Recent Development in the Structure of Securities Markets

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THE PAST TEN years witnessed a dramatic evolution of financial markets, as documented in the last two editions of the *Brookings-Wharton Papers on Financial Services*.[1] This paper assesses the outlook for consolidation in securities exchanges. Whereas the press continues to report news of agreements between exchanges, the track record of completed versus announced deals historically has been very poor, and the prospects for consolidation are uncertain.

Our paper is essentially empirical. We collect and analyze some novel empirical evidence on the consolidation of exchanges within the European Union (EU) and the United States in the past decade. Given the structural differences among the two systems, we analyze them separately with a particular emphasis on the European case, where many more deals have been made, presumably in response to the implementation of the European Monetary Union (EMU).

We pursue four research questions: (1) What explains the announced alliances among exchanges? (2) Why should we believe that recently announced alliances will be more successful than past deals? (3) What can be learned about the future path of the industry, given the experience

1. Litan and Santomero (1998, 1999). See also Berger, Demsetz, and Strahan (1999).

of the 1990s? (4) How can we assess the current outlook for consolidation in the United States on the basis of the European experience?

Our main findings are as follows. Deals are more often announced than implemented, with such announcements increasing in the past three years. In the European Union, the European Monetary Union may have triggered a cascade of deals as a response to the threat of more direct competition. We analyze a set of mergers and locate network effects as one of the main potential triggers to consolidation. Unfortunately, network effects seem to be relevant only after reaching a huge "customer base," in terms of listed firms and reputation (for example, the New York Stock Exchange) or by offering intermediaries remote membership, as was the case for derivatives contracts (for example, Eurex). There is space for only one or two such mega-deals, although no deal of this type has yet been observed. We argue that scale economies are very difficult to measure for exchanges but do not seem to have great relevance. This is because exchanges buy their "scale" by outsourcing technology (in at least twelve exchanges). Almost all the implemented mergers thus far have been domestic, within cash and derivatives markets. Noneconomic reasons may be driving these events, but they may also be related to some gains in X-efficiency. However, given the small absolute size of the exchange industry, these gains do not seem to be socially important.

Governance reasons may affect the consolidation process: exchanges, which are member-owned (either in cooperative or company form) and not fully electronic, have resisted the technological evolution (most notably remote membership) and integration. This may be due to the different time horizon of their members. Demutualization and privatization, which have been occurring in many countries, are thus a necessary condition for change in the industry. Nonetheless, the evidence seems to suggest that exchanges are natural cooperatives (even with a company status). This may be why large intermediaries are creating (EuroMTS) or taking over many exchanges (Tradepoint) or electronic communication networks (BrokerTec, REDIBook, E-Crossnet, and Archipelago).

Over time, exchanges have been behaving more like intermediaries, and intermediaries have been behaving more like traditional exchanges. We expect this to continue. The emergence of global leaders across the different segments of the financial services value chain will require exchanges to consolidate their reputation, their ability to innovate in financial products, and their membership. Nonetheless, we expect that many existing

exchanges will survive given their existing, though diminishing, market power due to home-country bias of investors, political reasons, and currency differences. The best solution for them should be to connect via a network. This solution, when compared with fierce competition with multiple listing, seems better for exchanges in the short term: they keep their investment, they avoid the fragmentation of liquidity, and they keep their brand and market power, especially with respect to small firms. In the long term, the network solution is equivalent to pure competition, because firms and traders will enter the network through the more efficient exchange: only a few exchanges will survive, each specialized in listing, trading, or price vending.

There are substantial similarities between the empirical evidence concerning both banks and exchanges: there seem to be no sure economies of scale, while there may be some economies of scope (because of clearing and settlement). There have been many mergers intranationally, but very few internationally in the near term.

We begin by describing a data set of about 100 deals among exchanges and classifying them by product, scope, location, legal form, and degree of integration. Next, we analyze which factors affect these deals, including location, regulation, and technology considerations. We also look at the time dimension by examining how the current consolidation movement differs from those of the past.

Then we turn to the factors that influence consolidation, including increasing cost efficiency, efforts to leverage the value of the network, possible collusion (due perhaps to risk aversion), and regulation. We also consider when consolidation is not expected to bring benefits and analyze a number of factors that may inhibit consolidation, including the level of substitutability between instruments traded on competing exchanges, barriers to entry erected by regulation, and barriers in the market for corporate control. (A more detailed analysis on this last topic is presented in appendix A). Finally, we analyze some financial data to shed light on the existence of cost economies: a typical expected benefit of consolidation. We track publicly available data on Tobin's q-ratio, looking for evidence of the time evolution of charter values, as securities markets are deregulated. We also briefly discuss the removal of barriers to consolidation.

We then analyze some cases of completed deals, discussing the impact of consolidation on X-efficiency, the impact of a common trading system on market liquidity, and governance. Finally, we pose three central

questions and draw conclusions from the analysis, offering some comments on the future shape of the industry. We argue that the future of exchanges seems to rely on reputation. Necessary but not sufficient conditions for an exchange to have a viable reputation are (1) it must have an acceptable level of regulation (either self-imposed or from a public entity); (2) it must be either a pure cooperative or a for-profit entity, perhaps listed as a public company, but not be a customer-controlled firm; (3) it must have advanced technology with direct access to institutional and final investors with long trading hours; and finally (4) it must have safe and efficient clearing and settlement. Two appendixes, related to the governance structure of exchanges and the competition from electronic communication networks, conclude the paper.

Our study is exploratory. Many issues addressed here are, to our knowledge, novel. The euro is an institutional experiment that allows us to learn much about the restructuring of exchanges. The U.S. market, by contrast, has seen the restructuring process occur more gradually, constrained by less open governance and older technology. We hope that our view will be more transparent in the discussion below, where we empirically characterize network effects by borrowing from the literature on competition between networks.[2] Our adaptation to the exchange industry is the first such attempt, and we extend the work of Pirrong to build a linkage between our approach and the discussion of competition for order flow for individual securities in work such as that of Biais and of Pagano and Roell.[3] Finally, we cast the likelihood benefits of mergers within the literature on the effects of mergers and acquisitions for financial intermediaries.[4] Here we augment this literature with the theoretical contributions on compatibility between network industries and provide empirical evidence expanding these arguments.[5]

Ten Years of Consolidation Deals in the Exchange Industry

In order to analyze the topic of consolidation in the exchange industry, we have compiled a data set including about 100 consolidation deals of

2. For example, Arthur (1989); Hagel and Armstrong (1997).
3. Pirrong (1999, 2000); Biais (1993); Pagano and Roell (1993, 1996).
4. Pilloff and Santomero (1997); Cybo-Ottone and Murgia (2000).
5. Katz and Shapiro (1985); Domowitz (1995); Di Noia (2001).

various types covering exchanges in both the European Union and the United States. Table 1 lists major events and deals in the experience of exchanges with competition and cooperation in the 1990s until September 1999, classified according to announcement dates.

We classify the consolidation deals in different categories because exchanges are part of a multiple-output industry, with different potential levels of vertical integration, technology use, location, and governance. This implies different approaches to consolidation, even between entities that look remarkably similar to one another. The classification of deals is quite difficult given the scarce details of each announcement and the lack of public pronouncements concerning implementation status. For these reasons our classification of some deals could be different from the classification used in other works or from the opinion expressed by the exchanges themselves.

The deals in our data set are between two or more entities where at least one entity is an exchange (or a clearing and settlement company), while the other could be an exchange (wherever it is located) or another entity (a technology provider, an electronic communication network, a clearinghouse or a depository, or an information vendor). We have reported these deals using four descriptive classifications: legal structure or vehicle, type of technological integration, implementation status, and geographic location involved (domestic or cross-border). However, not all deals can be classified along the four criteria.

First, deals can be classified according to the legal structure or vehicle employed:

—*Mergers*. A full integration of both entities with a merger or an acquisition of control.

—*Contracts*. The stipulation of long-term contracts for the supply of technology or any kind of collaboration.

—*Joint venture*. All types of mixed integration, using some type of common vehicle.

—*New market*. The creation of a new or different market.

—*Other deals*. A residual category, mainly for deals about clearing and settlement.

Second, deals can be classified according to the type of technological integration:

—*Outsourcing*. The outsourcing of information technology.

—*Common access*. A common access to previously separate trading platforms.

Table 1. Select Deals among Exchanges, 1990–99

Date	*Name*	*Institution 1*	*Institution 2*	*Institution 3*	*Legal*[a]	*Technical Integration*[b]	*Status*[c]	*Location*	*Areas*
1990		OM	EOE		JV	CA	D	Cross border	EU
	NORDQUOTE I	SSE, KSE, HEX, OSE			JV	CA	D	Cross border	EU
	EUROQUOTE	Various FESE Members			JV	CA	D	Cross border	EU
1991		Milan SE	CED SPA		C	OT	I	Domestic	EU
	EUROLIST	Various FESE Members			JV	CA	I	Cross border	EU
		Frankfurt SE	Other German Ex		M	CT	N	Domestic	EU
		LIFFE	LTOM		M	CT	I	Domestic	EU
		Madrid SE	Other Spanish Exchange		M	CT	N	Domestic	EU
		Milan SE	Other Regional		M	CT	I	Domestic	EU
	Swiss Exchange	Zurich SE	Other Swiss Ex		M	CT	N	Domestic	EU
1992		MTS	SIA SPA		C	OT	I	Domestic	EU
	FEX	OM	SOFFEX		JV	CA	D	Cross border	EU
		DTB	DBAG		M	CT	I	Domestic	EU
1993		DTB	MATIF		C	CA	D	Cross border	EU
	NORDQUOTE II	SSE, KSE, HEX, OSE			JV	CT	D	Cross border	EU
		CBOE	Ph SE		M	CA	D	Domestic	US
		NYCE	NYFE		M	CA	I	Domestic	US
1994		MIF	SIA/ISD(CAN)		C	OT	I	Cross border	EU
1995		LIFFE	CBOT		C	CA	D	Cross border	EU, US
		Milan SE/IDEM	OM		C	OT	I	Cross border	EU
		NOS	Oslo SE	OM	OTH	OTH		Cross border	EU
1996		EOE	ISD (CAN)		C	OT	I	Cross border	EU

		LIFFE	CME		C	CA	I	Cross border	EU, US
		COPEN SE	COP FUTOP		M	VI	I	Domestic	EU
		LIFFE	LCE		M	CT	I	Domestic	EU
		Vienna SE	OTOB		M	CT	I	Domestic	EU
	EUREX	DTB	SOFFEX		M	CT	I	Cross border	EU
		EL-EX	NORD POOL ASA		OTH	OTH	N	Cross border	EU
1997		LSE	Andersen Cons		C	OT	I	Domestic	EU
		CME	DTB		C	CA		Cross border	EU, US
		EUREX	SIMEX		C	CA	A	Cross border	EU, AS
		HEX	Computershare		C	OT	I	Cross border	EU
		LIFFE	TIFFE		C	CA	I	Cross border	EU, AS
		LISB SE	SBF		C	OT	I	Cross border	EU
		Oslo BORSE	Computershare		C	OT	I	Cross border	EU
		Oslo BORSE	SBF		C	OT	N	Cross border	EU
		Warsaw SE	SBF		C	OT	I	Cross border	EU
	EUROALLIANCE	EUREX	MATIF/MONEP		JV	CT	D	Cross border	EU
	GLOBEX	MATIF	CME		JV	CA	A	Cross border	EU, US
	AEX	Amsterdam SE	EOE		M	CT	I	Domestic	EU
	BEX	BRUXXEL SE	BELFOX	CIK	M	CT	I	Domestic	EU
	HEX	Helsinki SE	SOM		M	CT	I	Domestic	EU
		SBF	MATIF		M	CT	I	Domestic	EU
		SBF	MONEP		M	CT	I	Domestic	EU
1998		DBAG	St.Petersbourg		C	OTH	A	Cross border	EU
		EUREX	CBOT		C	CA	A	Cross border	EU, US
		Moscow SE	CBOT		C	OTH	A	Cross border	EU, US
		OTOB	OM		C	OT	I	Cross border	EU
		SBF/MATIF	CME/NYMEX		C	OTH	I	Cross border	EU, US
		SBF/MATIF	EUREX		JV	CA	I	Cross border	EU
		CBOT	CME		JV	OTH	OTH	Domestic	US
	EURONM	AEX, Paris Bourse	Neuer Markt	Bruxelles	JV	CA	I	Cross border	EU

Table 1. (*Continued*)

Date	*Name*	*Institution 1*	*Institution 2*	*Institution 3*	*Legal*[a]	*Technical Integration*[b]	*Status*[c]	*Location*	*Areas*
		Amsterdam SE	Brux SE	LUX	JV	CT	I	Cross border	EU
		Brux SE	SBF		JV	CT	N	Cross border	EU
	NOREX	Copenhagen SE	Stockholm SE		JV	CT	A	Cross border	EU
		Frankfurt	NASDAQ		JV	CA	A	Cross border	EU, US
		IPE	NORD POOL ASA		JV	CT	A	Cross border	EU
		LIFFE	DTB		JV	CT	D	Cross border	EU
		London Stock Ex	Frankfurt		JV	CT	D	Cross border	EU
		MATIF	CME	SIMEX	JV	CA	A	Cross border	EU, US-AS
	Euro Globex	MATIF/MONEP	MEFF		JV	CA	A	Cross border	EU
		SSE	Copenh SE		JV	CT	I	Cross border	EU
		SSE	HEX		JV	CT	D	Cross border	EU
		Vienna SE	DBAG		JV	CT	I	Cross border	EU
		Vienna SE	Eastern EUR EX		JV	CA	I	Cross border	EU
		Borsa Italiana	MIF		M	CT	I	Domestic	EU
		HK Futures Exch	HongKong Stock Ex		M	CT	A	Domestic	AS
		LIFFE	LCH		M	OTH	N	Domestic	EU
		NASDAQ	AMEX		M	CA	I	Domestic	US
		NASDAQ	Philadelphia Ex		M	CA	D	Domestic	US
	NYBOT	NY Cotton Ex	NY Coffee, Sugar&Cocoa Ex		M	CT	I	Domestic	US
		Pacific EX	CBOE		M	CA	A	Domestic	US
		Sidney Futures Ex	Australian SE		M	CA	A	Domestic	OC
		SIMEX	Singapore SE		M	CA	A	Domestic	AS
	OM Stockholm Exchanges	Stockholm Ex	OM Group Ag		M	CA	I	Domestic	EU
		IPE	NYMEX		M	CA	N	Cross border	EU, US

