Trading systems in European stock exchanges: current performance and policy options

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1. Introduction

Over the 1980s, in one country after another, policy-makers have subjected their national stock markets to radical reforms, generally after considerable resistance from the business communities traditionally operating in the exchanges. These reforms primarily concern three areas: liberalization of access to stock-exchange membership, liberalization of commissions, and drastic changes in trading systems, information dissemination and settlements procedures, with the extensive adoption of computerized systems. Often, this process has been accompanied by reductions in transaction taxes or stamp duties.

The first European market to venture on the path of drastic reforms was the London Stock Exchange, which, after a series of smaller preliminary innovations started in 1984, went through the so-called 'Big Bang' in 1986. That same year, the Paris Bourse started undergoing a complete overhaul, reaching completion only now. In Spain, where the

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Summary

The deregulation of financial markets and the liberalization of international capital flows raises a number of challenging issues. Market participants and policy-makers are treading largely uncharted territories. This article offers some markers, exploring the implications of economic principles and producing new evidence on European stock exchanges. One vast set of issues concerns the design of market operations. The article compares the merits, both in theory and in practice, of auctions versus market-making, of concentration versus fragmentation of trading, of batch auctions versus continuous markets and of single- versus dual-capacity dealers. Policy conclusions are grounded on a detailed analysis of the experience accumulated on European and North American exchanges.

Another theme runs through this article: the implications for the relative competitiveness of European financial markets. Rapid changes have already occurred in the late 1980s: while much wholesale trade has moved to London, continental exchanges have grown at an accelerated pace. We examine whether this is connected to innovations in trading systems and regulation. The paper also attempts to foresee the geographical structure of Europe’s integrated stock markets. At stake is the hierarchy of financial centres, the potentially dangerous drift towards competitive deregulation and the scope for wholly computerized trading where market location becomes irrelevant.
Efficient markets

JUST A NORMAL DAY AT THE NATION'S MOST IMPORTANT FINANCIAL INSTITUTION...

stock exchange worked along lines very similar to France, a reform that is closely patterned after the French example has been implemented in July 1989, while in Italy a similar reform is being discussed. In the most important of the German stock markets, Frankfurt, there are now plans for substantial changes in the trading system.

Why did policy-makers decide to go through this often painful process of reform in one country after another? The main answer is: competition between exchanges. The sequence of events can be largely seen as a chain reaction, propagated by the tendency of trading volume to migrate to the most cost-efficient and liquid markets. Two additional factors have provided further impetus: the gradual liberalization of capital flows – the 1990 deadline being lately one of the main contributing factors on this account – and the increasing mobility of the clientele across national borders – as a result of the increasing role of institutional investors and of technical advances in telecommunication.

These sweeping changes have so far received little attention from economists. We still lack a systematic analysis of the innovations which have occurred, of their impact on the competitive position of each market, and of the economic issues involved in redesigning the operation of a stock market. Still, this kind of analysis is indispensable groundwork to answer a number of questions of pressing interest. Should we expect that the 1990 EC liberalization will lead to further concentration of business on a single stock exchange, gradually turning other exchanges into peripheral, regional marketplaces? What are the costs and benefits from having a trading system ruled by market makers rather than by an auctioneer? And what is there to be gained in going from a batch auction at discrete intervals to a continuous market? For European policy-makers and businessmen these are burning questions. This paper is intended as a first contribution to fill the void. Given its scope, it is bound to be highly selective and incomplete in its coverage of both facts and issues, and merely tentative in its conclusions. At a minimum, we hope that it will provide an incentive for others to look deeper into this fascinating, though intricate, set of issues, and to tap the increasingly large body of evidence that is currently accumulating in European countries.

The paper is organized as follows. We start with a bird's eye view of the key institutional changes that have occurred, or are currently planned, in the main European stock exchanges (Section 2). Since these changes have generally been aimed at increasing trading volume and reducing transaction costs, we assess in Section 3 the competitive position of the various exchanges. Then, in Section 4, we try to evaluate the impact of the reforms already implemented and of those currently
planned or discussed, by focusing on four key choices that policy-makers face in redesigning the trading mechanism of national exchanges: an auction or a dealership market; a discrete or a continuous trading mechanism; a concentrated or a fragmented marketplace; and single-capacity or dual-capacity dealership (single-capacity firms are either brokers for their clients or dealers on own account, but not both). Finally, we face the most difficult and interesting set of questions, those concerning the future. Where is this regulatory competition among exchanges heading to? Will it lead to further concentration of trade on one or few marketplaces, turning the rest into regional exchanges specialized in small-size domestic companies, or rather to continued competition among exchanges? And if so, is there a social benefit from this competition?

2. Institutional change in the 1980s: the stylized facts

2.1. London

The reforms that have occurred in Europe in the 1980s (or are currently under way) can largely be seen as a chain reaction or, in economic terms, an example of competition among national regulators. The spark that ignited this chain reaction probably occurred 15 years ago on the other side of the Atlantic. The famous 1974 'May Day' liberalization of commissions on the New York Stock Exchange (NYSE) was one of the reasons why the authorities regulating the London stock market (the Department of Trade and Industry) gradually started to urge the members of the exchange to scrap the old fashioned system of fixed commissions and the closed membership rules of the exchange.

After substantial resistance from many members of the exchange, the 'Big Bang' of October 1986 eventually swept away the traditional roles of jobbers and brokers, opened dealership to competition by banks and other financial institutions, liberalized commission charges, and at the same time introduced the extensive use of computerized systems in price quoting and order placement procedures (see Tonks and Webb, 1989). This led to a substantial gain in the competitiveness of the London Stock Exchange: partly as the result of these changes and partly because of the concomitant reduction by 50% of the stamp duty, transaction costs fell substantially on the London market (by almost \( \frac{1}{3} \) on large transactions) as is documented in Table 1. At the same time, the volume of trading increased substantially: considering only customer business, in November and December 1986 average daily turnover rose by about 20% relative to the first 10 months of that year, and by a staggering
Table 1. London: total cost of a round-trip transaction of £500,000 (%)

<table>
<thead>
<tr>
<th></th>
<th>Before 'Big Bang'</th>
<th>After 'Big Bang'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stamp duty</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Commission</td>
<td>0.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Average touch</td>
<td>1.56</td>
<td>1.24</td>
</tr>
<tr>
<td>Total</td>
<td>2.87</td>
<td>1.99</td>
</tr>
</tbody>
</table>

Notes and sources: The figures for commissions are drawn from Table 4.2 of the Quality of Markets, Second Report, March 1987; the figures for the average touch are touches at maximum size for Alpha, Beta and Gamma stocks (Table 2.5), weighted by turnover (Table 2.2), Quality of Markets Quarterly, Summer 1987.

150% if one also includes previously negligible interdealer transactions.\(^1\) Despite the volume increase, the competition-induced reduction in bid-ask spreads and commissions has taken a heavy toll on the profits of securities firms: partly as a result of the excessive entry and of the overcapacity accumulated at the time of the 'Big Bang', several securities firms have posted substantial losses and some have even withdrawn from the market (especially after the 1987 crash and the concomitant fall in trading volume). However, the competition from London brokers has also started biting into the profits of continental securities firms, especially in France and Holland.

2.2. Paris

In 1987, the Paris Bourse lost to London a large share of trade on French stocks: in the first 10 months of that year, the turnover on the screen-based quotation system of SEAQ International in London for the 23 French 'blue chip' stocks was on average 42% of the Paris turnover for the same stocks, and 17% of the total Bourse turnover (data from Conseil National du Credit, 1988, Annexe XV). The danger of losing more business to London pushed French policy-makers to radical reforms. The Bourse has been endowed with a computerized facility

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\(^1\) Before the 'Big Bang', dealers were trading face to face with each other, and it was uncommon for a dealer to accept an order that was ostensibly coming from one of his competitors. After the 'Big Bang', market makers were required to satisfy any order within the size for which they had quoted firm prices. This contributed to a surge in inter-dealer trading. Regulators argued that the ability to unload large positions on other dealers would increase market depth. In early 1989, this regulation has been changed: the obligation to trade at quoted prices was restricted to customer business.
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for continuous trading (CAC: cotation assistee en continu) closely patterned after that of the Toronto stock market (CATS: Computer Assisted Trading System). Starting in July 1986, continuous dealing with automated clearing has gradually replaced the old system of batch auctions with open outcry dealing (marche a la crie). The shift to the new system has been completed in 1989, except for 13 highly active stocks that are still being traded in open outcry with continuous auctions.

Moreover, in January 1988 a law assigned the monopoly of all stock trading to a set of newly designed financial intermediaries, the societes de bourse, which can act as counterparties to transactions, operating as dual-capacity dealers. This ends the French tradition of single-capacity intermediaries, the agents de change, and effectively opens intermediation on the stock exchange to banks and other financial institutions. To appease the existing intermediaries, this part of the reform is being phased in gradually. Finally, in July 1989 all existing regulation of commission charges has been scrapped, leaving their determination to competitive forces.

Thus, in many respects, the evolution of the Paris Bourse has followed the same path as the London market, and is converging towards a rather similar organizational pattern. The only persisting difference between the two trading systems is that London remains a dealership market, where market makers quote prices at which they stand ready to satisfy incoming orders, and Paris remains an auction market (albeit now a continuous one), where prices are determined by a computerized auctioneer in charge of balancing supply and demand. But even this difference may not persist for very long. It is increasingly being noticed that large institutional investors often prefer to trade French stocks in London because they value the fact that SEAQ market makers stand ready to supply instantaneously firm quotes, net of commission expenses, even for sizable transactions. Some French firms have thus started to imitate London market makers, quoting prices outside the Bourse. In June and July 1989 this practice, hitherto illegal, has been sanctioned by new regulations introduced by the Conseil des Bourse de Valeurs: now a selected group of societes de bourse is allowed to buy and sell blocks of shares on own account outside the Bourse at prices different from those prevailing on the market. To coordinate these trades with the auction market of the Bourse, these market makers must report them within five minutes to the floor. Moreover, if the off-exchange

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2 The transition has been softened by granting the status of societe de bourse to all the existing agents de change and forbidding the creation of new such intermediaries until the end of 1991, so that the agents have been enabled to transform their businesses gradually by opening up their capital to banks and other intermediaries.
transaction has occurred at a price outside the *fourchette*, i.e. the spread between the best buy and sell order outstanding on the market, the market maker is obliged to place an order at that price on the floor. Thus, market makers have in effect been allowed to live side-by-side with the continuous auction on the Bourse.

