and vice versa. This is because the overwhelming majority of ECN orders cannot be matched internally due to order imbalances and insufficient market share. Contrary to many public quotes, the basic function of an ECN is not order matching but instead order gathering and searching for the best counterorders within the NASDAQ system against which the ECN orders can be executed. Thus ECNs are not direct competitors with NASDAQ itself. ECNs participate in the NASDAQ market as members, competing with market

¹⁴ Benhamou, Serval (1999).

¹⁵ Börsenzeitung, Nov 30, 2001, p. 5.

¹⁶ Börsenzeitung, 11.6.2002.

makers and making NASDAQ function more efficiently by providing automatic matching capabilities. The real competition is between the ECNs and the market makers. ECNs have taken a big share of trade volume away from market makers. Each trader today has the option to decide whether to submit his/her order to the dealer market or to the ECN. Traders can also take advantage of both markets by first using the ECN and – if their orders are not executed on it – subsequently going to the dealer market.

While subscribers can access each ECN via direct links, all other NASDAQ market participants can connect to ECNs via SelectNet.¹⁷ However, only the subscribers have the privilege to see the entire order book of ECNs. The crucial privilege of ECNs lies in the fact that they have the ability to display their best bid and ask quotes in the NASDAQ Quote Montage.

In June 2002, NASDAQ will replace its current Order Display Window, SelectNet and the Small Order Execution System by the new SuperMontage system. SuperMontage is a fully integrated order display and order execution system that executes on the basis of price/time priority. It allows market participants an insight into the order book by displaying price and volume of the five best orders on every side of the market. No distinction between market maker orders and orders entered via an ECN is made. The system guarantees the “best execution” principle, i.e. every incoming order is matched at the best available price. The best execution principle has been in place before, but its enforcement could not be guaranteed due to insufficient system support of the old SelectNet system. In addition, SuperMontage will allow NASDAQ market makers to enter orders anonymously (a feature which was implemented only within ECNs before), although market makers will be obligated to maintain a two-sided order consistent with SEC and NASD rules. Grundfest (2000) argues that the SEC should foster the use of modern technology in order to further increase transparency across all markets (including NASDAQ, NYSE and other regional exchanges) by mandating to use modern technologies. Through the use of open API/Peer-to-Peer technology, it is possible to send all bid and ask information to an electronically accessible address such that investors could (with the help of software based search agents) easily gain full transparency over all markets.

5. The value of order flow: economics of alternative trading systems and internal matching systems

According to an often raised argument, the success of ECNs within the NASDAQ system is the result of two factors: the low operating cost of running an ECN on the one hand and relative inefficiency of dealers at NASDAQ on

¹⁷ NASDAQ's SelectNet system was introduced in 1988 and allows participants to route orders to a particular market maker or ECN.

the other hand.¹⁸ Indeed, an empirical study by Conrad et al. (2001) finds that execution costs of orders filled by ECNs are substantially lower than orders filled by traditional brokers. The average cost difference amounts to 0.3% of stock value.

But there is another and may be even more important profit source for ECNs: the value of order flow. ECNs frequently sell their retail orders to market making firms and receive payments for order flow. Competition between ECNs ensures that this money is passed back to the brokers and finally to the retail investor. Since the best execution principle ensures that the investor receives the best available price in the market, it is surprising why market makers are willing to make an extra payment for order flow as long as spreads are at the competitive level. ECNs make substantial revenues from these payments. Ameritrade for example got 9% of revenues from order flow payments.¹⁹ Instead of selling the orders to another market maker, some online brokers have founded their own market making subsidiary. The subsidiary executes all orders and acts like a usual market maker. Schwab for example routes all online orders to its subsidiary Schwab Capital Markets. Schwab Capital Markets generated \$551 Million in revenue in 1999, or 14% of Schwab's total revenues.²⁰ Weber (2002) reports that 87% of all customer orders in NASDAQ stocks are routed to intermediaries that are either owned by the broker or that make payments back to the broker (payment for order flow). If market making is a competitive industry (as many believe) – why can a firm make profits from acting as a market maker for its own order flow or selling it to somebody else? The only satisfactory explanation is based on asymmetric information and can be rationalized using a model of Glosten and Milgrom (1985).