		OM Energy	Hand-El		M	CT	A	Cross border	EU
	Chicago Board Brokerage	CBOT	Prebon Yamane		NEW	CT	A	Domestic	US
	Cantor Financial Fut. Exch.	NYBOT	Cantor Fitzgerald		NEW	OTH	I	Domestic	US
1999		Cyprus SE	Computershare		C	OT	A	Cross border	EU, OC
		ParisBourse SBF	CME		C	OTH	A	Cross border	EU, US
		SwisseX	Cedel/Euroclear		C	OTH	I	Cross border	EU
		Wiener Borse	EUROCLEAR		C	OTH	A	Cross border	EU
		Borsa Italiana	MTS		JV	CA	A	Domestic	EU
	European Network	8 EU Ex: Aex, Bex, Frank., Lse, Madrid, BorsaIta, Paris, Sw			JV	CA	D	Cross border	EU
		Estonia SE	Lithuania SE	Latvia SE	JV	CA	A	Cross border	EU
		EUREX	HEX		JV	CT	A	Cross border	EU
	Energy Exchange	EUREX	NYMEX		JV	CT	A	Cross border	EU, US
		LIFFE	CME		JV	CT	A	Cross border	EU, US
		Lisbon SE	European Network	Ireland and LUX	JV	CA	A	Cross border	EU
		Lisbon SE	ParisBourse		JV	CA	A	Cross border	EU
		MIF	Euroglobex		JV	CA	A	Cross border	EU
		NASDAQ	HongKong Stock Ex		JV	OTH	A	Cross border	US, AS
		EuroNM	OM Stock, SWX, Copen., Oslo, HEX		JV	CA	A	Cross border	EU
		ParisBourse SBF	Swiss EX	Borsa Italiana	JV	CA	A	Cross border	EU
	North German Bourse	Hamburg SE	Hanover Ex		M	CT	A	Domestic	EU

Table 1. (*Continued*)

Date	*Name*	*Institution 1*	*Institution 2*	*Institution 3*	*Legal*[a]	*Technical Integration*[b]	*Status*[c]	*Location*	*Areas*
		Lisbon SE	Oporto Derivatives EX		M	CT	A	Domestic	EU
		Malaysia Futures Ex	Malaysia SE		M	CT	I	Domestic	AS
	OM Fixed Income Exchange	Swedish Bond Ex PMI AB	OM Stockholm fixed income segment		M	CT	A	Domestic	EU
		Vancouver SE	Alberta SE		M	CT	A	Domestic	CAN
	ISE Internat'l Securities Exch.	Etrade, Ameritrade	OM, Compaq		NEW	OTH	A	Cross border	US, EU
	EUROMTS	MTS	25 big banks		NEW	OTH	I	Cross border	EU
	Clearstream	CEDEL Int.	Deutsche Borse Clearing		OTH	OTH	A	Cross border	EU
		Clearstream	Sicovam		OTH	OTH	A	Cross border	EU

Source: The data set is constructed from reports and press releases of exchanges and supervision authorities, FIBV press releases, and FESE press views.
a. M = mergers; C = contracts; JV = joint ventures; NEW = new market; OTH = other deals.
b. OT = outsourcing; CA = common access; CT = unique access; OTH = other type of integration.
c. N = negotiated; A = announced; I = implemented; D = dropped.

—*Unique access*. A unique access to a single merged platform and consolidated limit order book.

—*Other type of integration*. Mainly vertical integration between a market and a clearing and settlement company.

Third, deals can be classified by implementation status:

—*Negotiated*. There are rumors of a deal.

—*Announced*. The deal is officially announced.

—*Implemented*. The deal is completely implemented.

—*Dropped*. The deal is dropped.

Finally, deals can be classified by geographic location:

—*Domestic*. Both parties in the deal are located in the same country.

—*Cross-border*. The parties in the deal are located in different countries.

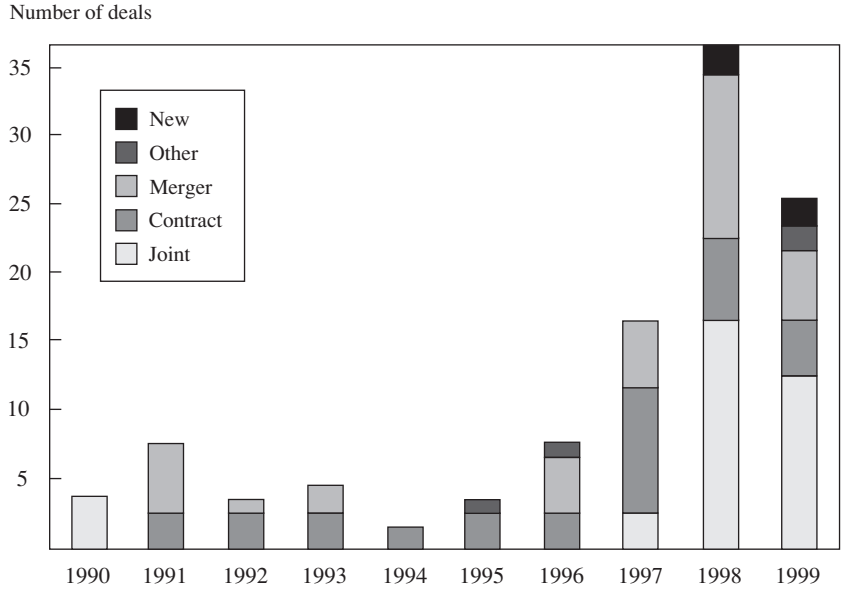
Analysis of the Deals

This section leverages our rich data set to provide a first-hand look at the type and motivation of the most frequent and important deals. Our first observation is that the total number of deals increases dramatically to a very high level by 1997–99 (figure 1).

We focus first on the EU deals—that is, transactions involving at least one EU exchange. Later, we discuss the evidence for the United States. In the mid-1990s, deals could be explained as domestic rationalization and privatization transactions, while now cross-border deals are being precipitated by the introduction of the euro. In the earlier period, cost efficiency was pursued at the domestic or financial center through full vertical and horizontal integration. In many cases, governments or shareholders privatized an exchange in order to attract talented managers better able to compete. However, it is only fairly recently that exchanges considered themselves as direct competitors. With free entry within this network-type industry, change, induced by the Investment Service Directive (ISD) and the introduction of the euro, made the national champion strategy insufficient to confront a possible price war.[6] Competition would eventually undermine the cost and scope advantage of the largest exchanges at the expense of others. Therefore, ex ante, some sort of cooperation was seen as a win-win situation for everyone. Thus a key factor

6. See Ferrarini (1998) and Steil (1996b).

Figure 1. Time Evolution of Select Deals among Exchanges, 1990–99



Source: See table 1.

for analyzing deals is to distinguish them as domestic or cross-border, as in table 2.

Legally, a full merger is defined as a transaction that leads to the creation of a new entity incorporating both entities. There have been more domestic mergers than cross-border ones. This is the strongest type of integration. Under a full merger, the new entity may suspend trading in one of the facilities, forcing all trading to migrate to the new facility. However, this destroys network externalities at the level of the individual stock. The leading example is the merger agreed by the Deutsche Börse (DB) and the Swiss Exchange in Zurich. They merged their derivatives exchanges (Deutsche Terminbörse and SOFFEX) into a single market, Eurex, launched in summer 1998. Another example is the transaction involving the Helsinki Stock Exchange and the Finnish Options Market (SOM), which signed a merger agreement in 1997 to form a new company, HEX (Helsinki Stock and Derivatives Exchange, Clearing House). Under the existing cooperation agreement between SOM and the Swedish exchange—OM Stockholm—SOM products are traded in Stockholm and

Table 2. Characteristics of Select Deals among Exchanges, 1990–99

Characteristic	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Legal vehicle										
Domestic										
Contract	0	1	1	0	0	0	0	1	0	0
Joint venture	0	0	0	0	0	0	0	0	0	1
Merger	0	5	1	0	0	0	3	5	3	3
Total	0	6	2	0	0	0	3	6	3	4
Cross-border										
Contract	0	0	0	1	1	2	2	8	5	4
Joint venture	3	1	1	1	0	0	0	2	15	10
Merger	0	0	0	0	0	0	1	0	2	0
Other	0	0	0	0	0	1	1	0	0	3
Total	0	1	1	2	1	3	4	10	22	17
Technological integration										
Domestic										
Common access	0	0	0	0	0	0	0	0	1	1
Unique access	0	5	1	0	0	0	2	5	1	3
Outsourcing	0	1	1	0	0	0	0	1	0	0
Total	0	6	2	0	0	0	3[a]	6	3[b]	4
Cross border										
Common access	3	1	1	1	0	1	1	4	8	7
Unique access	0	0	0	1	0	0	1	1	10	3
Outsourcing	0	0	0	0	1	1	1	5	1	1
Other	0	0	0	0	0	1	1	0	3	6
Total	3	1	1	2	1	3	4	10	22	17

Table 2. (*Continued*)

Characteristic	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Implementation status										
Domestic										
Negotiated	0	3	0	0	0	0	0	0	1	0
Announced	0	0	0	0	0	0	0	0	0	4
Implemented	0	3	2	0	0	0	3	6	2	0
Dropped	0	0	0	0	0	0	0	0	0	0
Cross-border										
Negotiated	0	0	0	0	0	0	1	1	2	0
Announced	0	0	0	0	0	0	0	1	7	19
Implemented	0	1	0	0	1	1	3	5	8	2
Dropped	3	0	1	2	0	1	0	1	3	1

Source: This data set is constructed from reports and press releases of exchanges and supervision authorities, FIBV press releases, and FESE press news.
a. One, vertical integration.
b. One, other.

at the market operated by OM's London-based exchange, OMLX; the products of OM are also traded in Finland.[7] This type of transaction can also happen via a takeover or through the buying of shares on the market: for example, the Paris Bourse, which controlled 23 percent of the Matif Futures Exchange, launched a takeover in September 1997; OM, which held part ownership of the Stockholm Stock Exchange after its privatization, tried to increase its own shareholding and, after some time, finally merged with the Stockholm Stock Exchange. The leading U.S. example of this type of transaction is the purchase of the American Stock Exchange (AMEX), making it a subsidiary of Nasdaq (National Association of Securities Dealers Automated Quotation system).

Mergers are of different types. At the beginning of the 1990s, regional stock exchanges were integrated into a national one (France and Italy), with the formal survival of the local exchanges (Germany) eventually connected by a common trading platform (Spain). This event did not happen for derivatives exchanges, which were born much later and thus were not at the regional level but directly at a national one. Many of the recent deals are mergers between cash and derivatives markets (Austria, Belgium, Denmark, Finland, France, Italy, and Netherlands), a phenomenon also witnessed in other countries (completed in Hong Kong and Singapore and attempted in Australia). A complete horizontal (cash and derivatives markets) and vertical (exchanges, clearinghouse, and central depository) integration has been achieved in some locations, for example, by Deutsche Börse, Amsterdam Exchanges, Brussels Exchanges, and the Helsinki Exchanges. Political reasons often form part of the rationale for such transactions, as do the exploitation of economies of scope and cross-subsidies from the interested depositories. These reasons can be illustrated in some European countries where public committees, at times headed by Treasury representatives, try to support the competitive position of their national exchange. Two good examples are the Paris Europlace in France or the Comitato per la Piazza Finanziaria in Italy. Many of these domestic mergers lead to a common trading platform, trying to exploit economies of scope. By contrast, one never observes such integration (cash and derivatives) in cross-border transactions.

7. International Federation of Stock Exchanges press release, July 1997.

The cross-border deals are mainly contracts and joint ventures. Deals organized as long-term contracts consist generally of the outsourcing of technology. Under a technology agreement an exchange purchases technology from another party (an exchange or a software house). For the purchaser, this is an outsourcing transaction; for the seller, if an exchange, it is a diversification of income. In some instances one observes swaps rather than the outright sale of technology. We were able to track at least fifteen completed contracts where an exchange outsourced the trading platform to a third party. One-third of all the existing European exchanges have been involved in such transactions. The market leaders in selling outsourcing capability were OM (five deals) and Société de Bourse Français (SBF, three deals). Actually, SBF launched its system in 1995 and since then sold it to more than fifteen cash and derivatives exchanges worldwide, including Brussels, Lisbon, Toronto, Chicago Mercantile Exchange, São Paulo, Singapore, Tunis, Casablanca, and Beirut.[8] Among the nonexchanges, the leader in selling technology is Computershare (three deals), the Australian company trying to take over the Sydney Futures Exchange.

In any case, the most important deal is probably Eurex, one of the very few cross-border mergers. In fact, most cross-border deals do not lead to a formal merger, but rather to common access or a common trading platform. In the case of common access, national exchanges try to sign deals to centralize remote access in order to avoid having all their members individually become remote members of other exchanges. This is true in spite of the fact that the largest institutions have access to all of the most important markets. For example, the MIF-Matif (Mercato Italiano dei Futures–Paris Futures Exchange) alliance is simply a cross–remote membership of some of the members of one market in the other. When offering remote membership, an exchange gives access by means of an electronic circuit; in this way, investment firms can trade on the exchange even if they are not located there. Remote membership is a feature of the European regulation of ISD, but many exchanges also offer it to non-European residents. The Stockholm Exchange was one of the first exchanges to offer remote membership, and many other exchanges followed. Tradepoint has followed a more complete strategy, offering remote access to U.S. investment firms, even though it is exempted from registration as a national exchange in the United States.