2.3. Amsterdam

This dual system resembles closely the Dutch market. Although the Amsterdam Bourse retains its old trading system (run by the *hoekman*, a single-capacity trader similar to the now extinct London jobber), since 1987 it has supplemented it with the Amsterdam Interprofessional Market (AIM) – a block trading system designed specifically for the needs of institutional investors. AIM allows institutional investors, banks and brokers to trade directly for deals exceeding DFL.1 m, with the only obligation to report trades promptly to the trading floor, so as to keep prices in the two markets in line with each other.

2.4. Madrid and Milan

Spain and Italy, where the stock market has traditionally been run along the lines of the former Paris system, are closely following the French example. In Madrid the reforms are already being implemented, while in Italy they have been discussed for four years but so far have remained on paper, blocked in the quagmire of local politics. In July 1989, the Madrid stock market adopted continuous trading, and replaced the *agentes de cambio* with *sociedades de bolsa* that can trade on own account and open their capital to banks, insurance companies and foreign securities firms.

The push for reforms in the stock exchanges of the Latin countries – France, Spain and Italy – has been stimulated not only by the British competition and the increasing openness of their financial markets, but also by the prior development of their markets for public debt. In all three countries, the need to finance conspicuous deficits has led to the development of well organized, continuous-time markets for public debt, operated by institutional investors (mostly banks) as market makers. The experience gained in setting up these markets for public debt, generally conducted under the close supervision of the Central Bank, is now feeding into the innovations in the local stock exchanges.

2.5. Frankfurt

Until very recently, among the major European markets, only the German stock exchanges had been immune from this wave of institutional change. This may be because the German equity market is even
more closely dominated by the banks than the other continental exchanges. Banks literally manage the German market: only they are legally entitled to channel orders to the exchange. Even institutional investors entrust their portfolio management to banks, rather than to securities firms as in London or Paris. As a result, reforms cannot rely on a pre-existing group of independent broker-dealers operating the exchange.

In Frankfurt, well representative of the German situation, trade occurs in auctions as in the other continental exchanges. The only difference relative to the system used, say, on the French Bourse before 1986, is the existence, for the most active stocks, of a continuous auction throughout the day in addition to the batch auction at the opening of the market. This continuous auction works along the same lines as in Paris, although it is not automated as the French CAC system: the auctioneer is still a public official, named Kursmakler.

So far, the only changes that have affected the Frankfurt market are technical ones (greater deployment of electronic technology in order routing, price information dissemination and settlement). In fact, Frankfurt has the most efficient and the safest settlement system in the world. Nor surprisingly, it is the banks that are going to manage the process of important institutional changes now under way. The major banks are already operating an interdealer market where they act as market makers, outside the stock exchange proper. Since January 1990, this interdealer market operates officially outside of the trading hours of the exchange: the resulting dual system goes under the name of IBIS project. There are plans to scrap over a two to three year hozizon the official auction market run by the Kursmakler, replacing it with a dealership market just like SEAQ in London – with the large German banks operating as market makers. But for this final step to occur, legislative change will have to take place.

2.6. Convergence of European exchanges?

A natural question is whether European stock markets are converging towards a similar trading system. In certain respects, they are: continuous markets, dual-capacity intermediaries, liberalization of commissions, removal or reduction of turnover taxes and stamp duties are all common features of the various national reforms. The only remaining divide is between dealership and auction systems or, as some prefer to put it, quote-driven and order-driven markets. So far, this dividing line distinguishes London from all the continental exchanges. However, even this line is starting to fade away: in Amsterdam and Paris a dealership market for large orders is now allowed to compete with a
retail auction market, in Frankfurt a similar dual system is in the works, and a pure dealership system may prevail in due time. Thus, a tentative conclusion is that the organizational pattern of European exchanges is converging to a model that includes some features of the British market. For wholesale trading, continental policy-makers are leaning towards London's dealership system. For retail business, they are more inclined to revamp the traditional auction markets. In the next sections we try to assess the merits of this two-pronged strategy in the light of the available evidence.

3. Trading volume and transaction efficiency in Europe: evidence for the 1980s

3.1. The location of equity trading

3.1.1. The broad picture: London's dominance. The dichotomy between the huge stock market of London and the smaller ones across the Channel is a traditional feature of Europe. The total value of the domestic companies listed in London is three times as high as in Paris or Frankfurt, and approximately five times as high as in Milan (see Table 2, column 1). This is not due to the greater size of the companies listed in London (the average market value of domestic companies is smaller than in most other European countries, Table 2, column 2), but to their large number. It may be that on the continent the owners of medium- and small-size companies are more reluctant to float shares. Obviously the total value of the companies listed on a stock exchange is the prime determinant of its trading volume: in fact the ranking of the main European markets is the same whether they are ordered by capitalization or by turnover, except for Zurich (Table 2, column 3).

However, a market can also be characterized by relatively active trade for reasons other than its sheer size: other things being equal, one would expect shares to change hands more frequently in markets with lower transaction costs and with higher liquidity (we shall see presently the various meanings that can be attached to market liquidity). The turnover ratio, that is turnover divided by capitalization, is a measure of trading activity that abstracts from market size and can be related to transaction costs and liquidity. Unfortunately, the heterogeneity of national definitions of turnover makes the figures on turnover ratios hard to compare across countries, and limits the economic meaning of this measure. This is mainly because the Milan, Madrid and Brussels figures refer only to trades performed on the floor of the exchange, and leave out the large volume of off-exchange trading – contrary to what is done in the other exchanges. Even leaving aside Milan, Madrid
Table 2. Capitalization and turnover in European stock markets (a)  
(1988, £ billions)

<table>
<thead>
<tr>
<th></th>
<th>Total market capitalization (domestic)</th>
<th>Average company capitalization (domestic)</th>
<th>Turnover (b) of which: Total foreign shares</th>
<th>Turnover ratio (%) (domestic companies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>London (ISE)</td>
<td>377.2</td>
<td>0.21</td>
<td>202.6</td>
<td>46.4</td>
</tr>
<tr>
<td>All German exchanges</td>
<td>139.3</td>
<td>0.23</td>
<td>102.0</td>
<td>6.05</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>126.8</td>
<td>0.37</td>
<td>58.2</td>
<td>5.9</td>
</tr>
<tr>
<td>Paris (c)</td>
<td>123.3</td>
<td>0.27</td>
<td>37.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Zurich</td>
<td>77.7</td>
<td>0.48</td>
<td>61.6</td>
<td>20.9</td>
</tr>
<tr>
<td>Milan</td>
<td>75.3</td>
<td>0.33</td>
<td>17.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Amsterdam</td>
<td>62.8</td>
<td>0.27</td>
<td>16.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Madrid</td>
<td>50.4</td>
<td>0.14</td>
<td>11.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Brussels</td>
<td>32.7</td>
<td>0.17</td>
<td>5.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>


Notes: (a) Total and average capitalization are as of December 30, 1988. Turnover refers to the whole of 1988, and does not double-count purchases and sales. (b) Turnover data are not comparable across all the countries in the table: in the case of German exchanges, Amsterdam, and Zurich, turnover includes off-exchange dealing, and in London it includes interdealer business (beside customer business); in Milan, Madrid and Brussels, instead, it only includes trade on the exchange and, therefore, is a severely downward-biased measure of trading volume (in all three exchanges off-exchange dealing is known to be substantial). Paris is exempt from this problem, due to the legal obligation to concentrate the orders on the official market in the French system. (c) Data for the Paris Bourse refer only to the main segment of the market (the ‘Cote Officielle’).

and Brussels, the turnover ratios in column 4 of Table 2 convey some information. London, Frankfurt and Zurich emerge as the most active exchanges if the comparison is limited to individual markets. They have also relatively high turnover of foreign shares, both in levels and as a proportion of total turnover. Indeed, in London to the £46 bn. foreign shares traded on the International Stock Exchange (ISE), we should add the estimated £87 bn. turnover of the London SEAQ International Exchange which specializes in foreign equities (figure from Tonks and Webb, 1989, who report that the average daily turnover on that market in 1988 is estimated to be £350 mn.).

To what extent does this picture result from changes over the 1980s? Figure 1 shows the recent evolution of the relative shares of EC equity turnover (comparability problems prevent the construction of longer time series). Immediately after ‘Big Bang’, London gained at the expense of Frankfurt, Paris and Milan. Since then, Frankfurt and, to
Figure 1. Relative shares of EC equity turnover

a lesser extent, Paris have started to recover market shares. However, the estimate of London’s gain is quite conservative because it excludes interdealer business and trading on SEAQ International.

The importance of SEAQ International as a marketplace for continental equities is highlighted by Table 3. The top panel of the table shows how London trading in foreign stocks compares to total trading in domestic stocks in the country of origin. The bottom panel reports instead London trading in foreign stocks as a proportion of trade in the same stocks in their respective national market: it indicates how much trade gets diverted to London once a stock starts being traded there, and thus provides a better measure of the threat posed by SEAQ International to continental markets.

The table shows a difference between those markets which have been exposed to competition from London for a few years – Paris and Frankfurt – and those that are starting to feel its bite only now – Milan and Madrid. Of the two ‘veteran’ markets, Paris appears to have been more severely affected than Frankfurt, while of the two ‘newcomers’, Milan is clearly the market that is losing more business to SEAQ dealers.