Glosten and Milgrom model an anonymous market in which a market maker posts quotes for a share: a bid, at which he is willing to buy, and an offer, at which he is willing to sell. The market maker acts competitively and thus earns zero expected profits. There are no transactions costs in the form of fees, inventory holding costs and so on. The spread in their model arises solely from the fact that there some knowledgeable traders in the market and the market maker on average makes a loss when he trades with these better informed traders. This is due to the fact that informed traders have superior information regarding the likely future price change of the stock. Thus, whenever the market maker trades with an informed investor, he buys in falling markets and vice versa. The market maker can recover the losses from dealing with informed traders because there is a second group of traders: liquidity traders. These do not have an informational advantage and will always trade. By quoting a bid price which is smaller than the offer price, the market maker an average earns on trades with liquidity traders. With competition between market makers, the

¹⁸ See for example Benhamou and Serval (1999).

¹⁹ Weber (2001).

²⁰ Weber (2001).

spread is set in a way such that losses to informed investors are just compensated by gains from trading with liquidity traders.

What can the Glosten/Milgrom model tell us on the profitability of ECN orders? Within the model, the market maker cannot differentiate between informed and uninformed traders. Further, the equilibrium spread depends on the relative frequency of both trader types: shares with heavy dealing by informed investors have a higher equilibrium spread in order to compensate the market maker for larger losses to informed traders. With the introduction of an ECN, the market maker still cannot identify the trader type, but he has one additional part of information: the source of an order. When the market maker executes ECN orders and he is sure that this order volume comes exclusively from small retail traders, he will rationally update his expectation about the fraction of informed traders within the order flow. If he believes that retail investors entail a low fraction of informed investors, the equilibrium spread for ECN orders is lower than for the overall trade flow.²¹ Competitive market makers thus are willing to execute at better prices, or – since the price is dictated by the best execution principle – make a compensatory extra payment if he may execute against the overall market spread.

6. Stock exchange regulation in Germany

The European markets are characterized by regulatory fragmentation. Stock market regulation in Europe is usually shaped by 3 independent regulatory bodies:

1. Institutions regulating Insider Trading and the flow of information from companies to investors (insider regulation)
2. Institutions regulating the capital adequacy of participants in the trading process (capital adequacy regulation)
3. Institutions which regulate stock exchanges or oversee the self regulatory bodies of stock exchanges (stock exchange regulation)

Unlike the situation in the US, the regulatory bodies for regulating stock exchanges work on a decentralized basis. This approach is sometimes called the “Silo-approach” to regulation since every authority is concerned with only one or few stock exchanges. An extreme example is the situation in Germany, where the local states have the duty of overseeing stock exchanges. This led to the curious situation that a local state government had to approve the planned merger of the German stock exchange with the London stock exchange – a de-

²¹ Barclay, Hendershott and McCormick (2001) show, that the reverse is true: ECNs attract more informed trading volume. However, a market maker who buys order flow from an online broker via an ECN buys only the ‘valuable uninformed part’ part of the overall ECN order flow. Thus, the quality of order flow is better than average.

cision which affects the interests of much more people than the voters of the local state of Hessen.

Due to the decentralized nature of competition, the regulatory actions concentrate on the business processes *within* the particular regulated stock exchange. Stock exchange regulators are mainly concerned with market integrity, i.e. the trading and price formation process within the supervised exchange. The overall stock market and the level of competition between different exchanges naturally lies beyond the scope of decentrally operating authorities.²² In other words: no institution currently is responsible for providing a fair level playing field between competing stock exchanges. And no institution comparable to the SEC exists which tries to consolidate competing stock exchanges and build a national (or European or global) market system.²³

Regulatory councils like the Federation of European Securities Commissions FESCO (2000) or the German stock exchange council (2001) discuss in length, to what extent stock market regulation principles should be applied to alternative trading systems but are silent on the regulation of competition between trading systems. In particular, the discussion is mainly concerned with the threats to market integrity and systemic risk posed by the new trading platforms. There is little or no discussion on an economic role of protecting new trading platforms against the dominant incumbent exchange. Benhamou and Serval (1999) note that a dominant player can successfully foreclose the market to the others by charging a high rate for the use of his matching system. Given the US experience, it seems unlikely that competing alternative trading systems can play a major role in Germany in the current regulatory structure.