8. Federation of European Stock Exchanges Newsletter 86 (July 1999): 13.

The next step is a common trading platform, which may increase network effects by increasing the number of members of the same trading system (again, Eurex is an example, as is Norex). This leads to an implicit merger.[9] This is an agreement between two or more exchanges to give reciprocal access to all of their respective brokers under a compatible platform and, possibly, cross-listing of stocks on both networks. In the case of derivatives exchanges, cross-listing could be replaced by mutual trading of reciprocal contracts or by the development of new common contracts. A sort of implicit merger was the first part of the agreement of 1998 between the London Stock Exchange (LSE) and the DB, which in the end should have developed into a full merger. Intermediaries in LSE and DB would have had access to the other exchange, and the top 100 LSE shares and top 50 DB shares would have been cross-listed.

There have been no dropped deals for domestic transactions, confirming the fact that these may be guided by reasons other than economics and thus may be achieved in an environment where most continental countries' exchanges are monopolist. By contrast, dropped deals are common among cross-border transactions. The number of dropped deals varies over time, but the ratio of failed agreements over total cross-border deals is 80 percent in the period 1990–93 and 8 percent in the period 1994–98, even if many announced deals are still open.

Many agreements between exchanges have a limited time span and are reversed, often because they did not reach the planned objectives, such as volume targets. Some deals failed in the 1980s as well. Inter-Bourse Data Interchange System (IDIS), an information exchange system among various members of the Federation of European Stock Exchanges, was planned in February 1984 but was dropped before it started. Euroquote, a joint venture based in Brussels among LSE, Frankfurt, SBF, and others, consisted of a price and quote information system, developed in 1990, but dissolved in July 1991. Eurolist, a multiple listing system created in 1991, has not had great success. The two attempts of Nordquote (among the exchanges of Stockholm, Oslo, Copenhagen, and Helsinki) in 1990 and 1993 were both suspended.[10] The two major agreements of the 1990s are still debated: the LSE–Deutsche Börse and Chicago Board of Trade (CBOT)–Eurex.

9. This definition has been used by Domowitz (1995), for derivatives markets, and by Di Noia (2001), for equity markets.

10. Licht (1998) describes the reasons of the failure of IDIS, Eurolist, Euroquote, and Nordquote. According to Arlman (1999), Euroquote failed mainly because of the diversity

U.S. deals have different characteristics, as shown in table 3, which contains both domestic deals and some of the cross-border deals already shown in table 1. The majority of the latest deals are cross-border, while many merger deals were attempted in the past. A critical obstacle to many deals or restructuring attempts is the nonelectronic nature of many member-owned exchanges in the United States. In addition, mergers like the AMEX–Nasdaq transaction do not lead to common trading systems, given that the merging markets have a different focus and structure. The case of Cantor Financial Futures Exchange is interesting by contrast, because it is fully electronic and thus follows the same strategy as Eurex and Tradepoint abroad, trying to offer remote access in some European countries.

As the deals show, the dramatic transformation of the exchange industry seems to be producing mixed evidence across the different topics: competition, alliances, governance, and regulation. On the one side, especially but not only in Europe, there has been a wave of exchange privatizations, increased competition, greater dependence on alliances, and deregulation. The transformation of the financial industry led to automated exchanges in many European exchanges at the beginning of the 1990s and competition among exchanges, such as London Stock Exchange versus European continental exchanges or London International Financial Futures and Options Exchange (LIFFE) versus Deutsche Terminbörse (DTB). Reforms of regulation have led many countries to privatize or demutualize (Sweden, the Netherlands, France, Italy) and to list exchanges (Australian Stock Exchange and Tradepoint). They have given exchanges self-regulatory powers because it seems that the public supervisory authorities were seen as obstacles to competition and to the development of financial innovations, such as cross-country membership and on-line trading. The model here has been the Anglo-Saxon world: in the United States, markets are historically private entities and member-owned exchanges (but generally closed to new entrants); in the United Kingdom, the Securities and Investments Board had only very general powers, while the powerful self-regulatory organizations and the exchanges themselves were the true rule makers.

Besides mergers, alliances among exchanges have been announced, which lead to unified and powerful markets (Eurolist or, especially, the LSE–DB alliance). There also has been a strong development of proprietary

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of trading systems and of Eurolist as well as because it was felt that it could split liquidity by fragmenting trading.

Table 3. Select Deals of U.S. Exchanges, 1990–99

Date	*Name*	*Institution 1*	*Institution 2*	*Institution 3*	*Legal*[a]	*Technical Integration*[b]	*Status*[c]	*Location*	*Areas*
1993		CBOE	PhSE		M	CA	D	Domestic	US
		NYCE	NYFE		M	CA	I	Domestic	US
		LIFFE	CBOT		C	CA	D	Cross border	EU, US
1996		LIFFE	CME		C	CA	I	Cross border	EU, US
1997		CME	DTB		C	CA	A	Cross border	EU, US
	GLOBEX	MATIF	CME		JV	CA	A	Cross border	EU, US
1998		CBOT	CME		JV	OTH	A	Domestic	US
		NASDAQ	AMEX		M	CA	I	Domestic	US
		NASDAQ	Philadelphia Ex		M	CA	D	Domestic	US
	NYBOT	NY Cotton Ex	NY Coffee, Sugar&Cocoa Ex		M	CT	I	Domestic	US
		Pacific EX	CBOE		M	CA	A	Domestic	US
	Chicago Board Brokerage	CBOT	Prebon Yamane		NEW	CT	A	Domestic	US
	Cantor Financial Futures Exch.	NYBOT	Cantor Fitzgerald		NEW	OTH	I	Domestic	US
		EUREX	CBOT		C	CA	A	Cross border	EU, US
		Moscow SE	CBOT		C	OTH	A	Cross border	EU, US
		SBF/MATIF	CME/NYMEX		C	OTH	I	Cross border	EU, US
		Frankfurt	NASDAQ		JV	CA	A	Cross border	EU, US
		MATIF	CME	SIMEX	JV	CA	A	Cross border	EU, US-AS
		IPE	NYMEX		M	CA	N	Cross border	EU, US
1999		ParisBourse SBF	CME		C	OTH	A	Cross border	EU, US
	Energy Exchange	EUREX	NYMEX		JV	CT	A	Cross border	EU, US
		LIFFE	CME		JV	CT	A	Cross border	EU, US
		NASDAQ	HongKong Stock Ex		JV	OTH	A	Cross border	US, AS
	ISE International Securities Exch.	Etrade, Ameritrade	OM, Compaq		NEW	OTH	A	Cross border	US, EU

Source: The data set is constructed from reports and press releases of exchanges and supervision authorities, FIBV press releases, and FESE press views.

a. M = mergers; C = contracts; JV = joint ventures; NEW = new market; OTH = other deals.

b. OT = outsourcing; CA = common access; CT = unique access; OTH = other type of integration.

c. N = negotiated; A = announced; I = implemented; D = dropped.

trading systems, whose main difference from a regulated exchange is the governance structure and regulation: they are for-profit companies (Tradepoint, Instinet) whose owners are, in general, not the traders using the systems; they are not regulated as exchanges but either they are exempted (Arizona Stock Exchange) or regulated as broker-dealers (Cantor-Fitzgerald, Instinet, Posit) or they are not regulated at all given their ambiguous nature (Reuters). This regulatory competition has been an important factor in the industry, leading even some regulated exchanges to choose this regulatory arbitrage and to create a subsidiary to behave formally as broker-dealer while doing exchange activity. An example is Mercato Telematico dei Titoli di Stato (MTS), Italy's regulated government bond market, which created Euro MTS, a pan-European bond market, regulated in the United Kingdom as a broker-dealer.

In more recent months, we have experienced pressure in the opposite direction surrounding mutualization, regulation, and alliances. The plans of U.S. exchanges to transform themselves into for-profit companies and even "list themselves on themselves" did not meet the self-imposed deadline. The self-regulatory model too is in crisis. The self-regulatory organizations in the United Kingdom are being merged into the new public Financial Services Authority. In the United States, the Securities and Exchange Commission (SEC) is studying a plan to have a single regulator of exchanges. Plans for a unified exchange between London and Frankfurt also were abandoned in favor of a virtual cross-border market among the eight major European exchanges. U.S. electronic communication networks have signed a letter of intent to share price information and other market data and are asking to be regulated as exchanges.[11] Intermediaries, tired of the exchanges' delays in transforming themselves, either are forming new mutual companies that are not very different from the old member-based exchanges (except for their legal status) or are investing in existing electronic communication networks or taking over existing exchanges. (See the Tradepoint example, where leading banks are taking stakes.) In the end, this may lead to the return of old monopolist exchanges, because the fear of fragmentation of trading could lead firms to integrate the different exchanges and trading systems into a unique

11. Edward Wyatt, "After-Hours Traders Sign Deal to Share Data," *International Herald Tribune,* September 17, 1999, p. 16. For example, Island, Eclipses, Archipelago, and Wit Capital asked, in 1999, for recognition as exchanges, thanks also to the new "Regulation of Alternative Trading Systems" issued by the SEC.

national information system, like the one sketched recently by the chairman of the SEC.[12]

Factors Affected by Consolidation of Exchanges: An Analysis of Cases and "Synthetic" Mergers

Economic theory predicts that consolidation will affect a number of factors. In generic industries, mergers have two types of effects, an efficiency-enhancing one and a potential collusion feature. In network industries like exchanges, the increase in efficiency comes both from the supply side through economies of scale and from the demand side through network effects. However, what we call an exchange is not a homogeneous concept. In fact, there are different types of exchanges (for example, cash, derivatives, bonds, stocks, goods) that do not perform all of the same activities of listing, trading, pricing, selling, clearing, settlement, and central custody.

A second consideration is that the different services performed as part of the transaction are part of a complete economic service. Listing, trading, clearing, settlement, and central custody are different parts of a single value chain, and thus it is possible to perform vertical integration (for example, trading and clearing) as well as horizontal integration (for example, cash and derivatives).

However, the demand for exchange services does not exclude the possibility that order flow can be directed to another exchange: for example, a firm may be listed on different exchanges at the same time. Finally, a firm may choose to be listed only on one exchange but cannot avoid being traded on other exchanges or trading systems.[13]

Improvement in Cost Efficiency

Improvements in cost efficiency in the exchange industry may stem from the existence of economies of scale by optimizing the use of a fixed-cost network; in addition, the availability of capital to invest in new technology

12. Arthur Levitt, chairman of the Securities and Exchange Commission, "Dynamic Markets, Timeless Principles," speech at Columbia Law School, New York, September 23, 1999.

13. Amihud and Mendelson (1996).

or a new network may be justified more easily after a merger. If two exchanges produce a homogeneous output and there are economies of scale, then a merger will move the exchange closer to the optimal size. If the products are not perfectly substitutable, however, cost savings may come at the expense of some product quality. The problem with scale economies here is that they are difficult to measure for exchanges given the particular nature of the service produced. It is easier to find scale economies in parts of the services, like clearing or, especially, central custodian.

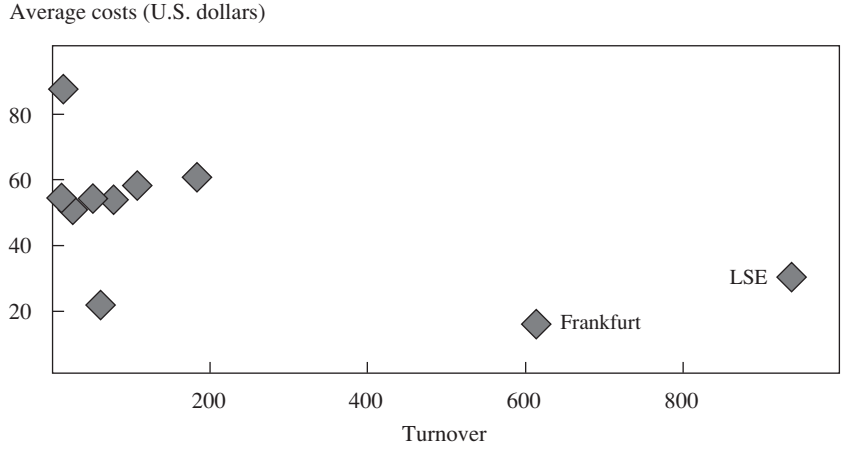
However, vertical integration may enjoy economies of scope as well in the complete product chain. Horizontal integration, for example, between futures and stock exchanges may rely on the existence of economies of scope. In addition, this is one way to cut costs and offer one-stop service at the country level, rather than at the product level. Common facilities may cut costs and enhance service as well. For example, one may discount remote access to a foreign player by giving full access to all the products of the financial center. However, the size of these gains is not clear.

We look for some evidence of the likely impact of consolidation from a sample of EU exchanges. Our sample is taken from the first half of the 1990s, when the process of consolidation had just begun. Malkamaki analyzed balance sheet data of thirty-seven exchanges for the year 1997 and found mixed evidence.[14] Overall, scale economies existed only for very large exchanges; there were no apparent synergies between listing and trading.

However, the measures of economies of scale and scope are very controversial in the case of exchanges because it is difficult to determine the inputs and the outputs. This is why we prefer to show only some descriptive data taken from a sample of balance sheets of eleven European stock exchanges in a clean period (1993–94), before the new wave of deals. Exchanges do not seem to show economies of scale with respect to their turnover, which is one approximate measure of an output (figure 2). Only the two biggest exchanges (LSE and Frankfurt) have a different cost scale that may lead to savings in costs, while the other exchanges are all at the same approximate level. However, there seems to be variation in the level of efficiency as seen by the variance of the ratio of total costs to total revenues (figure 3). In short, there appears to be considerable evidence of

14. Malkamaki (1999).

Figure 2. Economies of Scale among Exchanges



Source: See table 1.