Over time the picture for Paris appears rather mixed: as a proportion of total domestic turnover on the Paris Bourse, SEAQ trading in French stocks is now lower than it was in 1987, when business in London was
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Table 3. Continental stocks traded in London (SEAQ International) (a)

<table>
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<tbody>
<tr>
<td>As % of total domestic turnover in the respective national markets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paris</td>
<td>17.31</td>
<td>6.74</td>
<td>12.07</td>
</tr>
<tr>
<td>Frankfurt</td>
<td>N/A</td>
<td>6.70</td>
<td>8.02</td>
</tr>
<tr>
<td>Milan</td>
<td>—</td>
<td>—</td>
<td>4.85</td>
</tr>
<tr>
<td>Madrid</td>
<td>N/A</td>
<td>0.04</td>
<td>0.8</td>
</tr>
<tr>
<td>As % of turnover for the same stocks in the respective national markets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paris (no. of stocks)</td>
<td>41.29</td>
<td>27.45</td>
<td>50.17</td>
</tr>
<tr>
<td>(no. of stocks)</td>
<td>(24)</td>
<td>(29)</td>
<td></td>
</tr>
<tr>
<td>Frankfurt (no. of stocks)</td>
<td>N/A</td>
<td>12.65</td>
<td>16.21</td>
</tr>
<tr>
<td>(no. of stocks)</td>
<td>(13)</td>
<td>(15)</td>
<td></td>
</tr>
<tr>
<td>Milan (no. of stocks)</td>
<td>—</td>
<td>—</td>
<td>49.58</td>
</tr>
<tr>
<td>(no. of stocks)</td>
<td>(9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madrid (no. of stocks)</td>
<td>N/A</td>
<td>0.53</td>
<td>6.15</td>
</tr>
<tr>
<td>(no. of stocks)</td>
<td>(2)</td>
<td>(4)</td>
<td></td>
</tr>
</tbody>
</table>

Sources: The data for Paris in 1987 are drawn from Conseil National du Credit (1988), Annexe XV; the data used to construct all the other figures have been supplied by SEAQ International, the Societe des Bourses Francaises, Dresdner Bank, Euromobiliare S.p.A., the CONSOB and the Banco de Espana.

Notes: (a) All percentages in the table are averages of monthly figures. Dashes (—) indicate that no stocks from that market were traded on SEAQ International. Figures for Paris in the top panel are based on turnover in the marche a reglement mensuel. The number of companies is measured in June of the relevant year.

boosted by the 'grey market' in the shares of the French public corporations undergoing privatization. However, as a proportion of trading on the same stocks in Paris, SEAQ turnover has risen steeply in the first half of 1989, showing that competition by London dealers still poses a real threat for the Paris Bourse. Things are far less controversial for Italian stocks. The volume of business lost by Milan to London, beside being high relative to the comparable figure for Madrid, has increased at an impressive rate: looking at monthly figures (not reported in the table), one finds that in June 1989 London trading on Italian stocks amounted to a staggering 70.6% of the Milan turnover for the same stocks, up from 22.4% in January. Since the information in Table 3 covers a very short time span, one should be cautious in drawing conclusions. However, it is hard to escape the impression that Italian inertia is proving less effective at facing the British competition than the activist zeal of French reformers.

The number of foreign companies listed provides another indicator of the ability of a market to attract business from abroad. Figure 2 shows these numbers, standardized by the sum of all the domestic listings in the EC (Italy and Spain are missing because they have no
foreign listings). Again London holds the lion’s share: if one takes into account the companies traded on SEAQ International, foreign listings are more numerous and they have grown more rapidly than elsewhere. On the continent, only Paris, Frankfurt and tiny Luxembourg stand out for their ability to attract foreign companies.

In conclusion, over the 1980s London has maintained its initial pre-eminence relative to Continental exchanges, exploiting its first-mover advantage in the process of liberalization: the ‘Big Bang’ and the creation of SEAQ International have been its main assets. However, there are some signs that Frankfurt and Paris are starting to recover some of the lost ground.

3.1.2. Factors affecting stock markets’ location. The key question really is: why this pattern across Europe? Three main factors attract business to a financial market: lower transaction costs, higher market liquidity and simply tradition which so often permeates the behaviour of international investors. Obviously this third factor can very well interact with the two first to reinforce their effects. Indeed, it is reasonable to assume that higher trading activity reduces unit transaction costs (due to fixed costs or external economies in brokerage or dealership) or increases market liquidity (because of the implied reduction in the market power of each
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trader). Lower transaction costs and higher liquidity tend in turn to stimulate trading activity, creating a 'virtuous circle'. Tradition may actually just help in perpetuating this virtuous circle on some markets, at the expense of others, trapped in a symmetric 'vicious circle' of high transaction costs, low liquidity and low trading volume. (The possibility of 'virtuous' and 'vicious circles' of this kind on equity markets has been investigated by Pagano, 1989a, b, and Chatterjee, 1988.)

While the importance of tradition obviously cannot be quantified at all, one can attempt to quantify transaction costs and some aspects of liquidity. Before that, however, it is crucial to draw a line between the transaction costs and liquidity, and to clarify the various dimensions of the notion of 'liquidity'. Transaction costs indicate the explicit costs that are paid in brokerage commissions and taxes to carry out a transaction plus the implicit costs of the time required for its settlement. Any other deviation between the actual transaction price of a stock and the best estimate of its true value is instead a symptom of illiquidity: for instance, a stock with a wide bid-ask spread is more illiquid than one with a tight spread, because a wide spread will induce transaction prices to deviate from the mid-quote price, which is the best market estimate of the asset's true value.

An illiquid market imposes an additional cost on traders, on top of explicit transaction costs - a market-related cost, like the bid-ask spread. At times, it will be necessary to distinguish between various facets of the notion of liquidity. We shall call a market 'tight' if its prices are close to true market values for small transactions, and 'deep' if that is true also for large transactions. For example, if the bid-ask spread is small at the minimum size but widens substantially for large-size trades we shall say that the market is tight but not deep. In addition to tightness and depth, there is a third facet to the notion of liquidity: its time dimension, that is often termed 'immediacy'. A market where orders are executed rapidly at a stated price offers greater immediacy than a market where finding a counterparty takes time or exposes traders to execution risk. Unfortunately, while we can attempt to put numbers on market tightness and depth, for immediacy it is very hard to go beyond vague qualitative assessments.

3.2. Transaction costs

Table 4 displays a synthetic measure of explicit roundtrip transaction costs: it is the sum of commissions and taxes that one has to pay on the purchase and sale of the same amount of stock, as a percentage of the value of the trade. The two panels of the table report two different sets of estimates of these costs: the top panel shows estimates based on a
Table 4. Explicit transaction costs on major European markets: Percentage cost of buying and selling (roundtrip transaction) (taxes on transactions, stamp duties and commissions) (%)

<table>
<thead>
<tr>
<th>Private investors</th>
<th>Italy</th>
<th>France</th>
<th>Germany</th>
<th>UK</th>
<th>Spain</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2,500</td>
<td>1.68</td>
<td>1.84</td>
<td>2.70</td>
<td>3.95</td>
<td>0.9</td>
<td>3.24</td>
</tr>
<tr>
<td>$25,000</td>
<td>1.68</td>
<td>1.84</td>
<td>2.70</td>
<td>2.11</td>
<td>0.85</td>
<td>1.98</td>
</tr>
<tr>
<td>$100,000</td>
<td>1.02</td>
<td>1.84</td>
<td>2.70</td>
<td>1.65</td>
<td>0.85</td>
<td>1.725</td>
</tr>
<tr>
<td>Institutional investors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500,000</td>
<td>1.02</td>
<td>1.15</td>
<td>2.20</td>
<td>1.075</td>
<td>0.85</td>
<td>1.34</td>
</tr>
<tr>
<td>Settlement time</td>
<td>end of subseq. month or immediate for a 1% commission</td>
<td>end of subseq. month</td>
<td>2 days</td>
<td>10 business days</td>
<td>Friday of week of trade</td>
<td>10 business days</td>
</tr>
</tbody>
</table>

Estimates from the *Quality of Markets Reports*

<table>
<thead>
<tr>
<th>Domestic investors</th>
<th>France</th>
<th>Germany</th>
<th>UK</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>£10,000</td>
<td>2.14</td>
<td>1.70</td>
<td>2.47</td>
<td>3.19</td>
</tr>
<tr>
<td>Foreign investors</td>
<td>1.90</td>
<td>1.45</td>
<td>1.90</td>
<td>3.19</td>
</tr>
<tr>
<td>Domestic investors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>£100,000</td>
<td>1.88</td>
<td>1.70</td>
<td>1.12</td>
<td>2.65</td>
</tr>
<tr>
<td>Foreign investors</td>
<td>1.66</td>
<td>1.45</td>
<td>1.04</td>
<td>2.65</td>
</tr>
</tbody>
</table>


set of published sources, while the bottom panel displays estimates computed by the Quality of Market Unit of the London stock exchange. They complement each other, because the top panel distinguishes between private and institutional investors, while the bottom one takes into account the differential tax treatment of domestic and foreign investors, that tends to favour the latter in most countries.

Unfortunately, the two sets of estimates disagree on several points, the main one being the figures for Germany. However, they agree on one issue. While the London market is not competitive with continental markets at low transaction sizes, it is competitive for block trades: its schedule of charges is steeply declining in transaction size, more so than in any other country in the table. For large transactions, a French, German or Dutch investor pays a lower transaction cost in London than on the domestic market (an Italian is virtually indifferent), while in general for small- and medium-sized transactions this is not true. In fact, for these transactions a British investor ends up paying less if he trades on the Paris Bourse rather than on the London stock exchange.
Stock markets

(several British, French and third-country stocks are listed in both markets).