In Germany, the German Stock Exchange for a long time argued that there is no profitable niche for ECNs since the exchange system Xetra is said to be much more efficient than the systems used in US markets.²⁴ However, due to the threat that banks would build their own inhouse trading systems in order to internalize their own customer order flow²⁵ and due to the announcement of NASDAQ Europe to offer inhouse trading facilities to brokers and banks, the exchange changed its mind and recently proposed plans to offer order internalization to brokers on an exchange run system called 'Xetra Best'.²⁶ Economically, Xetra Best is equivalent to the current practice on NASDAQ to buy order flow via an ECN. XetraBest gives brokers the option to become the monopolist counterparty to their customer orders. The customer is protected by the same best price guarantee as in the US: customer orders are executed at the best

²² See for example Spindler (2002).

²³ The Committee of Wise Men (2000) of the European Union has identified the urgent need to develop transnational regulation. However, given the legal and institutional barriers in the area of stock market regulators, the paper proposes to rely on competition policy instead of exchange regulators as a complementary source of regulatory action.

²⁴ Deutsche Börse (1999).

²⁵ Neubauer (2001).

²⁶ For details, see various articles in *Börsenzeitung*, 3.7.2002.

available bid and ask quotes in the Xetra system. At the same time, NASDAQ Europe is offering essentially the same product to banks and brokers. Of course, one may wonder why banks or start up firms do not develop their own inhouse matching systems as they did in the US. Indeed, many banks have these systems in place but not yet operating. The main reason is article 10 of the German Stock Exchange Act, which requires all retail customer orders to be routed to a recognized exchange as long as the customer does not explicitly demands another trading venue. Since it is cumbersome to convince all customers about the merits of an internal matching system, German banks seek to internalize under the roof of a recognized exchange.

Since Xetra Best is part of a regulated exchange, it needs regulatory approval by the ministry of Hessen. As XetraBest will have the direct effect of fewer customer limit orders flowing into the open order book of Xetra, authorities have been concerned with likely effects of reduced liquidity and larger spreads within Xetra. For that reason, they require banks which participate in Xetra Best to act as a market maker in the open order book and continuously quote spreads which may not exceed some given level. NASDAQ Europe is regulated by a different state: the state of Bremen. The competition between Xetra and NASDAQ Europe presents a nice example of the effects of regulatory competition between two local German stock exchange regulation authorities. Unsurprisingly, Bremen was not concerned with the likely negative impact of NASDAQs internalization system on the liquidity of the Xetra system in Frankfurt. For that reason, no mandatory market making obligations for participating banks were required.²⁷ It is obvious that competition between both systems (and their respective regulators) severely restricts the power of Hessen to prevent spread increases by strict market making requirements for participating banks.

7. The impact of order internalization on market spreads

Order internalization has the direct effect that some customer orders which tended to reduce the spread in Xetra will no longer be entered into the Xetra order book and therefore increase Xetra spreads. As a consequence, trading costs of other market participants increase. However, this direct effect is presumably not the most important effect. The best bid and ask quotes are almost always determined by the quotes of professional market participants which act as 'voluntary market makers'.

A thorough analysis of the likely impact of order internalization on the size of spreads must model the effect on the spread setting behavior of market

²⁷ Bremen requires instead that the customers must receive a price improvement compared to the current Xetra quotes. However, it did not make public yet, how large this improvement should be.

makers. It has been argued above within the model of Glosten and Milgrom that spreads will increase if the proportion of informed traders increase in the Xetra order book. Since it is safe to assume that banks retail customers are most likely not informed traders, the market spread is likely to go up due to increased informed trading in the open order book.