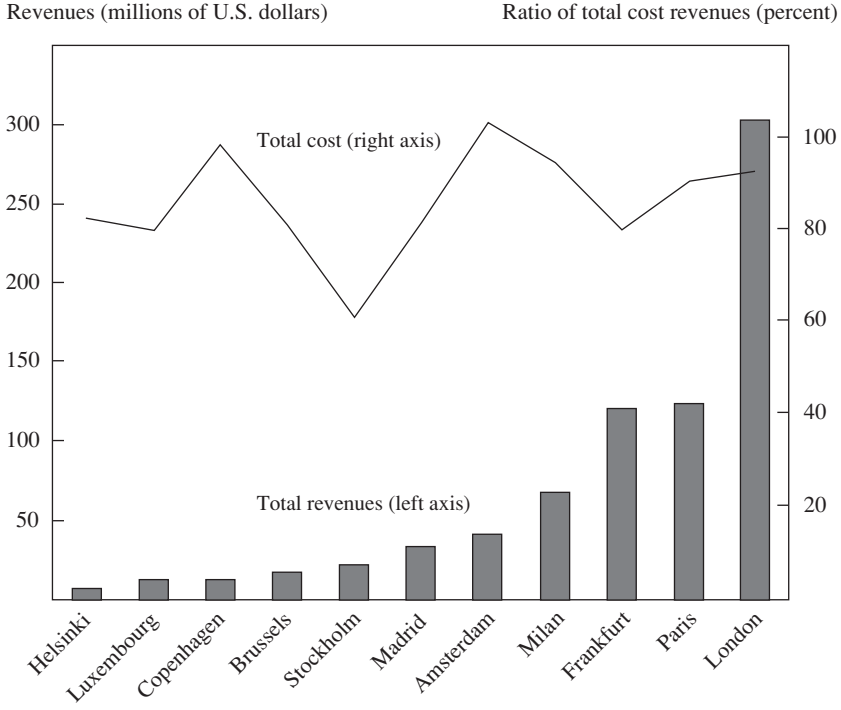
X-efficiency across the sample, which could lead to potential efficiency, even if the cooperative nature of those exchanges in that period makes the values of revenues not relevant. In fact, cooperatives only cover costs and, if necessary, give rebates on fees.

Evidence from the Time Evolution of the Network

The removal of barriers to entry would make cooperation more attractive to stock exchanges and certainly benefit their users, given the network nature of exchanges. In fact, exchanges can be considered as networks in which the greater the number of customers, the higher the utility for everyone.[15] All else being equal, firms want to be listed where other firms are listed (the direct-network effect) and especially where many intermediaries trade (the cross-network effect).[16] More liquidity exists in the market as the number of each type of participant increases. Intermediaries want to be present at the exchanges where more firms and intermediaries are present, as it is more attractive to their final customers (investors) and to their own portfolios and risk management. Arthur as

15. Economides (1993, 1995).
16. Di Noia (2001).

Figure 3. Cost Efficiencies of Eleven European Stock Exchanges, 1993–94



Source: See table 1.

well as Hagel and Armstrong claim that businesses characterized by network effects start with very low value, but grow exponentially after reaching critical mass.[17] Saloner and Shepard provide an interesting empirical analysis of these hypotheses for banks' adoption of automated teller machines.[18] All this implies that one should look at the time evolution of network scope.

In order to evaluate the competitive position of an exchange, with respect to trading and listing services, there are common measures. For trading, it is common to look at exchange liquidity in terms of the volume traded. However, this measure may be biased by regulation (the concentration principle), by home-country bias (which may disappear in the long term),

17. Arthur (1989); Hagel and Armstrong (1997).
18. Saloner and Shepard (1995).

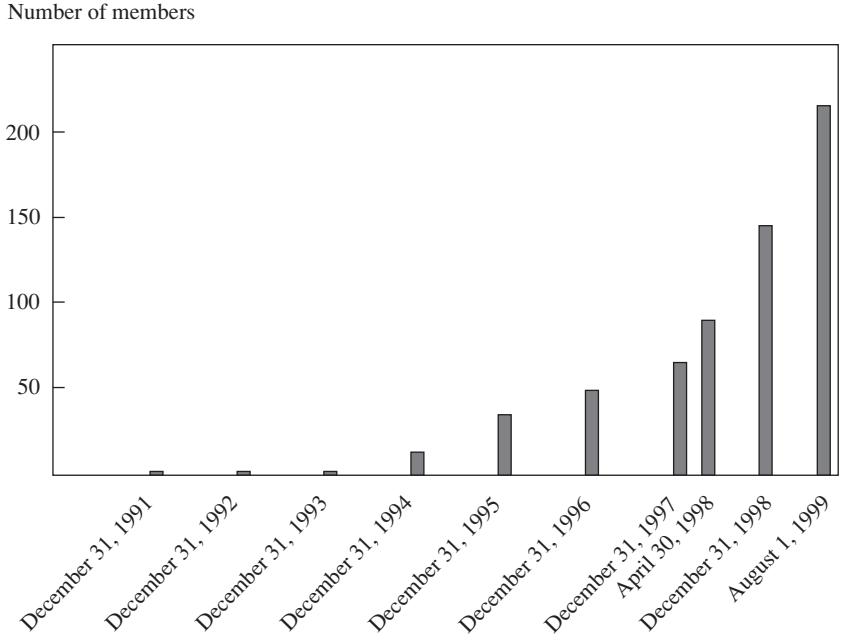
or by the fact that liquidity is a variable that exchanges cannot control when the providers of liquidity (banks and brokers) are becoming competitors. Nonetheless, liquidity is often measured by the number of listed companies, which depends on the relative industrial structure of firms (a multidivisional firm can only list once, while a firm structured as a holding company can be listed many times). The other common indicator is the total market value of an exchange, possibly scaled by the gross domestic product (GDP). Apart from the influence of GDP, the main problem with this measure is that if a firm goes public for only 10 percent of its capital, it may count its total capitalization and not its floating capitalization as part of its market value.[19]

We looked for better indicators to identify the true and "clean" output of an exchange. Two come immediately to mind. The first indicator is the number of brokers trading on the network. One indicator of network scope is the number of participants. However, this is a noisy indicator because inefficient markets tend to have "too many" national brokers, at least in the short run. A better indicator is the number of foreign brokers or the number of brokers requiring remote access. For instance, in the case of DTB–Eurex, we observe an exponential increase in the number of remote trading terminals in recent years (see figure 4). This is not true, for example, in the Stockholm case where, although this exchange was the first to offer remote membership, no network effect can be observed—market share of the remote members did not increase significantly from 1994 to 1997.

The number of traders is generally fixed in member-owned exchanges where, in fact, there exists a market for the seats. A proxy of the network effect here might be the price of a seat: an exponential growth may mean a growing network effect. This is what we find for the New York Stock Exchange (NYSE), where the seat price has been rising since 1990, despite the possibility of demutualization, which should decrease the interest in a long-term investment (figure 5). We offer different evidence from the time evolution of seat prices of European exchanges and other U.S. exchanges: the value of a seat on the LIFFE, which was the market leader in the first half of the 1990s, rose and fell, while the seat value on the International Petroleum Exchange remained at the same level throughout the decade (figure 6). By contrast, AMEX seat prices rose, in particular after the Nasdaq merger. Chicago Mercantile Exchange prices,

19. This was particularly relevant for many privatizations in Europe that boosted the national stock market without really increasing potential liquidity.

Figure 4. Remote Members of Deutsche Terminbörse and Eurex, 1990–99



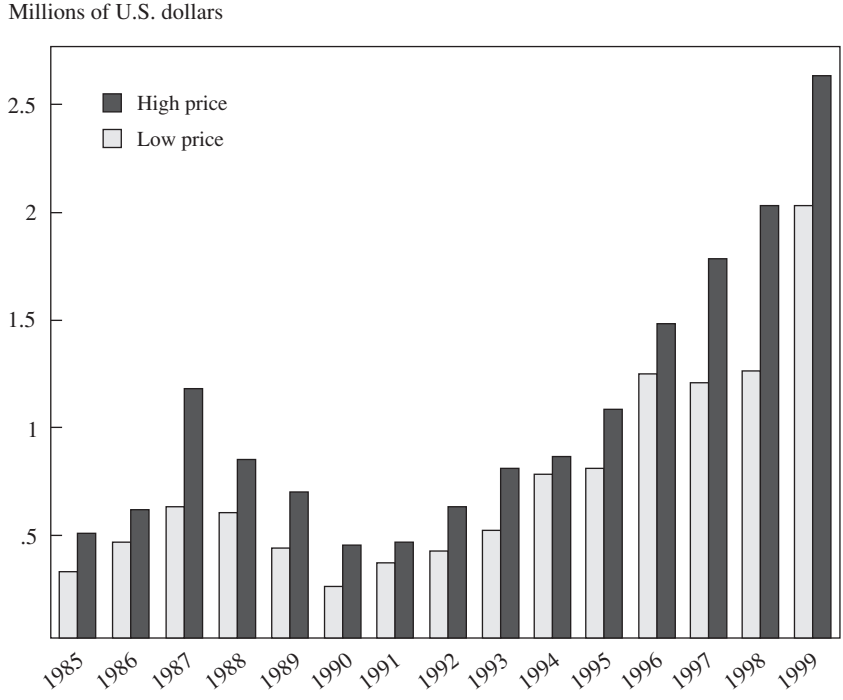
Source: See table 1.

after a rise in the mid-1990s, are now at the same level as they were at the beginning of the decade, and Chicago Board of Trade prices, after a crash in 1998, are rising again due to Eurex talks (figure 7).

The second indicator is the number of listed companies. If there is a network effect, the exchanges that exceed a certain critical mass should grow more than small exchanges—a large exchange should grow exponentially in new additions to listings. The interpolating curve of the total number of listings again should be an exponential function.[20] In figure 8 we present such a case, where the time evolution of foreign companies listed on the NYSE shows a typical network pattern, illustrating NYSE's

20. Other approaches are possible. If two exchanges compete for order flow, and one is more efficient but still the latter gains much of market share, we may infer that lock-in exists. A related indicator is the market share of dually traded stocks or differential revenues between exchanges. Another version of the lock-in hypothesis is that the incumbent exchange commands higher revenues than the competitor.

Figure 5. Seat Prices on the New York Stock Exchange, 1985–99



Source: NYSE Newsletter, *The Exchange,* vol. 6, no. 4 (April) 1999. p. 7

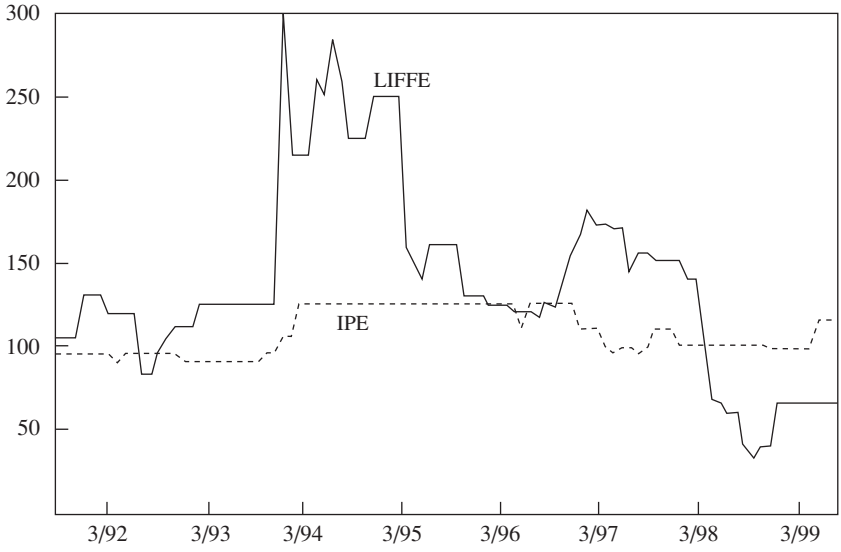
strong reputation. On the contrary, the LSE does not show this at all (figure 9). This seems to demonstrate that in the 1980s LSE, instead of focusing on competition for trading, which does not necessarily depend on exchange factors, should have focused on competition for listings.

These dimensions of exchange competition (trading, listing, and, possibly, price dissemination fees) are confirmed as key drivers of revenue for all exchanges. However, their relative value varies across exchanges. For example, the revenues of exchanges belonging to the International Federation of Stock Exchanges are reported in table 4, which breaks down revenue from three major sources: listing fees, trading fees, and services.[21]

21. International Federation of Stock Exchanges (1999). Malkamaki (1999), p. 9, analyzing some exchanges' balance sheets, shows that the two functions of exchanges are trading (as they have computers, software, and personnel for matching and processing

Figure 6. Time Series of Seat Prices on London International Financial Futures Exchange and International Petroleum Exchange, 1991–99

Seat prices in thousands of pounds



Source: Datastream.