The table also reports official estimates for settlement times. In practice, settlement times often exceed the official figures by a wide margin, especially when there are large unforeseen increases in turnover. This happened, for instance, in Milan during the stock price rally of early 1986 and in London during the crash of 1987. Nevertheless, the approximate ranking in the table is probably correct — with Germany outdistancing all other EC exchanges for its settlement efficiency, Italy lagging behind the rest of the pack, and other exchanges somewhere in the middle between these two extremes.

3.3. Market liquidity

In a dealership market, liquidity is easy to measure: one just looks at the bid-ask spread that dealers demand on a given transaction. If there is a variety of bid and ask quotes by several dealers, one can concentrate on the best outstanding quotes on either side of the market, the so-called 'market touch'. What about an auction market? In effect an implicit bid-ask spread exists also on an auction market. Even though no dealer is setting quotes there, it is generally the case that in selling even a modest amount of stock one gets a lower price than one has to pay to buy it. To satisfy an incoming order, speculators require a premium from buyers and impose a penalty on sellers, for precisely the same reasons that induce dealers to demand a bid-ask spread: they need to be compensated for taking risky long or short positions, for the risk of trading with an insider, and for the costs that they incur by maintaining a presence on the market.

Roll (1984) has proposed a very simple method to estimate the implicit bid-ask spread of a market, using solely transaction prices at relatively high frequencies. He has shown that when the market reflects all available information, including confidential information (the so-called strong form of market efficiency), the implicit bid-ask spread is negatively related to the covariance between returns on the stock in two subsequent periods. This is quite intuitive: as successive buy and sell orders hit the market, transaction prices bounce back and forth between the bid and the ask, thus inducing a negative covariance in the returns on the stock. The wider the spread, the higher this negative covariance.

\[ s = 200 \sqrt{-\text{cov}(r_t, r_{t-1})}, \]

where \( r_t \) is the percentage return on the stock between time \( t-1 \) and time \( t \).
This measure is far from perfect, however. If market prices do not reflect instantaneously all new public information (if they are informationally inefficient), stock returns will tend to show a positive covariance. Indeed, if information filters slowly into prices, a piece of good news generates a sequence of price increases, and thus raises stock returns above their normal level for several periods. Even in an efficient market, returns can be positively correlated if expected returns are: Campbell (1989) documents significant evidence of persistence in expected returns. Thus, the economic meaning of Roll’s measure is likely to be clouded. As we shall see, for most European stocks the data are subject to this problem.\(^4\)

In Table 5 we produce estimates of Roll’s measure of implicit bid-ask spreads for a sample of companies in Italy, Germany and France. The results show that, using daily data, the measure gives an appropriately positive spread only for a minority of stocks.\(^5\) The number of companies for which the measure is positive becomes higher when one moves to weekly data, presumably because at that frequency a greater portion of the adjustment of prices to new information has taken place, and the inefficiency in price formation is less visible. Our estimates of Roll’s implicit spread indicate that it tends to rise immediately after large and sudden declines in stock prices: in Germany and in France (daily data) it increases in 1987–88, in coincidence with the October 1987 crash, and in Italy it peaks in 1986 (in that year Milan stock prices doubled between January and May and then fell by 28% in June). This is reassuring, because it indicates that Roll’s measure is indeed related to actual bid-ask spreads: in the markets where spreads are observable, such as London, they did rise substantially for several months after the 1987 crash, clearly reflecting the higher volatility and decreased turnover.

Comparing averages over the entire period, Roll’s measure of the implicit market spread is significantly greater than zero only in Italy (weekly data). However, this is mainly a reflection of the fact that in the Italian sample there is a relatively large subset of medium and small companies (Roll’s implicit spread is inversely related to company size,

\(^4\) Roll’s measure of the spread, being based on a simple order-processing cost model of dealers, does not capture an important determinant of the market spread: asymmetric information (dealers must also be compensated for bearing the losses inflicted by insider traders). Roll rules out asymmetric information by assuming strong-form market efficiency. Inventory holding costs (dealers have to be compensated for holding risky positions) are also not fully captured by Roll’s measure.

\(^5\) When the covariance is positive, Roll (1984) carries the ‘minus’ sign outside the square root. Although this is incorrect (and leads to the nonsensical result of a negative estimate for the implicit spread), it signals the fact that for that stock the negative autocorrelation arising from the spread is swamped by the positive one.
### Table 5. Estimates of Roll's implicit bid-ask spread (%)

<table>
<thead>
<tr>
<th></th>
<th>Italy (69 stocks)</th>
<th>Germany (56 stocks)</th>
<th>France (13 to 16 stocks (a))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily data</td>
<td>Weekly data</td>
<td>Daily data</td>
</tr>
<tr>
<td>1984</td>
<td>0.029</td>
<td>0.313</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.827)</td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>−0.618 (-3.85)</td>
<td>1.402 (3.031)</td>
<td>−0.327 (-2.72)</td>
</tr>
<tr>
<td></td>
<td>(0.27) (3.815)</td>
<td>(0.471)</td>
<td>(0.802)</td>
</tr>
<tr>
<td>1987</td>
<td>−0.144 (-0.88)</td>
<td>1.185 (0.017)</td>
<td>−0.131 (−0.30)</td>
</tr>
<tr>
<td></td>
<td>(0.11) (3.097)</td>
<td>(0.326)</td>
<td>(1.156)</td>
</tr>
<tr>
<td>1989</td>
<td>−0.135 (-0.80)</td>
<td>0.495 (1.34)</td>
<td>0.326 (3.32)</td>
</tr>
<tr>
<td></td>
<td>(0.17) (2.24)</td>
<td>(0.306)</td>
<td>(0.971)</td>
</tr>
<tr>
<td>1984–89</td>
<td>−0.183 (-2.65)</td>
<td>0.745 (−3.23)</td>
<td>−0.306 (0.02)</td>
</tr>
<tr>
<td></td>
<td>(−1.23)</td>
<td>(−3.23)</td>
<td>(0.02)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>% of stocks with positive estimates spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.7</td>
<td>59.4</td>
</tr>
</tbody>
</table>

|                | 26.8                                       |
|                | 46.4                                       |
|                | 68.7                                       |
|                | 62.5                                       |

Regression of spread on a constant and logarithm of capitalization

| Size effect    | −0.391 (−5.40)                             |
|                | −0.001 (−0.01)                             |
|                | −0.105 (−2.18)                             |
|                | −0.032 (−0.21)                             |
|                | 0.303 (0.88)                              |
|                | 0.677 (0.75)                              |
| R²             | 0.302                                      |
|                | −0.015                                     |
|                | 0.070                                      |
|                | −0.019                                     |
|                | 0.052                                      |
|                | 0.039                                      |

---

Sources: Italy: Listino Borsa Valori di Milano; Germany: data supplied by Dresdner Bank; France: data supplied by the Société des Bourses Françaises.

Notes: t-statistics are given in parentheses. Prices are from the daily batch auction: for Italy, they are closing listino prices; for Germany, standard prices fixed by the Kurssmakler; for France, prices from the opening auction of 10:00 a.m. (a) France: numbers of stocks in sample are 13 for 1985, 14 for 1986 and 16 for 1987.

as shown by the regressions of the daily spread on the log of capitalization reported at the bottom of the table). To control for this size effect we report in Table 6 the average spread for classes of companies of comparable capitalization. For large- and medium-size companies the estimated spread is relatively low in Italy and Germany, whereas for small companies it is higher in Italy than in France. However, it should be stressed that the results for France should be treated with great

---

6 The most likely reason why this size effect is absent in the other two countries is that the German sample is heavily unbalanced towards large companies, whereas the French sample is very small. Interestingly, the size effect that we identify for Italy appears also in the estimates produced by Roll (1984) using NYSE daily and weekly data. He interprets this as a reflection of the lower liquidity of smaller companies. The findings that Roll's measure of the spread is negative for many stocks and is higher at weekly than at daily frequencies are also common to his 1984 study.
Table 6. Roll’s measure: comparative results for stocks of the same size class (size measured by market capitalization) (%)

<table>
<thead>
<tr>
<th>Capitalization (1988, end of year values)</th>
<th>Italy</th>
<th>Germany</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocks between £900 and 12,000 m</td>
<td>-0.666</td>
<td>-0.127</td>
<td>0.682</td>
</tr>
<tr>
<td></td>
<td>(4.62)</td>
<td>(1.01)</td>
<td>(2.33)</td>
</tr>
<tr>
<td>Number of stocks</td>
<td>35</td>
<td>37</td>
<td>8</td>
</tr>
<tr>
<td>Stocks between £3 and 900 m</td>
<td>0.420</td>
<td>—</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>(1.66)</td>
<td>(0.35)</td>
<td>(0.57)</td>
</tr>
<tr>
<td>Number of stocks</td>
<td>30</td>
<td>—</td>
<td>8</td>
</tr>
</tbody>
</table>

Sources and Notes as in Table 5.

cautions, given the very small number of companies in the French sample.

A more accurate and direct comparison of the market bid-ask spread is possible for the London market and the continuous auction market in Paris (Table 7). In London the average market ‘touch’ is 0.8% for alpha stocks (the highest-volume shares) for transactions of the minimum size (1,000 shares). As one moves to less frequently traded stocks, the spread increases substantially: it becomes 2 to 3% for beta stocks and 3 to 5% for gammas. The analogue of the bid-ask spread at minimum size on the continuous auction market in Paris (the fourchette) is the spread between the best buy and sell limit orders outstanding at a given time (except of course at the opening batch auction of 10:00 a.m., where the fourchette does not exist). In the bottom panel of Table 7, we report the average fourchette for various classes of stocks over approximately the same period as the spreads in the top panel. The first class (with average daily turnover above FF. 9 m) is comparable with the alpha stocks class in London, and features a fourchette around 0.5%. Like the bid-ask spread in London, the fourchette rises for less traded stocks, though less steeply; it reaches a maximum of 1.5% for the least active stocks.