Another relevant effect may be the effect on market maker competition. If order internalization reduces competition, market makers may be able to sustain spread levels above the competitive level. The following model explores this idea.²⁸ It is a very simplified and stylized model, based on the following assumptions:

1. The market consists of two types of individuals: traders and market makers. There is no asymmetric information about the value of stocks. All traders are thus liquidity traders.
2. Initially, stocks are traded in a pure dealer market (the incumbent market), in which two market makers compete for order flow. Both market makers simultaneously choose bid and ask quotes and commit to execute an unlimited order volume at this price.
3. Market makers act as Bertrand competitors in the incumbent market, i.e. their action variable is the quoted spread. The market is in equilibrium when no market maker wants to alter his own spread given the spread of his competitor.
4. When order internalization is introduced, every trader ex ante chooses between the existing order book and the in house trading system before placing his order.
5. The inhouse trading system provides a best price guarantee, i.e. traders receive the same transaction price on both markets and thus are indifferent between both systems.
6. Traders cannot place limit orders within the spread on either the dealer market or the inhouse system. They are restricted to unlimited market orders.
7. There is an identity between the market makers and the banks offering inhouse trading systems to their customers. For simplicity, we assume a symmetric situation, i.e. each market maker / bank receives the same amount of inhouse trading volume.
8. Market makers' cost function is linear in trading volume. The constant marginal cost may be interpreted as order handling costs following the usual microstructure literature.
9. Other transaction costs are assumed to be zero for both markets.
10. In an important deviation from the usual Bertrand model, we assume that a market maker quoting a lower spread does not lose all trading volume.

²⁸ A related model in the context of alternative trading systems in combination with order preferencing agreements can be found in Wahrenburg (2001).

Note that the contractual allocation order flow to the inhouse system and the open order book of the exchange takes place before the orders are placed by traders. It is this sequence of events which drives the main result of the model. By committing to execute the inhouse order volume before trading in the incumbent market takes place, the market makers are able to precommit to pursue a less competitive pricing behavior in the later trading session. Intuitively, following aggressive pricing strategies in the open order book become less attractive because lowering the spread *ceteris paribus* leads to a smaller increase in volume. This is due to the fact that the market makers compete only for the remaining orders in the open order book. By reducing the spread, a market maker receives a larger fraction of trades in the open order book, but this has a negative spillover to the profits from the inhouse system due to the promised best price guarantee.

In conventional market microstructure models, the market maker quoting the best bid or ask price attracts all trading volume. This assumption has the consequence that Bertrand competition drives down the spread to marginal cost, irrespective of the number of market makers. A market spread exceeding the market makers' marginal cost cannot be an equilibrium because every market maker would have an incentive to slightly undercut his competitor(s). He loses little in terms of the spread reduction but gains a lot in terms of order volume because he is able to attract 100% of the trading volume. This extreme reaction of trading volume is unlikely to be a good description of real world markets. Although price priority rules ensure that limit orders with better prices are served before any other order, the assumption of perfect competition as a result of bertrand competition does not adequately reflect market realities. A market maker quoting a higher spread can expect a non-zero trading volume for a number of reasons not acknowledged by standard microstructure theory:

1. At any specific point in time, competing market makers may post different bid and ask quotes because of differences in their current inventory positions.
2. Both market makers may quote different bid and ask prices as they have heterogeneous expectations about the fair (mid-market) value of the asset traded.
3. After a transaction has erased an order from the order book, it takes some time to place a new order. Within this time period, another market maker quoting a higher spread may attract trading volume.
4. Every market maker must continuously update his bid and ask quote in order to adjust to changing market prices. If this adjustment does not take place simultaneously, a market maker with a higher spread will at some points in time quote the best bid or ask quote.

A model of market maker competition should therefore have the property that expected trading volume is a decreasing function of the quoted spread, i.e. a market maker quoting aggressively receives more, but not all trading volume.