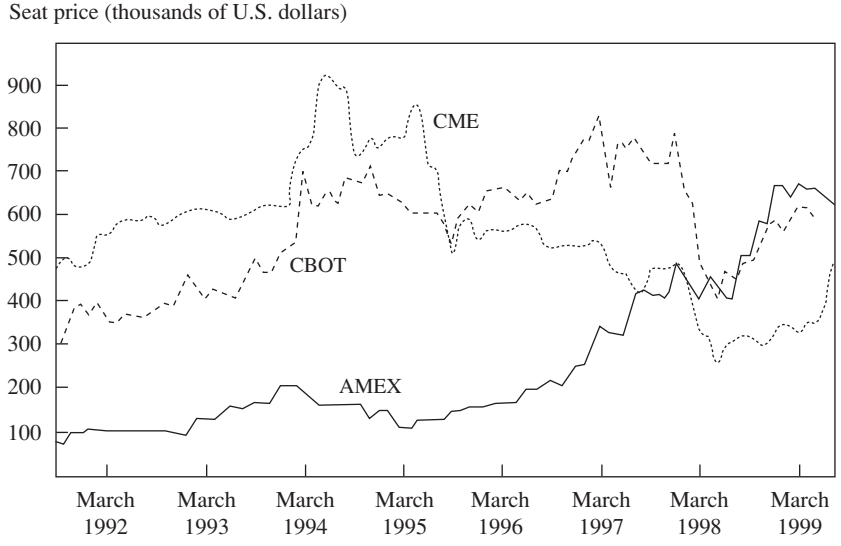
Generally, listing and trading fees are both initial and annual, while service fees include fees for clearing and settlement procedures, depository and computer services, membership, and market data dissemination. The "other" category consists of proceeds from financial investments, systems sales and assistance to other markets, fines, and rental of building and facilities.[22]

These revenues do not define either the "economic good" or "the good sold by the exchange," but they do illustrate that an exchange sells trading services that are structured in three parts: the traded object (issued by some

trades) and handling of complex information (which involves the personnel and regulation needed to maintain the marketplace and communicate with companies).

22. One problem, not solvable with available public data, is to understand how the costs are allocated. In fact, not all the costs contribute directly to the production of the three main "goods" sold. There are the costs for the regulation and supervision of the market that make it more efficient, and thus more attractive, for issuers and intermediaries to enter. There are R&D costs and marketing costs, and there could be an implicit cost in charging low or zero fees to traders and issuers.

Figure 7. Seat Prices on the American Exchange, Chicago Board of Trade, and Chicago Mercantile Exchange, 1991–99



Source: Datastream.

entities that generally pay a fee to have it listed—in the case of derivatives, the issuer is the exchange itself), the means of trading (trading facilities, computers, a computerized floor, settlement), and price dissemination. However, there is currently ambiguity as to how each of these component parts should be priced.

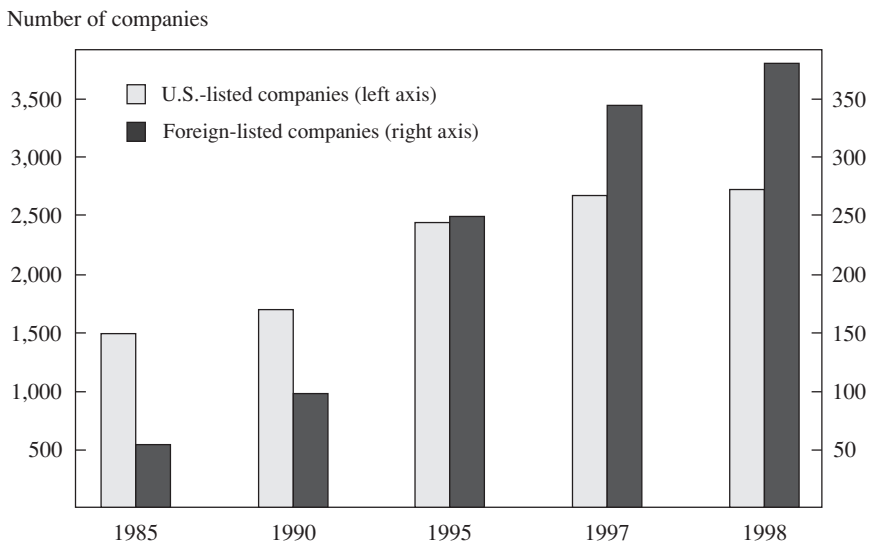
Exchanges have a trade-off surrounding listing fees. Should listed companies have to pay? They receive a service from the exchange, and the exchange has some cost in listing companies. Or should the exchange pay the companies to be listed? Having company stocks that can be traded is a necessary condition for selling, trading, and price dissemination services.

Exchanges have a similar trade-off in fixing the prices for trading services: to pay or be paid by traders (and at what level)? It is probable that the cost for trading services that are borne by the exchange is greater than the listing costs, but the question remains.

Similar issues arise around price dissemination: to be paid or give the service away to all interested parties for free?

The answer to these questions depends on the competitive position of the exchange, and the competitive posture of various exchanges varies

Figure 8. U.S.-listed and Foreign-listed Companies on the New York Stock Exchange, 1985–99



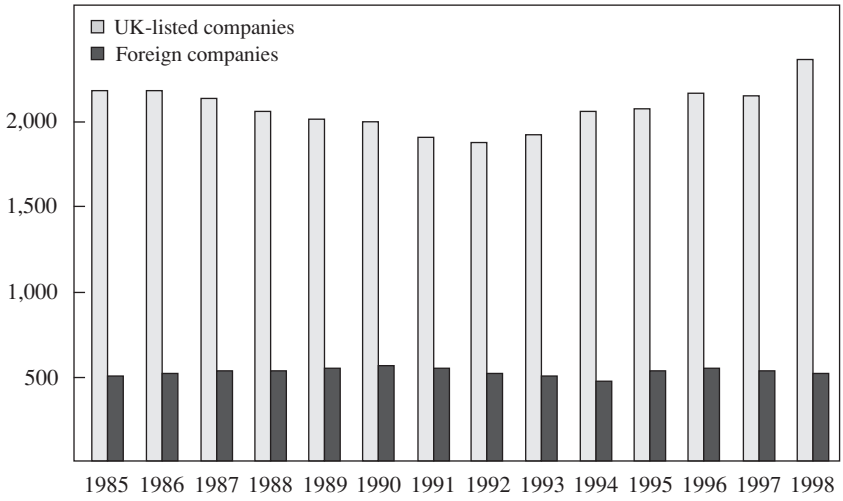
Source: See table 1.

substantially. On the listing side, in general, an exchange with a powerful network will try to exploit it through positive (and high) listing fees, while a weak exchange, or a new entrant, will try to attract issuers with low (or negative) fees. In the case of dual listing, the issuer has to bear other regulatory costs (maybe the public offer abroad or a second prospectus). A third option is to trade directly without listing, and this is what happened for SEAQ (Stock Exchange Automated Quotation) International and Tradepoint.

On the trading side, apart from governance problems, it is difficult to believe that the transaction fees can go to zero, but it is possible that new exchanges, which need to build up a network, may wish to offer the connection costs to the exchange without charge. (Eurex, for example, used this price structure.) In fact, remote trading is an area where exchanges do compete for the same customers: large international intermediaries. These customers are usually very demanding and at the same time are not important in exchange governance. This will bring pressure to reduce fees strictly for their network externalities.

Figure 9. UK-listed and Foreign-listed Companies on the London Stock Exchange, 1985–98

Number of companies



Source: See table 1.

The story of price dissemination depends strongly on what public regulation may impose (for example, free access to prices or maybe a national market system with rewards to a single exchange).

These considerations are confirmed by a more detailed analysis of the composition of revenues from eight European stock exchanges, averaging those of 1993–94 (figure 10). The Luxembourg exchange received nearly all of its fees from listing: all banks and industrial firms list their bonds in Luxembourg given the speed of listing procedures and the relative low

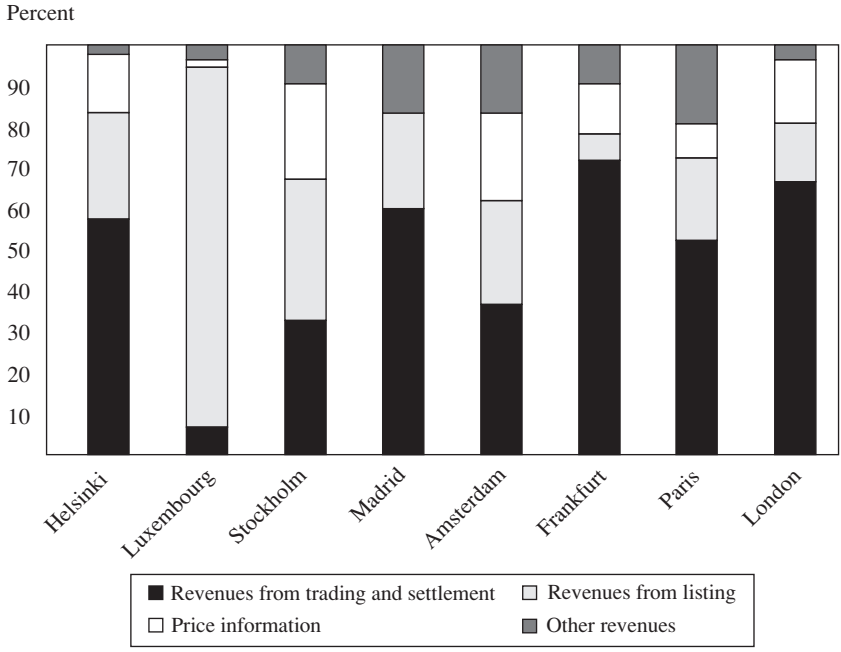
Table 4. Exchange Revenues of the International Federation of Stock Exchanges, 1998

Percent

Type of revenue	*European stock exchanges*	*North American stock exchanges*
Listing fees	19.3	32.1
Trading fees	45.1	39.7
Services	24.4	22.6
Other	11.2	5.7

Source: FIBV (1999).

Figure 10. Composition of Revenues of Eight European Stock Exchanges, 1993–94



Source: See table 1.

requisites. Then, as the Luxembourg exchange is in the list of regulated markets according to the ISD, the securities have advantageous regulation even if they are often really traded over-the-counter. No other exchange has focused on the listing network as the major source of income from fees.

Removal of Barriers to Consolidation

A number of factors may inhibit potential consolidation, such as country factors, the level of substitutability between instruments traded on competing exchanges, barriers to entry erected by regulation, lock-in effects and, in particular, barriers in the market for corporate control.

Much has been said about the impact of the EMU on consolidation of the EU financial services industry. The most intriguing problem is the battle between stock index futures within the EU area. At the moment, despite the creation of some pan-European indexes that are used as benchmarks by

investment managers, stock index trading remains confined to country indexes. Country factors could be more, rather than less, important in explaining resistance to consolidation. Economic policy, the major factor driving securities trading, is not centralized, in spite of the fact that monetary policy is centralized in the European Central Bank (ECB), because fiscal policy remains domestic within the EU budgetary constraints. In fact, the institution of the euro could direct more trading toward local exchanges than before, given the absence of currency differences. In addition, a strong home-country bias still exists as well as many regulatory and, especially, fiscal differences, all of which helps to keep trading at local exchanges.[23]

In many countries regulation plays a key role in the consolidation of the financial industry. The situation is different in Europe and the United States. In many European countries where the exchanges were formerly public entities, there is still some protectionism with respect to foreign competition. ISD eliminated the barriers to remote membership, but existing regulations do not allow automatic remote membership for non-EU exchanges. The placing of remote terminals is often subordinated to an agreement among the national authorities, which may take time to achieve: the same applies to the United States (see the Tradepoint and Eurex example). Other problems may rise from the different definitions of an exchange and regulated markets in each jurisdiction: entities that are broker-dealers in one country may be considered exchanges in others. Another barrier is the eventual presence of concentration rules, like those existing in some European countries (Italy, Spain) and Rule 390 for NYSE. Finally, membership in a national exchange by foreign entities is often restricted, with some regulations allowing the membership only to broker-dealers but not to institutional investors or private individuals.

So What?

These numbers, though preliminary and not necessarily robust statistically, may help us to forecast the evolution of the structure of the industry.

Scale economies may be relevant only for a merger, or implicit merger, of large-scale entities, as between Frankfurt and LSE. Otherwise, it may prove to be irrelevant for other European exchanges.

23. For example, Italy adopted the dual corporate tax system, which provides three-year fiscal incentives for new listings only on the Italian Stock Exchange. This tax incentive is currently challenged by the European Union.

Network effects may be relevant, but only for very big exchanges (super-network effects), again possibly between Frankfurt (stronger on the trading side) and LSE (stronger on the listing side, but behind the NYSE). A possible network effect could be relevant for a merger between NYSE (with a strong reputation for listing) and some electronic communication networks. Order flow seems to attract order flow, but more at the level of an individual stock than globally, which is why listing supremacy remains relevant.

Analysis of Selected Completed Deals

Within the large number of deals representing a complete list of full horizontal and vertical integration in the chain of listing and trading services, we selected two of the most noteworthy: the integration of the Frankfurt exchanges within Deutsche Börse (DB) and the integration of the Amsterdam Stock Exchange and the derivatives exchange within Amsterdam Exchanges. The two deals are remarkably similar, except for the governance features: DB maintained its cooperative status, with an increased role of universal banks versus locals; Amsterdam Exchanges demutualized and indemnified locals, the most important members of European Options Exchange (EOE).

DB (in 1993) was the first EU exchange to pursue complete integration of trading in stocks and derivatives, including clearing and settlement and central shares depositories. The transaction was a consequence of a change in management and strategy in 1993. The attempt to merge the eight regional German exchanges—the former chief executive officer mission—was replaced by a stand-alone strategy by the stock exchange. This was supplemented by a productivity enhancement program, between 1992 and 1995, leading to a reduction in unit costs of two-thirds, an increase in productivity of 32 percent, and a reduction of DM 300 million from price cuts and reimbursement to exchange members. Alliances formed by DB are examined in other parts of the paper.

Amsterdam Exchanges is the result of the merger on January 1, 1997, between the Amsterdam Stock Exchange, EOE–Optiebeurs (the derivatives exchange), the settlement operations of these exchanges, and the depositories Necigef and Niec. The available data show pro forma balance sheets for 1994–96 and true balance sheets for 1997–98. There were

no apparent economies of scale on the labor side, as the staff costs and staff cost per employee kept increasing. However, total revenues tripled (from 67.9 million euros in 1994 to 200.3 million euros in 1998); revenues per employee increased 250 percent; and the ratio of total operating expenses over income decreased in five years from 91 to 61 percent. The competitive position of Amsterdam seems less positive than the data show, however. In particular, the big increase in total revenues was due not to the equity market, where listing fees declined even though turnover more than doubled, but rather mainly to fees and commissions from options and futures, which increased from 38.5 million euros to 90.1 million euros.[24] This is a result of the strong competitive position of the derivatives market, which, in terms of trading in individual stock options, is the biggest in Europe and the fourth largest in the world, while it places only eighth for equities.