Thus, the Paris fourchette is generally lower than London’s spreads, and rises by less as one moves to less active stocks. Since the fourchette applies to small transactions, like the spread at minimum size, one can conclude that for small transactions the Paris Bourse has a double advantage over the London market: it offers to the small investor both lower explicit transaction costs and higher liquidity. This statement needs to be qualified, however. First, it does not imply that the Paris Bourse is more competitive for large transactions, especially since
Table 7. The market bid-ask spread in London and Paris: percentage cost of buying and selling

<table>
<thead>
<tr>
<th></th>
<th>Alpha stocks</th>
<th>Beta stocks</th>
<th>Gamma stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 1987 Pre-crash</td>
<td>0.83</td>
<td>1.76</td>
<td>3.00</td>
</tr>
<tr>
<td>September 1988</td>
<td>0.80</td>
<td>2.88</td>
<td>5.00</td>
</tr>
<tr>
<td>December 1988</td>
<td>0.85</td>
<td>3.20</td>
<td>5.30</td>
</tr>
<tr>
<td>March 1989</td>
<td>0.84</td>
<td>2.57</td>
<td>4.76</td>
</tr>
</tbody>
</table>

Average 'fourchette' in Paris by turnover Daily average turnover in million FF

<table>
<thead>
<tr>
<th></th>
<th>&gt;9</th>
<th>4-9</th>
<th>2-4</th>
<th>1-2</th>
<th>&lt;1</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 1988</td>
<td>0.54</td>
<td>0.67</td>
<td>1.00</td>
<td>1.20</td>
<td>1.46</td>
</tr>
<tr>
<td>November 1988</td>
<td>0.52</td>
<td>0.63</td>
<td>1.00</td>
<td>1.21</td>
<td>1.35</td>
</tr>
</tbody>
</table>


Explicit transaction costs are lower in London in this segment of the market: the Paris Bourse is a tighter market, but SEAQ may be a deeper one. Second, to be accurate, the comparison between the liquidity offered by the two markets must be effected on the same stocks and over the same time period. The empirical analysis reported in the next section deals with both these problems.

4. The design of the trading mechanism: the key options

Upon designing the mechanisms of a stock exchange, policy-makers confront four key choices. First, is the exchange to work as an auction market or as a dealership market? Second, if one opts for the auction market, should the auction be structured as a sequence of discrete batches, possibly at daily intervals, or as a continuous auction? (With continuous auction, the market clears every time at least two orders can be executed against each other. A dealership market is inherently continuous.) Third, should one provide incentives or impose rules to favour the concentration of trade on a single market, or rather allow off-exchange dealing? Finally, again in the context of an auction market, should one allow exchange members to act as brokers and to deal on own account?

Obviously, these are not the only choices that matter in the operation of a stock market. The amount and timeliness of information on prices and orders and the regulation of take-over bids are equally important. However, these are the choices more directly related to the trading mechanism. It should be noticed that some of these decisions naturally imply other decisions. For instance, allowing double-capacity dealing implies that new financial intermediaries must be given access to stock-exchange membership, since the required capital typically exceeds by
far what is required to operate as a broker. This does not necessarily imply that the authorities will remove all barriers to entry—the reforms in European exchanges have left some restrictions to entry in place.

Inevitably, redesigning the trading system of a stock exchange involves facing one or more of these choices. For instance, at different stages, the reform of the French Bourse has involved all four of these choices. The first stage of the reform has concerned the frequency of trade and the capacity of exchange members. The Bourse has been turned into a continuous market with dual-capacity dealers, retaining its two other traditional features, the auction market and the compulsory concentration of trade. In the second stage of the reform, started in 1989, even these two traditional features have been partly altered, as French policymakers have allowed a dealership market to live alongside the auction market, although in a coordinated fashion. Spain, instead, has so far implemented only the changes that formed the first stage of the French reforms.

4.1. Auction markets versus dealership markets

4.1.1. Costs and benefits of dealers. Theories contrasting auctions and dealership markets are quite rare, possibly because these two trading systems differ in rather subtle ways. Some authors regard dealership markets as ones where bid and ask prices are constant, independent of aggregate trading volume (Pithyachariyakul, 1986; Mendelson, 1987). However, in practice dealers do quote prices which depend on the size of individual transactions. Some observe that most dealership markets are continuous, while auction markets are often discrete; however, the frequency of trading cannot be the central difference, because continuous auction markets are increasingly common (as in Toronto, Tokyo, Paris and now Madrid). Others focus on the presence of dealers’ monopoly power; but in Europe, the UK dealership system is highly competitive, and even on American exchanges monopoly specialists (NYSE and AMEX) have to compete with floor or upstairs traders.

One could be tempted to dismiss the distinction between dealership and auction markets as being inessential from an economic viewpoint: after all, the speculators of auction markets can be regarded as playing the same economic role as dealers, as both absorb temporary imbalances of supply and demand to make a profit. In spite of this similarity dealers are a special breed of speculators because of their many implicit and explicit obligations and privileges. Some of the institutional constraints on dealers’ behaviour are rather nebulous, as the exchange authorities form some opinion of what constitutes ‘good behaviour’ for a dealer, and set indirect rewards and punishments (for example, a NYSE
specialist who is considered to set a tight market and provided high liquidity in the October 1987 crash is rewarded by having attractive newly-listed securities allocated to his care). This can lead dealers to adopt strategies that are not profit-maximizing in the short run, for example, by quoting narrow spreads in an extremely unstable market. A more obvious example of the constraints on dealers' behaviour is their obligation to quote firm prices publicly: this is a handicap insofar as it forces them to reveal much of their trading strategy to all other market participants. The offsetting advantage is that other traders cannot compete with them by exposing limit orders directly to the rest of the market.

The fact that dealers have to quote firm prices implies that each trader is insured against execution risk, i.e. the risk of finding few or no counterparties to trade. In contrast, in an auction market, a trader who places a market order faces execution risk because his order may execute at an unfavourable price if no offsetting order reaches the market at the same time. On the other hand, if the trader tries to insure himself against this kind of outcome by placing a limit order, he runs the risk that his order may simply not be executed: execution risk takes the form of uncertainty on the actual execution of the order, rather than that of uncertainty on the price at which it will execute. In a dealership market either form of execution risk is absent: the dealer quotes a bid and an ask price, and at those prices he stands ready to trade against incoming orders.

Thus, the dealer can be seen as a provider of insurance against execution risk. Is such insurance socially efficient? In other words, are customers better off buying insurance from dealers than bearing the risk themselves? We attempt to answer this question in a companion paper which is described in Box 1. The key result is that it is efficient for dealers to perform the insurance role only if they are sufficiently less risk-averse than their customers. In particular, the dealership market is superior if dealers are risk-neutral and customers are risk-averse. The hypothesis that dealers as a group may behave as if they were less risk-averse than their customers is not far fetched: this can happen if they divide orders among themselves so as to share the riskiness of the implied inventories, or if they have access to particularly favourable lines of credit to finance their positions or enjoy special tax treatment on their operations.

4.1.2. Do dealership markets actually offer higher liquidity? Most of the existing empirical studies on this issue have drawn on the experience of the US and Canada, where there are no pure batch auction markets like those in continental Europe and, therefore, are somewhat out of focus from
Box 1. The analytics of the choice between auction and dealership markets

In Pagano and Roell (1989) we consider a simple model of the market for a risky security under the two regimes. Customers are assumed to place market orders of 1 unit (they have inelastic demand functions). Each order must be entirely filled in a single transaction with another agent and at each instant the probability of a customer placing a buy or sell order is the same.

In the auction market, competitive speculators contribute to market liquidity by placing limit orders at the ask and bid prices. Since speculators are risk-averse, in equilibrium these prices just compensate them for the risk borne by adding 1 unit of the asset to their inventories (or going short by 1 unit). The customers' and the speculators' orders are aggregated and transacted at the market-clearing price. Customers bear execution risk in the form of price uncertainty: if a customer is lucky enough to encounter an offsetting order, the two orders cross directly at the market mid-price; if instead no counterpart order arrives, he will have to trade with the speculators at the less favourable limit prices, that reflect the risk premium required by the speculators. (One may object that in practice, on a continuous auction market such as the Paris Bourse, a market order will never transact with an offsetting market order inside the market's quotes, because the probability of the two orders hitting the market exactly at the same instant is virtually zero. However, on such a market a trader can attempt to place a limit order inside the current market quotes, hoping that it might be crossed promptly by an offsetting order, and then turn it into a market order if it does not execute. Our model captures precisely the situation that arises if a trader follows this strategy: the trader will transact inside the pre-existing market quotes if he is lucky, and will instead transact at those quotes if he is not.)

In the dealership market liquidity is provided by dealers who quote a competitive ask and bid price. Dealers are assumed to have the same degree of risk aversion as the speculators of the auction market. The bid-ask spread is just sufficient to keep the dealers content with being in business. The key difference from the auction market is that in the dealership market, offsetting customer orders cannot be crossed directly, and must instead go through the dealer just like all other orders. As a result, dealers earn the bid-ask spread also on these orders, although the spread that they charge is narrower than the limit order spread of the auction in equilibrium. In return, the dealership market protects customers against execution risk.
a European perspective. In the US the competing market models are the pure dealership system with competitive market makers of the National Association of Security Dealers (NASD, renamed NASDAQ after its automation), and the so-called ‘specialist’ system, a rather hybrid system used on the New York Stock Exchange (NYSE) and on the American Stock Exchange (AMEX). The specialist is an order book official who is also charged with performing as a market maker, and thus is allowed to trade on own account (but not to act directly as a broker for non-members). Although the specialist is a market maker, this system has one key ingredient of an auction market: all investors are entitled to expose their limit orders to the market, and thus do not have to trade at the terms set by the specialist’s quotes. In Canada, the system used at the Toronto Stock Exchange (TSE) is even closer to the auction market paradigm, as market makers have an even more limited role. Comparing these three models, Tinic and West (1974) have concluded that the liquidity of the TSE was unambiguously lower than that of the NYSE and of NASD. Using various indicators of liquidity, they also found that the hybrid market of the NYSE mildly outperforms the dealership market of NASD.