In order to formalize this idea, assume that aggregate demand for dealer services is inelastic such that the aggregate trading volume is given by a constant X . Furthermore, the share of trading volume that a market maker attracts is a linear function of his own spread and the spread quoted by his competitor. For simplicity, assume that the fraction of trading volume attracted by market maker x_i is a linear function of the spreads s_i and s_j quoted by each market maker:

$$x_i = 1/2 - s_i + s_j$$

We may use the intuition that the model is a simplification of a more complicated dynamic model where individual traders place their orders sequentially and uniformly distributed over the time interval and x_i is the fraction of time in which market maker i is quoting the best spread, given that market maker j follows a strategy of placing s_j . When both market makers set the same spread, they both receive 50% of the trading volume. If one of the market makers lowers his spread, he is gaining market share but not the complete market and vice versa. Note that x_i and x_j sum up to one.

Market maker costs are assumed to be c per unit of trade. Each trader sets the profit maximizing spread given the spread set by his competitor. We are interested in the equilibrium spreads of this Bertrand competition for order flow.

Absent an inhouse trading system, the profits of trader i given the spread chosen by trader j , is given by

$$\begin{aligned} \pi &= x_i X * (s_i - c) \\ &= \left(\frac{1}{2} - s_i + s_j \right) X * (s_i - c) \end{aligned}$$

The market maker sets the profit maximizing spread. The first order condition is

$$\pi'_i = X \left(\frac{1}{2} - 2s_i + s_j + c \right) = 0$$

The first order conditions of both market makers define the reaction functions:

$$\begin{aligned} s_i &= \frac{1}{4} + \frac{s_j}{2} + \frac{c}{2} \\ s_j &= \frac{1}{4} + \frac{s_i}{2} + \frac{c}{2} \end{aligned}$$

In equilibrium, the spread exceeds marginal cost:

$$s_i = s_j = \frac{1}{2} + c$$

Equilibrium profit for each market maker turns out to be

$$\pi_i = \pi_j = X \frac{1}{2} \left(\frac{1}{2} + c - c \right) = \frac{X}{4}$$

Bertrand competition in this setting does not erase market maker profits. Due to the inelastic demand, market makers are able to realize a profit in equilibrium.

Now, suppose that both market makers offer an inhouse trading system to their customers. They convince a fraction α of all traders to direct their trades away from the open order book and execute their trades within the inhouse trading system. Due to the best price guarantee, traders are indifferent between both markets. Every α between zero and one thus can constitute an equilibrium. By the symmetry assumption, $\alpha/2$ trades are executed within each of the two inhouse systems. Each market maker's profit function now has two components: the profits earned in the open order book and the profits earned on the inhouse system. The inhouse trading system profit depends on the benchmark price due to the best price guarantee.

When the two market makers quote different prices, the question arises how the benchmark price is determined. For the sake of simplicity, we assume that the benchmark price equals the average price of transactions in the open order book. Since both spreads are observed with probabilities x_i and x_j , the benchmark spread earned from inhouse systems is given by:

$$s^{IS} = x_i s_i + x_j s_j$$

When setting their spread in the open order book, the profit function of market makers has changed as compared to the situation without inhouse systems for two reasons

1. The market makers compete only for the remaining fraction of overall trading demand $(1-\alpha)X$
2. When setting the spread market makers have to take into account the effect on the profits of their inhouse trading system since this profit is determined by the benchmark spread.