Carey has studied the impact of the merger between the Stockholm and Copenhagen Stock Exchanges, which was announced on January 21, 1998, and was implemented in the spring of 1999.[25] This is the most striking example of a true integration of trading systems on a cross-border basis. The two exchanges formed a common service platform, called Nordic Exchanges (Norex), in which each member had a stake of 50 percent. An event study looking at the impact of the merger on the liquidity and volatility of about forty randomly selected stocks from the two countries has shown that only Danish blue chip stocks, the most liquid stocks from the smallest of the two exchanges, benefited from the merger.

Of equal interest, there have been at least two cases where an EU exchange had a contestable corporate governance in the wake of privatization and demutualization, Sweden and Italy. In both cases, a single entity, OM Gruppen in Sweden and Sanpaolo–IMI Group in Italy, bid for a controlling (in Sweden) or pivotal (in Italy) stake. In the Italian case, the banking group Sanpaolo–IMI reached 25 percent of total shareholdings. After an intervention by the Antitrust Authority and the introduction in the Statute of the Borsa Italiana of a voting limit of 7.5 percent of shareholdings, the banking group sold some of its excess shares: 4.5 percent was bought by the Emittenti Titoli, a company formed by the listed firms.

24. Authors' calculations based on Amsterdam Exchanges annual reports.

25. Carey (1999).

Both attempts have been blocked by other intermediaries and regulators. In the end, OM Gruppen finally merged with the Stockholm Stock Exchange.

Another example is offered by Tradepoint, which was established in 1992 with the strategic goal of building a new screen-based electronic market for securities trading. In 1995 the Securities and Investments Board recognized Tradepoint as an investment exchange. After that, Tradepoint launched trading in U.K. listed stocks, gathering more than forty-five members. Tradepoint's second important milestone was SEC approval to allow U.S.-based investment firms to trade U.K. equities on its trading system. The application was filed at the end of 1997, and the SEC granted approval in March 1999.

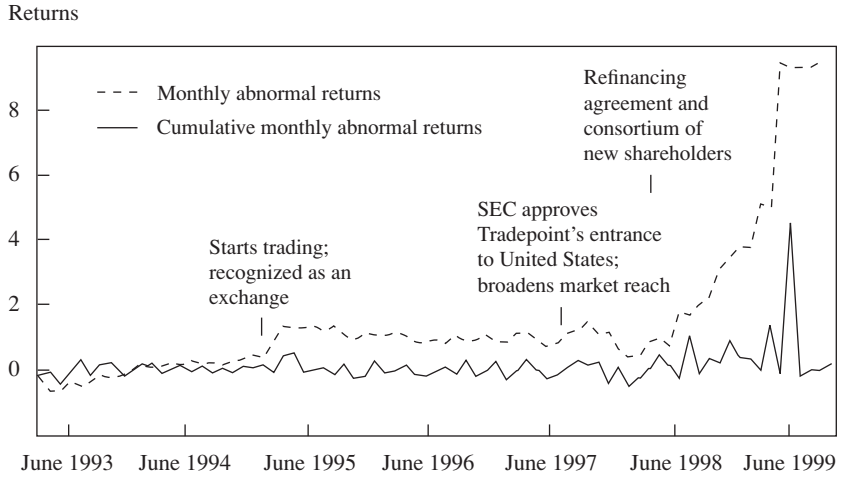
Tradepoint has been suffering financial problems since it began operations. The critical mass necessary to sustain its business (about 2 percent of total trading in U.K. stocks) has never been reached. It has never gained more than a 1 percent market share, piling up losses of £30 million. At the beginning of May 1999, a consortium of big players in global finance, led by Instinet, took control of Tradepoint Stock Exchange with a stake of 54 percent, planning to put their London trading through its system. Among the other investors, there were American Century, Morgan Stanley, JP Morgan, Warburg, and, indirectly through their ownership in Archipelago, Goldman Sachs and Merrill Lynch. They were later joined by Dresdner, Credit Suisse, Merrill Lynch, and Deutsche Bank. However, the new Tradepoint shareholders are probably aiming to get more business from the U.S. market, where, given recent SEC approval, Tradepoint has a small but useful foothold. Accordingly, Tradepoint stock market valuation has reached unprecedented levels.

Taking account of both the announcement of SEC approval and the financial rescue of the consortium, the market cap of Tradepoint has increased almost tenfold. On May 8, 1999, after the public announcement of financial rescue, Tradepoint market value was approximately £130 million, while the consortium had just committed itself to spending £14 million. The market reacted very positively to the news, showing strong leadership by "customers" (figure 11).

Some of the new Tradepoint shareholders also participated in a recent $24 million new funding for EASDAQ, the Brussels-based pan-European regulated exchange for high-tech companies.

Many other leading intermediaries, although major participants on regulated exchanges, are creating or investing in one or more new electronic

Figure 11. Market-Adjusted Monthly and Cumulative Returns of Tradepoint, 1993–99



Source: See table 1.

communication networks. For example, Charles Schwab, Fidelity, and DLJ Direct joined Spear, Leeds & Kellogg LP in July 1999 to build an electronic communication network, REDIBook. Nineteen of the largest U.K.-based funds also announced plans to set up an electronic network (called E-Crossnet) that would allow them to bypass the European exchanges. The system will be run by Merrill Lynch Mercury and Barclays Global Investors and be chaired by the former chief executive of LIFFE and director of Tradepoint. BrokerTec, an electronic trading platform aiming to become a global derivatives exchange, was formed in June 1999 by seven of the largest international banks (Citigroup, Credit Suisse First Boston, Deutsche Bank, Lehman Brothers, Morgan Stanley Dean Witter, Goldman Sachs, and Merrill Lynch). Archipelago is owned by Instinet, Goldman Sachs, E*Trade, JP Morgan, American Century, Merrill Lynch, and a couple of other firms.

Three Questions and Main Conclusions

This paper has focused on the consolidation of the EU exchange industry in the 1990s. What lessons have we learned, and what are the

implications for consolidation in the U.S. market? In this section, we develop three main themes for future discussion: Is this wave of consolidations different from past ones? What is the impact of governance on consolidation? Are exchanges a network industry?

Is this consolidation different from the previous ones? In short, yes. What makes this phase of consolidation different is a combination of new developments in the late 1990s in Europe, whose effects are relevant throughout the world: the impact of technology, implementation of the Investment Service Directive, the reality of remote membership, the creation of the euro, and a new corporate governance structure.

Technology enables exchanges to overcome locational differences with the possibility of offering, if regulations and governance structure allow, remote access to national exchanges from every location in the world. This eliminates one of the key reasons for fragmentation of firm listing among different national exchanges and a reason behind their natural monopoly. Advances in technology also decrease the cost for international data transmission. In addition, the convergence in market microstructure to the continuous auction model has made them compatible networks de facto. By contrast, in the 1980s the exchanges were more isolated technologically.

The full implementation of the Investment Service Directive will further integrate financial markets in Europe. The ISD allows each recognized exchange—regulated market—to be recognized automatically in other EU countries and to offer "remote access" to intermediaries in other EU countries without any further regulatory burden. Being a "regulated market" does indeed represent a competitive advantage with respect to unregulated markets such as automated trading systems. In fact, regulated markets are entitled (Article 15.4) to provide trading screens to investment firms based in other member states without having to seek approval from the relevant foreign authority. According to Steil, "This provision of the Directive is popularly viewed as the European 'single passport' for screen-based trading systems."[26] Remote membership has substantially increased competition in domestic markets by giving more access to foreign intermediaries, which have been the main users of this feature.

The other main reason for fragmented listing and trading (currency differences) has been eliminated in all the EU countries, with one important exception: the United Kingdom. The euro is affecting the demand side

26. Steil (1996a), p. 129.

of exchange business by altering the slope of the demand function for European securities and making them more and more quasi-perfect substitutes. The euro is slowly reducing spreads between countries and will induce investors to price macro-risk with a pan-European index and further decompose the remaining risks along sectors, rather than countries, causing a substantial reorganization of the asset management industry.

A marked difference of this consolidation phase is that entry into the industry is much easier than ever before for three main reasons: costs, regulation, and governance structure. Advances in technology make it much cheaper to set up an exchange than it was decades ago. According to Domowitz and Steil, "Tradepoint's system was developed for less than $10 million."[27] The existing exchanges are no longer legal monopolists, so entry is possible. Finally, the demutualization and privatization process makes it possible to obtain ownership in existing exchanges. Given their ex-monopolist status, their market power is quite difficult to combat directly through a completely new exchange (the only European exception being Tradepoint).

What is the impact of governance on consolidation? There is a lively debate in the United States (as well as in Europe) on the pivotal role of demutualization as a trigger for the restructuring of U.S. stock exchanges. It is sometimes heard that stock exchanges organized as private corporations under control of entrepreneurs will improve the efficiency and product quality of exchanges. Our view is that this argument, albeit valid in some theoretical models like the celebrated one of Hart and Moore, is not borne out in the evidence of privatizations and demutualizations in the EU.[28] Despite their legal form, all privatized or demutualized exchanges in the EU are controlled by a coalition of domestic financial intermediaries (usually universal banks), and they have limits on their charters so that the exchange is not free to compete with them by giving direct access to final investors. As the examples of OM Gruppen and Borsa Italiana show, even in cases when the governance structure was contestable, a new equilibrium with de facto mutual governance was established.

A related issue is whether governance impedes the transition to an electronic trading system. The most important case study here is the competition for core interest rate derivatives (Bund contracts) between LIFFE

27. Domowitz and Steil (1999), footnote, p. 39.

28. Hart and Moore (1996).

and DTB (Eurex). At the beginning of the 1990s, LIFFE created most of the liquidity on Bund futures. Despite its less costly screen-based system, the latecomer DTB had to struggle to keep a 30 percent market share. LIFFE had many proposed projects to automate trading, but they were never approved by the board, which felt that screen-based trading would harm locals and drive business to large universal banks and investment banks' trading rooms. At the time of launch of the Bund contract, LIFFE was not complacent about its first-mover advantage. Management long felt that Frankfurt would repatriate Bund business sooner or later. Within a few months, at the beginning of 1998, market shares suddenly reversed, and DTB gained considerably. Most market players agree that screen-based technology and the aggressive approach to allow remote trading were key factors favoring this outcome. Nevertheless, the weight of locals in the decision not to automate the market had put LIFFE in jeopardy.

Two cases from the United States show that governance can hinder market automation. Think first about the Globex saga. Globex was created by Leo Melamed at the start of the 1990s as a side bet to allow Chicago exchanges to retain competitive leadership in off-hour trading of financial contracts. The trading system was developed quickly by a joint venture between Chicago Mercantile Exchange (CME) and Reuters, which funded the $100,000 development costs. Melamed was able to convince management of the Chicago Board of Trade (CBOT) to enter the agreement, but the departure of Melamed from CME chairmanship caused a series of false starts. During its history, only Matif, which had joined the alliance, really traded on the system.

More recently, AMEX and Nasdaq joined forces in a highly publicized deal. No matter what the potential economies of scope between them, any project to unify them under a screen-based auction system seems far away. Market makers on Nasdaq do not like auctions with time priority; specialists on the floor on AMEX do not want to lose their franchise to screen-based trading. This merger appears to create small benefits indeed.

In our view, the cases hint that there is a grain of truth in the proposition that some large U.S. exchanges need a change in governance. The controlling coalitions of large exchanges, like the NYSE, AMEX–Nasdaq, CME, or CBOT, are too dispersed and reliant on a floor trading approach to shift to a screen-based system. What is really needed is a new charter that allows a reshuffling of controlling interests, possibly with appropri-

ate liquidation of incumbents. A demutualization, with the provisional deviation from a one-share, one-vote system, would allow this. However, we anticipate that in due time the exchange will revert to a mutual structure, albeit with a new, possibly more narrow, controlling coalition.

Are stock exchanges a network industry? The EU experience of consolidation also allows us to add some knowledge to the strength of network effects in stock and futures exchanges. We found evidence of network effects in listing at NYSE, but not at LSE, the two major competitors for listing in the world. On the one hand, listing on NYSE seems to signal commitment to a shareholder value approach. (See, for example, the press advertisement by continental European companies when listing on NYSE.) On the other hand, NYSE seems less well suited to competition in its second major output, trading technology. Again, the reason is the refusal to use completely screen-based trading; over time, this has caused the NYSE slowly to lose market share in its stocks to alternative trading systems, including off-the-shelf block trading, automated trading system, regional exchanges, and perhaps also stock index futures.

Evidence of continuous appreciation of the value of a NYSE seat shows that the positive franchise of listing outweighs the alleged limits of floor trading. Here, we feel that the lesson has to be learned from Europe. EU exchanges commit most of their effort to trading but completely disregard the listing output. The major sinner here is LSE, which pursued a myopic strategy of stealing order flow from EU exchanges, where its natural specialization would be to craft a European listing standard. On these accounts, the LSE–DB proposed deal has been a lost occasion to merge the two largest EU markets, with Frankfurt supplying trading technology and LSE focusing on listing.

The other network effect we were able to document was related to the sale of remote trading. We have shown that, although all major EU exchanges are pursuing this strategy aggressively, only Eurex has attained sufficient mass from remote membership. Other exchanges, whose reputation is less valuable in terms of liquidity (for example, the Stockholm Stock Exchange), were only able to have one-shot increases in liquidity but were saturated as soon as the major ten to fifteen international brokers sought access. Only these brokers seem to command enough volume to seek membership in a medium-size exchange (for example, the Finnish market, which, in terms of international mass, only commands trading in Nokia stock). The lesson for the U.S. case is that CME and CBOT, by

moving to a Eurex approach, should probably attract a network effect even if their starting point is at much higher absolute volumes than Eurex. A similar scenario may occur for screen trading of government bonds: here Euro MTS is the most relevant contribution from Italy to the exchange industry and deserves attention (Euro MTS is now a tiny multinational).