The competitive advantage of NYSE has been confirmed by Hamilton (1976), although it has decreased substantially with the automation of NASD (Hamilton, 1978). More recently, Marsh and Rock (1986), using the average absolute value of the percentage price change from trade to trade as an indicator of illiquidity, have found that this measure is 45% higher on NASDAQ than on AMEX, whereas AMEX and the NYSE are statistically indistinguishable. The difference seems largely attributable to higher bid-ask spreads on NASDAQ. Marsh and Rock attribute the lower spreads and higher liquidity of the AMEX and NYSE exchanges to the fact that on these markets all investors have the right to expose their limit orders to the market, whereas on NASDAQ competition in quote setting is restricted to a handful of professional market makers. (This conclusion must be qualified: average transaction size is higher on NASDAQ than on Amex, which may contribute to a higher measured spread.) Moreover, on the AMEX and NYSE exchanges, buyers and sellers can interact directly to effect inside-the-quote transactions, and this appears to be twice as frequent on AMEX as on NASDAQ.7

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7 Similar studies have been performed on equity options, traded both on AMEX with a specialist and on the Chicago Board Options Exchange (CBOE) by competitive market makers. Neal (1988), for instance, finds that for low-volume options, the AMEX spread is up to 20% lower than that on comparable CBOE options, and transactions inside the spread are more prevalent on AMEX. The difference between the two trading systems diminishes and indeed reverses for high trading volume. Neal concludes that the specialist system seems to dominate for low-volume but not for very high-volume instruments.
Thus, it seems that the hybrid specialist system of NYSE and AMEX – where market makers compete with public orders from the floor – tends to outperform both pure dealership markets like NASDAQ and markets where market making has a lesser role like the TSE. What is missing from this literature is a direct comparison between a pure dealership market, like that of London, and a pure auction market, like those of the European continent. We try to provide here such a comparison, using data on the French stocks that are traded both on the Paris Bourse and on SEAQ International in London. There are 28 such stocks, but in Paris only 16 of these are traded on the computerized CAC system (the others are traded with the continuous open outcry system), and for these stocks only there is an automatic record of the best outstanding limit orders (and thus of the fourchette), transaction prices and quantities. We have obtained from the Paris Bourse minute-by-minute data for these stocks from June 19 to July 13, 1989, and from SEAQ International a record of bid and ask prices in London for the same stocks from July 3 to July 13, 1989, at various times of each day. The advantage of these data is that we can match them perfectly by time of day. Using all the matched observations, the SEAQ average touch for these stocks is 1.52%, whereas the Paris fourchette is 0.41%. This confirms our earlier finding that the Paris market is tighter than the London one: in fact, the difference is substantially greater when the comparison is performed on the 16 cross-listed French stocks (1.1%) than when it is performed on the most active classes of British and French stocks in Table 7 (about 0.3%). Figure 3 compares the 16 stocks, ranked by decreasing market capitalization (left to right). Both the SEAQ spread and the fourchette tend to rise as size decreases, but the SEAQ spread tends to rise by slightly more: the difference between the two is 0.87% for the largest six companies and 1.25% for the smaller 10.

Even if the Bourse is tighter, in principle London could be deeper. To check this, we first consider the maximum size for which London dealers on SEAQ International quote firm prices for each of these 16 French stocks (Table 8, column 2): on average the SEAQ quotes are firm up to FF 1,368,021 in the period under consideration. This is the maximum order size for which the bid-ask spread can be expected to be constant in London. Then we ask by how much prices move in Paris when one attempts to carry out transactions of the same magnitude: this gives us a natural way to measure the market spread for large transactions in Paris, and to compare it with the (constant) spread in London.

To understand how our measure of the market spread is constructed, consider what happens when a new buy order is placed on the market.
If the order has a limit price above the current ask (or is a market order), it will immediately execute against the best outstanding sell order, i.e. against the upper bound of the fourchette. However, if the buy order is abnormally large, it will exceed the sell order at the upper bound of the fourchette, and part of it will execute against sell orders that carry a higher limit price: the buyer will 'slide' along the supply curve of the market, and the prices at which he transacts with each seller will trace out this curve. The price at which the entire order will actually execute is the average of these observed transaction prices. The same argument can be repeated for a large sell order. The difference between the average price at which large buy and sell orders execute on the market is what we call market spread, and will obviously vary according to the size of the order.

Since the available data relate to actual transactions rather than to orders, to estimate market spreads we had to reconstruct the underlying orders by aggregating contemporaneous or immediately subsequent transactions effected in the same direction by the same trader, and for each order we had to compute the corresponding prices as the weighted average of the relevant transaction prices (for details see Pagano and Roell, 1990, which also reports additional results). Moreover, we dropped all the observations that correspond to the 10:00 a.m. batch auction
where by definition there is no *fourchette* and no spread) and all the transactions performed inside the *fourchette*. A large portion of the most sizable transactions are in fact arranged outside the market and then executed at a price within the outstanding *fourchette* by a special procedure which allows the two orders to reach the market as a joint buy–sell order.

The results are reported in Table 8. For each company we report the average market spread for orders of size comparable to that for which SEAQ dealers quote firm prices (column 4). The average *fourchette* and the SEAQ spread are also reported (columns 3 and 1) for ease of comparison. It turns out that large transactions have virtually no appreciable price pressure effect in Paris. Even at the maximum size for which London dealers are ready to quote firm prices, the Paris spread is not much larger than the *fourchette*, and stays substantially lower than the SEAQ bid-ask spread (except for Pechinay). Thus, our data say that the Paris market is not only tighter but also deeper than the London market for French stocks.

Does this imply that an investor who wants to place a large order should prefer to trade in the Paris Bourse rather than on SEAQ International? The answer on this point must consider not only the difference between the London spread and the Paris spread in Table 8, but also the relative magnitude of transaction costs – especially commissions – on the two marketplaces. When this element is taken into account, things become less clear cut. From Table 4 we know that transaction costs for large trades are somewhat lower in London. Considering the difference in spreads in Table 8, the cost advantage of London is in general too modest to tip the balance in its favour. The problem is that Table 4 may underrate the cost advantage offered by SEAQ International to many customers, since its dealers often quote their prices net of commissions (‘about half of all non-UK equity deals are transacted without a commission’, *Quality of Markets Quarterly*, January–March 1989, p. 29). For the deals settled without commission, transaction costs on SEAQ are zero (in the UK there is no stamp duty on foreign equity deals): in this case London’s advantage on this account becomes significant, and slightly outweighs the spread advantage of the Paris Bourse. Thus, the choice between the two markets depends quite sensitively on whether SEAQ dealers require a commission for the transaction or not.

This conclusion deserves two words of caution. First, we have no information on market depth for extremely large orders: in our French data we observe virtually no such orders, and no data are available on SEAQ quotes for orders exceeding the size for which quotes are firm. Second, it should be recalled that transaction costs and market depth
## Table 8. Market depth in Paris and London (a)

<table>
<thead>
<tr>
<th>Company</th>
<th>Average SEAQ bid-ask spread (%)</th>
<th>Maximum size for which SEAQ quotes firm prices (no. of shares)</th>
<th>Average fourchette on the Paris Bourse (%)</th>
<th>Average market spread on the Paris Bourse (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSN</td>
<td>0.48</td>
<td>2,500</td>
<td>0.139</td>
<td>0.282</td>
</tr>
<tr>
<td>LVMH</td>
<td>1.56</td>
<td>500</td>
<td>0.307</td>
<td>0.314</td>
</tr>
<tr>
<td>Carrefour</td>
<td>1.42</td>
<td>500</td>
<td>0.391</td>
<td>0.484</td>
</tr>
<tr>
<td>Total</td>
<td>0.92</td>
<td>2,000</td>
<td>0.501</td>
<td>0.540</td>
</tr>
<tr>
<td>Eurotunnel</td>
<td>1.41</td>
<td>10,000</td>
<td>0.243</td>
<td>0.411</td>
</tr>
<tr>
<td>Pernod-Ricard</td>
<td>1.44</td>
<td>1,000</td>
<td>0.345</td>
<td>0.421</td>
</tr>
<tr>
<td>Bouygues</td>
<td>2.27</td>
<td>2,000</td>
<td>0.514</td>
<td>0.807</td>
</tr>
<tr>
<td>Havas</td>
<td>1.88</td>
<td>2,000</td>
<td>0.358</td>
<td>0.441</td>
</tr>
<tr>
<td>Bancaire</td>
<td>1.33</td>
<td>1,000</td>
<td>0.464</td>
<td>0.497</td>
</tr>
<tr>
<td>CCF</td>
<td>2.26</td>
<td>5,000</td>
<td>0.367</td>
<td>0.594</td>
</tr>
<tr>
<td>Source Perrier</td>
<td>1.23</td>
<td>1,000</td>
<td>0.326</td>
<td>0.439</td>
</tr>
<tr>
<td>Rhone-Poulenc</td>
<td>1.11</td>
<td>2,500</td>
<td>0.546</td>
<td>0.706</td>
</tr>
<tr>
<td>Club Med.</td>
<td>2.19</td>
<td>2,000</td>
<td>0.481</td>
<td>0.570</td>
</tr>
<tr>
<td>CMB Packaging</td>
<td>1.93</td>
<td>2,000</td>
<td>0.523</td>
<td>0.705</td>
</tr>
<tr>
<td>Schneider</td>
<td>2.18</td>
<td>2,000</td>
<td>0.564</td>
<td>0.852</td>
</tr>
<tr>
<td>Pechiney</td>
<td>0.76</td>
<td>2,500</td>
<td>0.709</td>
<td>0.939</td>
</tr>
</tbody>
</table>

Notes: The number in brackets are t-statistics.