The new profit function is:

$$\pi_i = (1-\alpha)X x_i (s_i - c) + \frac{\alpha}{2} X (s^{IS} - c)$$

The new first order condition is:

$$\pi_i' = (1-\alpha)X \left[\frac{1}{2} - 2s_i + s_j + c \right] + \frac{\alpha}{2} X \left(\frac{1}{2} - 2s_i + 2s_j \right)$$

Solving for the new equilibrium as above, we find the new equilibrium spread:

$$s_{i,j}^{IS} = \frac{1}{2} + c + \frac{\alpha}{4(1-\alpha)}$$

For the special case $\alpha = 0$ (no trading volume going to inhouse systems), the equilibrium spread coincides with the above result for the market without inhouse system. For positive α , the spread increases and is a monotone function of α . Thus, market makers are able to raise their spread in equilibrium. The introduction of order internalization using inhouse trading systems turns out to reduce competition between market makers. The inhouse system allows market makers to quote spreads which are closer to the monopoly situation. (As α approaches 1, the spread grows without bound. This result is due to the assumed inelastic demand for market maker services which enables a monopolistic market maker to demand an arbitrarily high spread.)

While the model is highly stylized and simple, the basic intuition for the spread increase after introducing inhouse trading is straightforward and is robust to possible extensions of the model. When a trader calculates the marginal gain of lowering the spread in a situation without inhouse systems, he has to consider three effects. First, he earns a lower profit margin. Second, he enjoys an increase of trading volume because he attracts a larger market share. Third, he has to take into account the reaction of his competitor. Since the reaction functions have a positive slope, the competitor will also decrease his spread, resulting in a decline of trading volume. After the introduction of inhouse trading systems, the situation changes. The trader now has to take into account the additional effect on profits made from inhouse trading. Since the inhouse trading volume has been contracted ex ante, there is only the price effect left: lowering the spread thus unambiguously decreases the profits from inhouse trading. In other words: the inhouse trading system serves as a precommitment device which weakens price competition in the later trading stage by lowering the returns from decreasing the spread.

8. Conclusion

As we have demonstrated, the introduction of alternative trading systems may have the undesired side effect of decreasing competition at the market making level when ATS are used for order internalization as currently planned in Germany. When regulators try to intensify trading system competition by promoting ATSS, they may have to trade off the efficiency gains through intensified competition at the trading system level with a decrease of competition at the market making level. Of course, one may argue that many market making firms compete in today's open Xetra order book. However, firms tend to specialize on individual stocks and the collusion experience at NASDAQ forcefully shows

that competition on the market making level may not work perfectly. If one tries to compare both effects in terms of practical importance, there is a clear indication that market maker competition should be much more important than trading system competition: commissions for using a trading system are an order of magnitude lower than the bid-ask spread in most markets.

This poses the question of the *raison d'être* of ATSs: do these systems exist because they can successfully compete against inefficient and costly trading systems of traditional exchanges? Or are they better described as vehicles to increase market maker profits by limiting the ex post competition for orders by using order-preferencing arrangements? The model outlined here suggests that the second motive may be a valid reason for implementing inhouse trading systems. This view is supported by the fact that the owners of alternative trading systems are almost always securities trading firms or banks actively engaged in securities trading. In conversations, some representatives of European ATSs openly admitted that the spread income made by selling the order flow to securities firms is much more important than economies realized in operating a more cost efficient trading system.

If the second motive of operating ATSs should be the dominant one, it is still an open question whether customers are worse off after introduction of an ATS and whether regulators should intervene in the competition between traditional exchanges and ATSs. As long as there is free entry into the market making industry, any profits made on inhouse systems or other ATSs should be competed away. Ultimately, the gains must be passed over to consumers.

Two final remarks on this chain of reasoning are in order. First, it is questionable whether competition on all levels works smoothly and ensures that the extra fee paid by customers for market-making services will in the end flow back to them in the form of lower brokerage costs. Frictions and rigidities in the vertical chain may well leave part of the rents within the securities industry. Second and more important, the argument highlights the importance of understanding the multidimensional nature of transaction costs paid for securities trading services. The overall cost of trading includes brokerage fees, fees and commissions for settlement and related services and finally the spread paid to market makers. While fees are an obvious and transparent cost of transacting, many investors have only a limited understanding of the amount of money they pay for market-making services in the form of the bid-ask spread. The shift of trading volume away from traditional exchanges towards ATSs may result in a general shift of transaction costs away from transparent items such as brokerage fees towards non-transparent items such as the spread. Future regulation should ensure that customers have access to all necessary information in order to make an informed decision between trading systems.