We conclude with some comments on the shape of the exchange industry as observed from our particular methodology.

Exchanges that trade a perfectly substitutable product may forge an implicit merger, through an agreement to cross-list stocks on both networks and to give reciprocal access to all their brokers under a compatible platform. Under an implicit merger, the two exchanges compete only on cost efficiency of the networks, since the possibly opposite effect of network externalities washes out. One example where an implicit merger is mutually advantageous is when one exchange has wide scope and another has better technology. This is very important in the cash market, where no single exchange is able to capture price discovery of a pan-European basket of blue chip stocks. The potential for merger is lower if the two exchanges are more similar. The potential for merger is also lower for very substitutable products, like fixed-income futures where a war is indeed observed. The case for stock market indexes is more complicated because of a linkage problem between the two games.

A final point is that lock-in effects continue to dominate, and hence markets are still regarded as incompatible networks. In this case, implicit mergers resemble past attempts to link exchanges. The links attracted very small volumes, and all orders continue to flow to the main exchange. In this case, remote linking is just a limited cost-cutting strategy at the level of order routing, but each exchange sticks to its blue chips. Limited differences in cost efficiency can survive given imperfect substitution between stocks (a broker cannot direct orders to the most efficient network, as it will lose some risk-reward combinations available only on the smaller networks).

Deregulation has opened up the national networks to competition from larger national networks trading similar goods in a framework of increasing returns. The first reaction was just benchmarking to reach best practice in terms of technological efficiency. This is self-defeating, as described by Porter, because the ultimate consequence of this approach is for

exchanges to ruin themselves in a price war or to look for some cooperation or some contrary approach.[29]

We argue that the expectation of the euro and the impact of the ISD and privatization jointly changed the relevant exchange strategies. However, this perception has been uneven at the level of the various players, some of whom are stuck in the old "domestic-closed network" framework. This structure gave them some scope for success in the old regime, but not in these new times. Some markets, such as France or OM Gruppen, that compete only on the best technology will be a second-order factor in the new competitive environment, where critical mass is key.

We argue that exchanges are "natural cooperatives" and so the "for-profit" wave is just a device to get rid of old members who are an obstacle to electronic trading and remote membership: in the end we will see member-based exchanges owned or controlled by important intermediaries. In the meantime, such firms will be taking over or creating important electronic communication networks. There is evidence against economies of scale in exchanges, which is also proved by many outsourcing deals: that is, exchanges buy outside their scale. Network effects are clear only for super-size exchanges.

With respect specifically to the U.S. exchanges, remote membership obviously would be useful to attract cross-border business, but a necessary condition is to open membership in the European way: every intermediary authorized to trade must be admitted to the exchange.

The U.S. evidence is mixed. The NYSE displays quasi-monopolist power in listing that may be a result of the partial concentration of trading imposed by Rule 390. It is possible that the strong competition in trading by electronic communication networks will lead to a major focus and specialization in the listing services. The Nasdaq–AMEX merger is still debating long-term projects that may save the floor of AMEX, given its governance problem.

At the start of the 1990s we had bilateral competition between incompatible networks. In the mid-1990s we observed deregulation and breaches

29. Porter (1996). Porter's model assumes perfect substitutes, an assumption that is violated here. An implicit merger in this case is not enough to let network externalities completely disappear since traders will continue to use the market that they expect to be more liquid, as in Pagano (1989).

in the rules. Now, approaching the end of millennium, we have armistice and implicit mergers.

APPENDIX A

Is the "For-Profit Wave" Affecting the Consolidation of Securities Exchanges?

A NECESSARY, THOUGH not sufficient, condition for consolidation (through mergers) in every industry is an open governance structure. This is also a key factor for exchanges:

> To understand the behaviour of an exchange, it is insufficient to think of it merely as a black box. Approaches which ignore the inner structure of exchanges, such as those viewing an exchange solely as a trading system (in the language of microstructure financial economists), a reduced-form production function (in the language of neoclassical economists), or an impersonal instrument guided by its managers (in the language of organizational theorists), are not rich enough in detail or subtlety to be able to explain the nature and conduct of exchanges.[30]

In this appendix we do not revisit all the problems of the governance of exchanges, which already have been analyzed in the literature.[31] Our aim is simply to make evident that the for-profit wave misunderstands the true nature of exchanges.

Governance reasons may affect the consolidation process: exchanges that are member-owned (both in cooperative or company form) and not fully electronic tend to resist the technological evolution (especially remote membership) and integration, given the different time horizon of their members. Demutualization and privatization are thus a necessary condition to change the shareholders and management (either government-appointed or members of the exchange). This has been and is going to be implemented in many countries. In spite of this, the short experience of two European exchanges where informal takeover attempts were blocked seems to show that moving to for-profit status may be meaningless if

30. Lee (1998), p. 8.

31. In particular, Lee (1998); Hart and Moore (1996); Domowitz and Steil (1999).

shareholders are not dispersed. The listing of exchanges on an exchange should be implemented to avoid "customer-controlled exchanges." More important, we think that exchanges are natural cooperatives (even with a company status) given that they are otherwise competitors of their members: that is why big intermediaries are creating (Euro MTS) or taking over (Tradepoint) many exchanges or electronic communication networks.

The classical problems of member-owned exchanges (both cooperatives and for-profit companies) are that the controlling members, or shareholders, are all or some of the intermediaries. They could also be issuers of listed securities.[32] The exchange is thus customer-controlled.[33] The problem with customer control is that, in these kinds of firms, pricing policies and, in general, profit-maximization policies are decided by some of the customers who consume the good. There may be perverse effects of allowing these "dual-capacity" individuals to have a relationship with the firm.

On the one hand, owner-users get utility from the share of the firm's profits; on the other hand, they get more utility paying the lowest price possible for the good they purchase from the firm. The different maximizing problems of diverse shareholders can also create conflicts of interest not only in pricing policies but also in investment policies, in self-regulation, and in enforcement of regulation among members. Pirrong argues that the exchange, in some cases, may not maximize the total wealth of exchange members due to the governance structure.[34] For example, "it is likely that the exchange membership will choose a level of enforcement that is smaller than the level that would maximize the wealth of exchange members. This is especially true if the exchange membership is large."

Given that many exchanges are moving to for-profit entities (NYSE, LSE, and Nasdaq, for example) and listing (Paris Bourse and Amsterdam), the topic is relevant (table A-1). In fact, their pricing policies, which do not maximize profits, may present a problem for dispersed and minority shareholders. Normal customers, not owners, may be affected, too, in the case of different pricing policies due to customer-owners. For example,

32. This is not the case for the two exchanges that are listed on another exchange (Australian and Tradepoint), but many others (Paris, NYSE, and Amsterdam) are thinking about permitting this.

33. Di Noia (1998).

34. Pirrong (2000).

Table A-1. Privatization and Demutualization of Exchanges, 1993–2000

Exchange	*Year*
Stockholm Stock Exchange	1993
Helsinki Stock Exchange	1995
Copenhagen Stock Exchange	1996
Amsterdam Exchanges	1997
Borsa Italiana	1998
Australian Stock Exchange	1998
Iceland Stock Exchange	1999
Simex	1999
Athens Stock Exchange	1999
Stock Exchange of Singapore	1999
Hong Kong Stock Exchange	2000
Toronto Stock Exchange	2000
London Stock Exchange	2000
Agreed privatization or proposed initial public offering	
Nymex	
Nasdaq	
Paris Bourse	
Deutsche Börse	
Chicago Board Options Exchange	
Chicago Mercantile Exchange	
New York Stock Exchange	
Oslo Stock Exchange	
International Petroleum Exchange	
Chicago Board of Trade	

Source: Adapted from Domowitz and Steil (1999).

the management of an exchange controlled by big banks may structure the pricing policy as a two-part tariff with a huge one-shot fee and a very small transaction fee, so that the average fee is much lower for big intermediaries. More important, conflicts may arise as a result of the relation between ownership structure and the two functions of the exchange: managing and surveillance of the market. Self-regulation of the exchange can have potential problems, which are often analyzed in the literature.[35] In general, self-regulating entities find it difficult to enforce rules against their members, and, even if they are sufficiently independent at the beginning, capture is going to arrive, sooner or later. An obvious example can be the drafting of market regulation that affects shareholders. On the other side, the reputation and efficient regulation of exchanges affect, in the long run, its success.

35. See the arguments in Pirrong (1999).

Fishel and Grossman point out that there is a close relationship between the extent to which a future exchange provides regulations to achieve customer protection and the volume of trade. In this sense, the basic conflict of interest where one member engages in an activity (fraud) that benefits himself but hurts other members and the overall reputation of the exchange is offset by competition among exchanges that should drive out the ones with the lowest quality-to-price ratio.[36] Finally, it seems difficult to believe that common investors buying shares of an exchange just for profit reasons will diversify their portfolio, given the "interested" pricing policies of some of the exchange's owners. In this sense, the listing of a stock exchange may not seem reasonable, given that intermediaries and other customers of the exchange retain effective control of it.

To summarize, moving to for-profit status has a real meaning in the competition and consolidation of markets only if a stock exchange company is listed with an initial public offering of 100 percent of capital and a limit on the purchase to investors different than customers. But exchanges are natural cooperatives: thus their demutualization or privatization is only the device to change the existing governing members. From a welfare point of view, Di Noia shows that the most efficient policy would be to set the placement of the stock exchange shares such that customer-owners keep a share of the capital of the exchange exactly equal to their proportion of customers.[37] In this sense, regulations (or self-regulations) that allow intermediaries to buy shares of the exchange in proportion to their trading volumes (and fees) seem correct.

APPENDIX B

ATS Competition and Responses of Traditional Exchanges

EXCHANGES ARE FACING even stronger competition from quasi-exchanges, like automated trading systems (ATSs), where it is possible to *trade* securities generally *listed* on exchanges. ATSs compete with exchanges even if their nature is not clear from a regulatory point of view. Some regulators have reacted to this problem with new rules (in particular the SEC)

36. Fishel and Grossman (1984).
37. Di Noia (1998).

or proposals (see the interesting ATS proposal of the Ontario Securities Commission issued on July 2, 1999).[38] The existence and nature of exchanges once were not controversial. They were easily identified and characterized. New computer technology has led to the birth of these new MONSTERS (Market-Oriented New Systems for Terrifying Exchange Regulators).[39]

In general, automated trading systems do not offer listing services, given that they generally trade only securities listed on other exchanges. Furthermore, they sometimes free ride on the price-discovery process because members of exchanges may direct trade on ATSs to make some arbitrage or to operate in off-regular hours. But the main customers of ATSs seem to be institutional investors that generally are not allowed to trade directly on exchanges.

ATSs are present in developed financial systems, in part to compete with traditional exchanges, in part to absorb the excess demand that exchanges cannot satisfy (opening hours), and, finally, in part to satisfy the needs of those who cannot trade on exchanges because they are not admitted or because they want to trade unlisted securities.

ATSs compete in four ways with an exchange:

1. Allowing arbitrage among different exchanges,
2. Trading listed shares during exchange trading hours,
3. Trading listed shares after exchange trading hours, and
4. Trading unlisted securities that are considered close substitutes for listed securities.

In terms of the first point, some ATSs, as predicted by the network literature, are "adapters of incompatible networks." Namely, they offer the possibility of comparing the books of different exchanges and addressing the order to the most convenient one, as for example Instinet does during official trading hours. They receive a fee for this service.

In the second instance, many ATSs trade listed shares during official trading hours. They offer different types of competition with an official exchange:

—Direct price competition, because there may be the possibility of closing a transaction at a better price than on the exchange.

38. Ontario Securities Commission (1999).
39. Lee (1998).

—Indirect price competition, as the final price of the transaction, including the eventual fee to the ATS, is lower than the total price on the exchange (the eventual fee to a broker, in order-driven markets, and the market impact). This often happens to institutional investors that are allowed to trade directly on ATSs but not on exchanges.

—Nonprice competition, in particular immediacy and anonymity.

The third area springs from the reality that life is short for both man and machines. So exchanges have normal trading hours and other nonoperating hours. Demand for off-trading hours arises for two reasons: investors want to trade at those hours, or events may influence prices during off-exchange hours. A connected and relevant point is how regulation is imposed in off-hours trading. Are concentration principles (where applicable) or best-execution rules applicable during off-exchange trading hours? Is there a price limit on transactions that take place after hours? There may be different rules for different players.

Finally, alternative trading systems are of value because they trade unlisted securities. This is due mainly to the fact that listing a stock is costly, and some issuers may prefer not to pay for it, and listing a bond may not be necessary because bonds are traded mainly by institutional investors who care more about rating and liquidity than trading place.

Strategic Response of Traditional Exchanges to ATS Services

In order to avoid the competition of ATS "adapters," the strategic response of diverse exchanges is either to merge or to create a unique trading platform or access. The first option seems to have succeeded in very few cases (Norex and Eurex), as has the second one (the network solution). This is because it needs common rules at the level of both the exchange and the public regulator, open-minded governance of exchanges, and smooth clearing and settlement procedures.

Transactions rarely are executed away from the market, trading directly with an intermediary (or an ATS) at a price that is consistently better than the price on the exchange. In fact, Domowitz and Steil show that for listed stocks electronic markets do not perform better than traditional brokers who send orders to regulated exchanges.[40] In this sense,

40. Domowitz and Steil (1999).

exchanges may think that there is no need for a strategic response. However, given the increasing volume of trades executed off-exchange, the quality of the prices formed on the exchange during normal trading hours is not as "perfect" as before, and it is possible to "move" the prices more easily.