(a) SEAQ data: observations at selected times between July 3 and July 13, from 9:00 a.m. to 4:00 p.m. (UK time). Paris Bourse data: all the transactions between June 19 and July 13, 1989, except those at the batch auction of 10:00 a.m. (French time), those inside the fourchette and those where the same trader appears as buyer and seller (the latter two groups largely coincide: see text). (b) Being computed on the entire sample, this average fourchette is not the same as that displayed in Figure 3, where it is computed using only observations that are time-matched with those from SEAQ International. (c) The Paris spread is computed as twice the percentage deviation of the price at which an order is transacted from the middle of the fourchette observed at the same time. Here the average spread is computed for orders of size ranging from half to twice the SEAQ maximum size reported in column 2.
are only two of the factors that investors evaluate in choosing where to trade, although they are the only measurable ones. Immediacy is another important factor: especially for large institutional investors, getting quotes over the phone from a London dealer and striking deals in a matter of seconds may be preferable to securing a slightly tighter spread on the Paris Bourse at the cost of waiting for a counterparty. In fact, we do have indirect evidence that, to a certain extent, large traders who transact in Paris give up immediacy: we find that on average the fourchette is lower when large traders place their orders than it is in the entire sample. This suggests that, before placing an order, large traders wait for the market to be sufficiently liquid: if so, the results in Table 6 overestimate the liquidity really offered by the Bourse.

4.2. Batch trading versus continuous trading

A dealership market is inherently continuous, but an auction market is not. With an auction, there is the choice of how frequently the auction should take place: should the market be cleared once a day, more than once a day, or whenever two outstanding orders can execute against each other? The traditional organization of trade in continental exchanges was to have one batch auction per day at the beginning of the trading day, plus optional subsequent callbacks at a broker's request for heavily traded stocks, often leading to bilateral bargains in the 'crowd' rather than to renewed batch auctions (see Whitcomb, 1985). All these markets are now switching to a continuous auction, although still retaining a batch auction at the beginning of the trading day. What are the costs and the benefits of such a move?

4.2.1. Costs and benefits of more frequent clearing. When auctions are held more frequently, traders have to wait less before performing a trade: the market offers greater immediacy. One could think that this benefits mainly insiders, who typically have a fleeting informational advantage, but in fact it can be an advantage for liquidity traders as well. A risk-averse liquidity trader will prefer to trade quickly before new information may change the fundamental value of the asset: for him waiting increases execution risk. However, more frequent auctions have costs because, in general, in each auction the market will be thinner. This has implications in terms of the risk-bearing capacity of the market, market depth and insider trading.

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8 Frankfurt, however, appears to be somewhat of an exception to this rule, since for the most active stocks it has always had a true continuous auction system, following the opening batch.
First, let us consider the case when no trader has insider information. In Appendix A we examine what happens when, as auctions become more frequent, each auction will see a reduction in the number of participants. Then, the volatility of the market price is affected by the relative change in the number of speculators and liquidity traders. If an increase in trading frequency produces an equiproportional reduction in the number of speculators and of liquidity traders intervening at each auction, price variability will increase. The reduction in the risk-bearing capacity of the market due to the fall in the number of speculators more than offsets the fall in the variability of demand due to the decrease in the number of liquidity traders. The greater price variability implies that a liquidity trader will be more likely to trade at a price that is far away from the underlying value of the security (provided of course he does not have the opportunity to try several auctions before executing his order). Conversely, on average speculators will make more profits, since they have larger scope for 'buying low' and 'selling high'. Thus, the increase in trading frequency tends to damage liquidity traders and benefit speculators. This obviously need not be the case if the increase in trading frequency causes a smaller proportional reduction in the number of speculators than of liquidity traders participating in each auction: one would expect this to be the case if speculators face lower costs to maintain a presence on the market. If more frequent trade lowers the number of liquidity traders participating in each auction, but leaves unchanged the number of speculators, price volatility is definitely reduced.

However, as the number of speculators decreases, each of them starts perceiving that his orders have an adverse effect on prices (the market is not deep). Each speculator will then start behaving as an imperfect competitor. If the model is extended to capture this element, then a decrease in the number of participants to each auction makes traders worse off, because they will all tend to restrain their orders. To the extent that speculators use the market as a mechanism to reallocate risk efficiently among themselves, they will be hurt by the need to restrain their orders. This adverse effect may even outweigh the beneficial effect that a speculator gets from higher price volatility, particularly for large orders which are more penalized by the lack of market depth (see Pagano, 1989b). Finally, one can introduce insider traders into the picture.\footnote{In Appendix B, we use a model of Kyle (1985) with risk-neutral competitive speculators, liquidity (or 'noise') traders and a monopolistic insider.} If more frequent trade leads to a decrease in the number of liquidity traders participating in each auction (while leaving their total
unchanged), on average the insiders will succeed in creaming more profits.

To summarize, increasing the frequency of trade implies a gain in terms of immediacy for all traders, but tends to decrease market depth, with adverse consequences for liquidity traders and possibly also for uninformed speculators who need to rebalance their position by large transactions. A similar tradeoff (though cast only in terms of effects on price volatility, not on welfare) had in fact been already envisaged by Garbade and Silber (1979). However, the above discussion may detract too much from the merits of frequent trading opportunities if liquidity traders have some flexibility over the timing of their trades, and use it judiciously. Then, trade tends to concentrate at specific times of the day as liquidity traders bunch together in order to trade when the market is deepest (Admati and Pfleiderer, 1988). Insiders do the same, because their profits are higher when many liquidity traders are active on the market (see above). On the other side, by bunching together they compete more aggressively against each other and thus end up improving the lot of liquidity traders. Obviously this argument presupposes that traders can coordinate quite precisely on the time at which they will bunch. In this sense, it may be a good idea to retain an opening batch auction even in a continuous market (as in the Paris market), in order to encourage those who have discretion on the timing of their trades to bunch together at the auction and benefit from the greater market depth at that time.

4.2.2. Do continuous markets perform better than discrete auctions? The main empirical work on the relative performance of batch and continuous trading is by Amihud and Mendelson (1987, 1989a) and Amihud et al. (1989). Amihud and Mendelson (1987) compare the variance of the NYSE daily open-to-open and close-to-close returns. The NYSE opens with a sealed-bid batch auction in which about 6% of average daily volume is traded. In contrast, the close ends a period of continuous trading, and the average closing transaction accounts for less than 1/8th of the opening batch volume. They find that close-to-close returns have a variance 20% lower than returns of the opening batch auction. More recently, Amihud and Mendelson (1989a) looked at the Tokyo Stock Exchange. Because this exchange closes for lunch, there are two batch openings and two continuous closing times per day. They find again that the morning open-to-open variance is 15% above that of the afternoon close-to-close, but also that the lunchtime close-to-close and open-to-open have almost identical variance. This suggests that the first result may arise from greater volatility early in the morning rather than from the type of trading method. Amihud and Mendelson conjecture
that, in the absence of previous price information (since the first morning transaction follows a long period of no trade), traders are more uncertain about the equilibrium price.

The Italian case provides a good test of this hypothesis. Normally this market opens with a period of continuous bilateral trading in the crowd, followed by an open outcry call auction (listino) between 10:00 a.m. and 1:45 p.m., followed by continuous (durante) trading for the rest of the day. On some days, instead, the market opens with the call auction and then switches to the continuous market. For 12 blue-chip stocks over 1984–87, Amihud, Mendelson and Murgia (1989) find that the first price of the continuous session is 10% more volatile than that of the batch auction, whereas the last price of the continuous session is 7% less volatile than that of the batch auction. This pattern, however, appears to reflect a declining pattern of volatility during the trading day, rather than the effect of the trading method. In fact, the volatility of the opening price is lower when the first transaction of the day is at the call auction (34% of days) rather than on the continuous market. Thus, a call auction may be a more efficient opening mechanism, but repeated trading later in the day is beneficial since it permits trade on the basis of information based on previous prices.

The recent reform of the Paris Bourse provides further evidence on the relative performance of batch auctions and continuous trading. The Paris Bourse used to work along lines similar to the current Milan system—a batch auction followed by bilateral trading in the crowd until closing time. Gradually, bilateral trading during the day has been replaced with a continuous auction, although the initial batch auction has been retained. Thus, French data do not only provide the opportunity to compare volatility in the opening batch auction and in the continuous market at the close: they also allow us to analyse the effect of replacing the traditional bilateral trading system with a continuous auction. As Amihud et al., we find that the returns of the opening auction are more volatile than those of the continuous market at the close: Figure 4 shows the variance of daily percentage returns for a sample of 16 French companies listed on the Bourse (each observation being the average value of the 16 variances).

More surprisingly, for the sample of companies, the shift to the new system of continuous auction has been accompanied by a reduction in volatility of both open-to-open and close-to-close returns, after controlling for individual company effects and for changes in the volatility of the market index (see Pagano and Roell, 1990). Following Section 4.2.1, this reduction in price volatility suggests that the decrease in the noise introduced by the liquidity traders intervening at each auction has been so large as to exceed the decrease in the risk-bearing capacity of the
market. The Paris data also offer the opportunity to check whether the greater immediacy offered by the continuous auction has led to a significant increase in trading volume. Table 9, which uses data for 15 stocks, shows that the switch to continuous trading is associated with a significant increase in trading volume for most of the stocks if turnover is measured in levels (whether at market prices or in number of shares traded). However, this seems due mostly to the increase in the total volume of trade in the Paris Bourse rather than to the effect of the switch to continuous trading: when the test is effected on the ratio between each company turnover and total market turnover, it turns out that for 10 out of the 15 companies considered the change in trading volume has been significantly lower than for the market as a whole (for a detailed discussion, see Pagano and Roell, 1990).