References

- Angel, J.J. (1998): Consolidation in the global equity market, working paper.
- Barclay, M.J., W.G. Christie, J.H. Harris, E. Kandel, P. Schulz (1999): The effects of market reform on the trading costs and depth on Nasdaq stocks, *Journal of Finance*, Vol. 54, 1-35.
- Barclay, M.J., T. Hendershott and D. T. McCormick (2001): Electronic communications networks and market quality, working paper.
- Benhamou, E., T. Serval (1999): On the competition between ECNs, stock markets and market makers, working paper.
- Blume, M.E. (2002): The structure of the US equity market, working paper.
- Busato, E.J. (2001): The electronic communication networks and the internet: a new concept of business in the capital market, working paper.
- Committee of Wise Men (2000), Initial Report on the regulation of European securities markets, November 2000.
- Conrads, J., K.M. Johnson, S. Wahal (2001): Alternative Trading Systems, working paper.
- Deutsche Börse (1999): Alternative Handelssysteme in den USA und in Europa.
- Fan, M., S. Srinivasan, J. Stallaert, A.B. Whinston (2002): Electronic commerce and the revolution in financial markets, Thomson Learning.
- FESCO (2000), The regulation of alternative trading systems in Europe, September 2000.
- German stock exchange council (2001) (Börsensachverständigenkommission), Empfehlungen zur Regulierung alternativer Handelssysteme, Mai 2001.
- Glosten, L.R., P. R. Milgrom (1985): Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics*, vol. 14, 71- 100.
- Grundfest, J.A. (2000): The future of the United States securities regulation in an age of technological uncertainty, working paper.
- Heusinger, R. (2001), "Monti rüttelt am Börsen.-Silo", *Börsenzeitung*, 4.4.2001.
- Moskowitz, (2000), "The rise of ECNs will push traditional exchanges into a single electronic trading network", *Red Herring*, 4.12.2000.
- Munz, T. (2001), "Absage an bankeigene Börsen", *Börsenzeitung*, 8.5.2001
- Neubauer (2001), *Die Bank*, 104.
- Spindler, G. (2002): Elektronische Finanzmärkte und Internet-Börsen, working paper.
- Wahrenburg, M. (2001): Trading system competition and market maker competition, in: *Bank for International Settlements, BIS Papers No. 7*, November 2001, 53-60
- Weber, B. (2001): Revolutionary changes in the security markets: Where is technology leading the major exchanges? Working paper.
- (2002): What holds online markets back? An examination of U.S. stockbrokers rule 11AC1-6 reports, working paper.

Summary

This paper investigates the nature of competition between stock exchanges and alternative trading systems (ATS) and concludes that unregulated competition will unlikely yield an efficient market outcome. Regulation of stock markets in the US is contrasted with the current *laissez faire* approach in Europe. It is shown that the success of alternative trading systems in the US since 1997 is closely related to regulatory changes mandated by the SEC. The paper argues

that profits made from order internalization are a key driver of ATS success. Market making firms are willing to pay for retail orders since they inhibit only a small degree of informed trading. In Germany, order internalization will be introduced with Xetra-Best in the near term future.

The likely impact of order internalization using inhouse systems on the size of equilibrium spreads is analyzed by using a stylized model of market making. Market makers use ATS to precommit to pursue a less aggressive pricing strategy in the incumbent market, by committing to buy a part of the overall order flow and committing to execute them at equilibrium prices later derived in the incumbent market. Intuitively, following aggressive pricing strategies in the incumbent market becomes less attractive because lowering the spread *ceteris paribus* leads to a smaller increase in profits due to a smaller reaction of trading volume as compared to the situation without the inhouse system. The introduction of alternative trading systems may thus have the undesired side effect of decreasing competition at the market-making level. When regulators try to intensify trading system competition by recognizing or promoting inhouse systems, they may have to trade off the efficiency gains through intensified competition at the trading system level with a decrease of competition at the market-making level.