The possible response of an exchange is to change the microstructure, as LSE did in 1997, or to change the rules in order to allow institutional investors to trade directly. The problem is that primary regulation may not allow exchanges to respond, as in the example of many European exchanges.

Steil and Schwartz show that different market microstructures are strong competitive factors.[41] Some intermediaries prefer to trade in an anonymous way without even passing through a broker. Others prefer the immediacy of a quote-driven market to waiting for their order to be executed in an order-driven market. Mixed microstructure can be implemented with market makers operating in order-driven markets, using some electronic call auctions in continuous trading.

After-hours trading is a very interesting issue, connected with the development of the Internet. If there really is an after-hours demand, the obvious strategic move of an exchange would be to lengthen its trading hours. This has happened in Europe, due to the harmonization of trading hours of the eight exchanges of the E-8 alliance, while in the United States the plans of NYSE seem to be stopped. The cons of having more trading hours are quite simple: the additional demand occurring in the new trading hours would not be so large, and the demand coming from small investors would be small. Therefore, the quality of orders would not be very good, coming, as it would, from people who are not very sophisticated or perhaps are new to the game.[42] All of this makes an eventual lengthening of trading hours dangerous because it would give rise to very volatile prices: for example, early trading in London opened big price spreads at the end of September 1999. Maybe exchanges should keep shorter hours and "good" prices.

41. Steil and Schwartz (1996).

42. An interesting consequence of after-hours trading is that "traditional" regulations require listed companies to spread news when markets are closed. But when ATSs are open, the impact on prices could cause great volatility.

The response of exchanges in this case is twofold. On the one side, exchanges must be more attractive to issuers with greater reputation than nonregulated markets or must have lower fees. On the other side, if regulation allows them, they could trade unlisted securities when, for example, demand for this activity is high or their rating is "good."

Comments and Discussion

Comment by George Sofianos: Carmine Di Noia repeated many times, "Everything is a mess." Exchanges are groping in many different directions, and they are all over the place: horizontal mergers, vertical mergers, selling technology, outsourcing technology. We should be thankful to Cybo-Ottone, Di Noia, and Murgia for providing us with such a useful guide through the "mess." In my comments I focus on why the cross-border consolidation of equity markets is so difficult. We know where we want to go, but getting there is hard.

First a general comment on the paper, and this is both a strength and a weakness. In a rapidly changing market—at least one new development is announced every day—the paper covers too much. The downside of being comprehensive is lack of focus. The paper needs a more coherent framework and more in-depth analysis. Cybo-Ottone, Di Noia, and Murgia discuss vertical integration: the integration of order flow transmission, trading, and settlement. They discuss horizontal integration: for example, the combination of derivatives and cash markets. And they discuss order flow consolidation. These three are very different dimensions of consolidation and cannot be discussed easily in one paper because the driving forces differ dramatically. I will focus on order flow consolidation.

Let me remind you how simple the structure of equity markets used to be. Each country had a single national exchange surrounded by member broker-dealers. The public investors had to go through these broker-dealers to access the exchange, and a regulator supervised the process. Rules required brokers to direct all orders to the national exchange in an effort to ensure order flow consolidation and maximize the benefits of network externalities. These rules also avoided the conflicts of interest that arise

when broker-dealers internalize the order flow. Many countries, especially in emerging markets, still have this simple structure today. Exchanges in this simple arrangement are essentially public utilities and, as in all public utilities, we need to curb monopoly power, regulate pricing, and so forth. The resulting lack of competition leads to markets that are slow to respond to the changing needs of investors and issuers.

We are moving rapidly away from this market structure for three reasons. First, we have learned over time that the public sector is not necessarily better than the marketplace even in the case of market failures. The massive privatizations of the past twenty years are all the result of this realization. Second, the growth of cross-border raising of capital and trading is challenging the concept of a "national" exchange as an isolated island of liquidity. The third reason is technological innovation. Technologically, for example, national boundaries are obsolete. There is no technological need for broker-dealers to transmit the order flow from investors to market.

The Holy Grail is a True Global Exchange (TGE), which should have at least six desirable features:

—A list of "world class" stocks (I do not know how many there are or how to define them other than as stocks with strong cross-border investor appeal, typically multinationals with global name recognition);

—Cross-jurisdictional regulation (the location of the investor should not affect regulation);

—A single fungible security globally traded or, even better, complete dematerialization and electronic book entry;

—A single trading platform for twenty-four-hour seamless trading with a twenty-four-hour limit order book;

—Twenty-four-hour real-time trade and quote dissemination; and

—Global clearance and settlement.

The two most important constituencies—investors (especially institutional investors) and issuers—both want a TGE. A TGE will make it cheaper for issuers to raise capital and for investors to trade.

But how can a TGE be created, and what stands in the way? Broadly speaking, there are three ways to create a TGE, and, in varying degrees and combinations, all three are currently being pursued. First, from the outside, a new entity starts from zero and creates a TGE. Tradepoint is an example of this approach. But it could also be a complete outsider like, for example, Amazon.com, which has a global users network. The second approach is from within, through alliances among existing exchanges.

Nasdaq is emphasizing this approach, although its SoftBank partnership has elements of the outside approach. The third approach is also from within, but through cross-listings: listing on an existing exchange and successfully trading foreign stocks. The New York Stock Exchange (NYSE) is emphasizing this approach.

All three approaches are being tried. But, as the paper emphasizes, it is proving very hard to create a TGE for several reasons: (a) regulation, (b) the first-mover advantage, (c) the politics of alliances, (d) the incentives of broker-dealers, (e) the trading platform problem (which is the best trading system?), (f) clearance and settlement, (g) the nonfungibility of American Depository Receipts (ADRs), and (h) the time zone effect.

Regulation is the most difficult obstacle to overcome. National regulatory agencies still think in terms of regulatory island fortresses and national jurisdictions. Clearly, there are legitimate concerns over how best to protect investors and the possible (but not inevitable) danger of regulatory arbitrage with trading migrating to the least constrained jurisdiction. We must move beyond national regulatory jurisdictions in order to create a TGE. The banking industry, through the Basel Accord, is way ahead of the securities industry on this front. Even within the European Union, however, where most of the regulatory barriers have been removed, it is hard to achieve cross-border consolidation of equity markets. Other factors are at work.

Another important barrier is the first-mover advantage. Most "world class" stocks already have established markets, typically the home market, and it is difficult for an outsider to take away the order flow. This is a problem with the "from the outside" approach. A problem that Tradepoint or Amazon.com will face. It is also a problem with the "from within through cross-listings" approach, a problem that the NYSE faces whenever it lists foreign stocks and has to compete with the home market. Hence all the talk about global alliances. The liquidity is out there already, in the home market, if only we could use alliances to link these established pools of liquidity.

Unfortunately, we run into the politics of alliances. One dimension of this problem is the national airline syndrome: each country must have a national airline. It has nothing to do with economics: many national airlines perennially lose money, but each country must have a national airline, and each country must have a national exchange. How can national

exchanges be convinced to give up their national identity or at least some of their stocks to a supra-national alliance? How can the revenues of the alliance be allocated to the constituent national markets? What trading platform should be used? The EU experience is particularly disheartening, because within the European Union each country basically has the same electronic trading platform, and they still cannot consolidate into a single trading platform with a single consolidated limit order book. Another problem is determining who should lead the alliance? These are political, not economic, obstacles.

The broker-dealers are another potential obstacle. Broker-dealers play an intriguing role because they provide an alternative way of integrating global trading: many trading centers are connected by global broker-dealers. This is the Merrill Lynch strategy: through their membership in many exchanges all over the world they can potentially provide their customers with seamless twenty-four-hour global trading. A successful TGE will mean less demand for broker-dealer intermediation. So here is the question: do global broker-dealers want a TGE to succeed? Broker-dealers can make or break a TGE because they control the order flow.

On the clearance and settlement front, an integrated global clearance and settlement system is a must for a TGE. But in pursuing such a global system, we encounter the same problems that we discussed with national exchanges. We currently have national clearing and settlement systems: how do we achieve a true global clearance and settlement system? From outside or from within? From outside, Euroclear and Cedel are good examples of supra-national entities that could evolve into a true global clearance and settlement system. The NYSE is trying to finesse the cross-border clearance and settlement process through bilateral arrangements between, for example, U.S. and Canadian institutions for Canadian stocks and U.S. and German institutions in the case of DaimlerChrysler global shares. This is a cumbersome process.

Incidentally, global clearance and settlement would be much simpler if we had complete dematerialization and global electronic book entry. We should be striving for this.

American Depositary Receipts, the instrument of choice for trading foreign stocks, creates another obstacle. ADRs fragment the market by creating two distinct, nonfungible instruments: the ADRs and the underlying home-market security. A prerequisite for a TGE is a fully fungible global

security. The DaimlerChrysler global shares innovation is a step in that direction. Again, complete dematerialization and global electronic book entry would facilitate the process.

The time zone effect creates a problem for the NYSE's policy of listing foreign stocks. The evidence shows that trading concentrates in the home-market trading hours. In a recent paper, we examined a sample of about 250 NYSE-listed non-U.S. stocks. We divided the sample stocks by the time zone of the home country and calculated the U.S. share of global trading volume by time zone. The U.S. share of the global volume in NYSE-listed North and South American stocks (similar time zone to New York) is 47 percent. Moving away from the New York time zone, the U.S. share of trading in NYSE-listed European stocks is 20 percent. Farther away, the U.S. share of trading in NYSE-listed Asia-Pacific stocks is less than 10 percent.

The time zone effect makes it difficult for an existing exchange to become a global exchange by listing foreign stocks. The NYSE is trying to overcome the time zone effect in two ways: by moving away from ADRs toward fully fungible global shares and by planning to expand trading hours to increase the overlap with the home markets.

Finding the Holy Grail—complete global consolidation—may be unrealistic, so how about a compromise? One possible compromise would be to have, instead of a global consolidated limit order book, several local (home-market) limit order books linked electronically. This is the arrangement within the United States where the NYSE is connected with other U.S. markets through the Intermarket Trading System (ITS). This structure consolidates only the inside quote and not the whole book. This is also what the eight EU exchanges are now proposing after failing to agree on a common trading platform.

Is this compromise good or bad? In my mind, we may be losing too much. Institutional investors, in particular, will struggle to find the liquidity they need because the market, beyond the inside quote, remains fragmented. All that is achieved is easy accessibility of a collection of inside quotes. If in six months, when the U.S. equity markets switch to decimals, we start trading in pennies, the inside quote in active stocks will be only 100 shares. All you are going to be getting through ITS will be 100 shares here or there. But Fidelity wants to trade 200,000 shares. To find this liquidity, Fidelity must go up and down the limit order books. But the limit order books remain fragmented, and institutional investors cannot effi-

ciently aggregate the liquidity across the various limit order books beyond the inside quote. The buy side in the United States is therefore complaining about the increasing fragmentation of the market, especially the Nasdaq market, and the lack of a consolidated limit order book.

Economically, order flow consolidation is inevitable. How fast it happens and how far it goes depend on the strength of economies of scale and network externalities. Network externalities, I believe, are the important economic force behind consolidation. Network externalities in equity markets are strong, but they are difficult to quantify.

Consider this imaginary chart. On the vertical axis is an index of the quality of trade execution (which is very hard to quantify in practice). This index should include commissions charged by the exchanges, spreads, market impacts more broadly defined, time to execution, and so forth. On the horizontal axis is some measure of order flow concentration. Order flow concentration is also hard to quantify because we need to take into account the liquidity that is not displayed. Suppose we had these ideal measures, and we plotted the relationship. This is what I suspect we would find: starting with, say, 10 percent order flow concentration initially, as the amount of concentration increases, the quality of execution improves until a critical point is reached beyond which the disadvantages of lack of competition outweigh the advantages of order flow concentration, and the quality of execution begins to decline. At some point the optimum combination is obtained.

General Discussion: Jim Angel argued that the key factor for understanding the structure of the securities exchange market is the regulation that determines who owns the quotes and how much the markets can charge for the information they create and disseminate. He explained that if the regulatory system decides that intellectual property belongs to the market that creates it, and the market is free to do anything with it, then one can expect a very different market organization than if the regulators decide to treat the quotes as public goods that essentially must be given away freely to all.

Frank Fernández asked what would be the financial incentive for exchanges to give up a proprietary hold on some of their order books and allow them to consolidate. George Sofianos responded by calling this the "regulator's dilemma": one cannot demand a consolidated limit order book and expect competition at the same time. For instance, if the regulators

force everyone to consolidate, all of the electronic communication networks will lose a substantial part of their competitiveness.

John Heimann predicted the emergence of a bifurcated system, global and local, where globally traded shares in companies with large market capitalization will be traded in the global market, but shares in local companies will continue to be traded in local markets. The question then rises as to the kind of an exchange structure that is appropriate and necessary for such a bifurcated system. Heimann also explained that for multinational financial institutions to penetrate local markets successfully, the companies must be able to provide services in local currencies and in local bond and stock markets. These institutions must also become an integral part of the financial intermediation system in the country that the companies have selected.

Robert Litan argued that the largest impediment for the global consolidation of securities exchanges are the regulators and each country's desire to have its own regulation of securities markets. Anthony Santomero responded that the combination of technology transfer, outsourcing, and the development of similar securities platforms that is taking place in Europe illustrates that there is some recognition of the benefit of consolidating and is a sign that the Europeans at least are willing to provide a kind of infrastructure that will facilitate cross-country trading.

George Sofianos acknowledged that exchanges have not been able to achieve the same results as they have in banking supervision and regulation but argued that there has been progress in Europe where there is now at least some basis for a common regulation of exchanges. He added that the issues relating to regulation and supervision in the securities exchanges probably are more complicated than those in the traditional banking sector, because it is extremely difficult to know where the transactions are made and who is making them, especially with development of the Internet. He noted that national exchanges will not necessarily disappear, especially for small enterprises, because the information on these firms is more easily accessible to investors in national exchanges than in their foreign counterparts.

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