These results should be taken with some caution because of the small size of the sample. However, the fall in volatility observed in the French data should be encouraging for the European markets which are currently switching to continuous trading. The volume effect may be reversed in Spain and Italy: as we shall see in the next section, both countries feature a large amount of off-exchange dealing – contrary to France – and part of this trading may be recaptured by the official market once continuous trading is introduced.
Table 9. The transition to continuous trading: effect on turnover on the Paris Bourse

<table>
<thead>
<tr>
<th>Company</th>
<th>Date of the transition to continuous trading (1)</th>
<th>Test on the level of own volume measured at market values (2)</th>
<th>Test on the level of own volume measured by the number of shares traded (3)</th>
<th>Test on the ratio of own volume to the volume of the market (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schneider</td>
<td>22/08/86</td>
<td>8.05</td>
<td>9.17</td>
<td>3.18</td>
</tr>
<tr>
<td>Alsthom</td>
<td>24/10/86</td>
<td>6.65</td>
<td>6.52</td>
<td>-4.76</td>
</tr>
<tr>
<td>Auxiliare</td>
<td>23/01/87</td>
<td>4.79</td>
<td>6.07</td>
<td>-1.41</td>
</tr>
<tr>
<td>Total</td>
<td>20/02/87</td>
<td>-0.91</td>
<td>1.74</td>
<td>-11.67</td>
</tr>
<tr>
<td>Eaux</td>
<td>23/04/87</td>
<td>2.80</td>
<td>2.92</td>
<td>-0.51</td>
</tr>
<tr>
<td>Midi</td>
<td>23/06/87</td>
<td>10.17</td>
<td>7.02</td>
<td>3.33</td>
</tr>
<tr>
<td>Carrefour</td>
<td>23/06/87</td>
<td>4.64</td>
<td>2.50</td>
<td>-10.25</td>
</tr>
<tr>
<td>Paribas</td>
<td>23/06/87</td>
<td>0.09</td>
<td>-2.11</td>
<td>-2.06</td>
</tr>
<tr>
<td>Club Med.</td>
<td>23/12/87</td>
<td>4.53</td>
<td>2.65</td>
<td>-5.70</td>
</tr>
<tr>
<td>Bancaire</td>
<td>23/12/87</td>
<td>4.40</td>
<td>-3.96</td>
<td>-8.60</td>
</tr>
<tr>
<td>BSN</td>
<td>22/01/88</td>
<td>8.02</td>
<td>3.92</td>
<td>-5.29</td>
</tr>
<tr>
<td>Saint Gobain</td>
<td>22/01/88</td>
<td>-5.30</td>
<td>-2.56</td>
<td>-2.76</td>
</tr>
<tr>
<td>Michelin</td>
<td>22/01/88</td>
<td>18.81</td>
<td>6.59</td>
<td>-16.41</td>
</tr>
<tr>
<td>Bouygues</td>
<td>22/01/88</td>
<td>7.30</td>
<td>7.91</td>
<td>2.01</td>
</tr>
<tr>
<td>Havas</td>
<td>22/02/88</td>
<td>-3.24</td>
<td>-0.18</td>
<td>-0.12</td>
</tr>
</tbody>
</table>

Source: Societe des Bourses Francaises.

Note: (a) The test is implemented on daily data for turnover on the marché a reglement mensuel. A value of the test statistic above +1.96 (below −1.96) indicates that the transition to continuous trading has been associated with a significant increase (decrease) in turnover (at the 5% level of significance).

4.3. Concentration versus fragmentation of trade

4.3.1. Sources of fragmentation Off-exchange dealing is allowed in most European stock exchanges. France is the exception: in Paris all trades must be channelled through the exchange, even if they have been prearranged off the exchange. In some of the other countries, off-exchange dealing reaches tremendous proportions: in Italy, the average intermediation of stocks effected by banks in the period 1978–81 has been estimated to be 420% of the total turnover of the stock exchange. 10 Similarly in Denmark, off-exchange dealing has traditionally accounted for a volume four times larger than that of the exchange, and in Spain,

10 Source: L’attività di investimento e negoziazione in titoli delle banche italiane, Istituto Mobiliare Italiano (IMI), various issues. The data refer to a sample of 93 Italian banks of all dimensions, not to the entire population.
market professionals estimate that turnover off the exchange is at least
as large as that on the exchange. In some of these countries, the main
reason for this huge diversion of trade away from the main exchange
is the existence of fixed brokerage commissions. In Italy, for instance,
by crossing two orders in-house a bank saves a commission of 0.7%
(that is the fee that an agente di cambio would charge to a bank for the
whole transaction) and gets a total commission of 1.4% from the two
parties involved, that seems likely to exceed the bank's order-processing
costs. This is not true of other countries, however: in Spain, until the
recent reform, even in-house deals by banks had to be channelled
through a stock exchange member at a 0.5% commission. (This may
explain why in Spain off-exchange dealing, though still very substantial,
is estimated to be less widespread than in Italy, as a proportion of the
turnover on the official exchange.) This particular motive for in-house
execution of orders should, however, disappear as soon as statutory
fixed commissions are scrapped and their rates are left to competitive
forces.

Another important motivation for off-exchange dealing in Italy and
Spain comes from the quest for depth by block traders, who often end
up trading off the floor even at prices considerably different from those
prevailing on the floor of the exchange. Apparently, block traders tend
to deal outside of the exchange because they perceive the off-exchange
market as being deeper than the official one. In part, the reason may
be that the banks which operate the off-exchange market can meet the
demands of block traders both by drawing on their large inventories
of equities and by searching for counterparties via their contacts in the
business community. The greater depth of the off-exchange market
may also be the result of self-fulfilling expectations: all large traders
turn to that market because they expect it to be deeper, and as a result
the market ends up actually deeper (see Pagano, 1989b). Finally, some
argue that the lack of immediacy of the batch auction market is partly
responsible for the magnitude of off-exchange dealing: if trade were
more frequent on the floor of the exchange, less of it would go to
financial intermediaries off the floor.

As we have seen in Section 3.1.1, in Europe market fragmentation
occurs not only because of domestic dealing off the exchanges, but also
because a substantial share of trade is attracted to foreign marketplaces,
and particularly to the SEAQ International Exchange in London where
orders originating from other countries generally concern block trades.
The reason is the same as for domestic off-exchange dealing: often
large traders from France, Spain or Italy perceive the London market
as offering greater depth and immediacy than their domestic exchanges,
partly because of the readiness of London dealers to quote firm prices
even for large transactions, partly because of the high number of institutional investors who operate on that market.\textsuperscript{11}

4.3.2. Costs and benefits of concentration. There is nothing that domestic policy-makers can do to forbid off-exchange dealing abroad, but they can ban it domestically, as is done in France. Is this a good idea? The costs of fragmentation are not dissimilar from those of increasing the frequency of trade: fractioning trade across market places is equivalent to fractioning it over time. Thus, one would expect fragmentation to result in higher price volatility (Mendelson, 1987), less market depth (Pagano, 1989b) and higher profits for insider traders. Market fragmentation can in fact help insiders to make a killing on the market, especially in the context of changes in corporate control. If there is a large unofficial market with fairly unsophisticated agents who take the official market price as a reference point, a potential take-over bidder can artificially depress the official market price and buy large amounts of the stock outside the market. Even if traders are sophisticated, knowing that they are unable to tell apart a bona fide purchaser from a potential manipulator, on average they exact a small premium from buyers, thus taxing bona fide traders and subsidizing raiders. Furthermore, the rumour that a raider is trading will spread more slowly in a decentralized setting (outside the official market) than it would if all orders were concentrated on the official market.

The search for the deepest market creates a natural tendency for trade to bunch together in a marketplace, in the same way as it does for timing. Fragmentation should arise only if there are fixed transaction costs which differ from one market to another. Then we expect that several markets can survive, with the larger traders select the market with greater depth and higher fixed transaction costs. Studying the case of two markets, Pagano (1989b) shows that a situation where both markets are centralized exchanges is (Pareto) inefficient. If instead one market is a centralized exchange and the other is a search market specialized in block trading, there is no \textit{a priori} way to rank this system relatively to a single market. In this case concentration benefits small traders on the centralized market but may hurt large traders who are prevented from searching for a counterpart off the exchange: search

\textsuperscript{11} One episode (reported by a Spanish banker) is quite telling. On 2–4 June 1988, the Spanish government sold shares that it owned in the Endesa corporation—about 10% of the company's capitalization—using the current market price as reference. It could not sell the entire amount on the domestic market, while abroad buy orders exceeded the offer three times. In that year, Endesa was the 5th largest company by capitalization on the Madrid stock exchange, and the 12th most active stock by turnover.
off the exchange can be a more efficient way of producing market liquidity than an auction on a centralized market.

Where does this leave us? A tentative conclusion is that there are advantages to concentration, but that banning off-exchange dealing altogether may be very costly for block traders. It may eventually be self-defeating in a regime of free capital mobility if block traders migrate abroad. A more practical alternative is probably the two-pronged strategy enacted in the Amsterdam exchange in 1987 and in the Paris Bourse in 1989 (and not dissimilar from the approach traditionally used on the NYSE): create an 'upstairs dealers' market' for block trading, and devise mechanisms to keep prices on the floor in line with those struck 'upstairs' by block traders.

4.4. Single-capacity versus dual-capacity dealing

Single capacity means different things in different countries. In London's dealership market, before 'Big Bang' there was single capacity in the sense that the brokers dealt with the clientele but could not operate directly on the market, and the 'jobbers' dealt on the market, also on own account, but received orders from brokers, not directly from the clientele. In the auction markets of the continent, where there are no market makers like the jobbers, single capacity has traditionally meant that stock-exchange members cannot take positions but must simply transmit orders from the clientele to the floor. After 'Big Bang', most London 'jobbers' have become dual-capacity dealers, and brokers have been allowed to be dealers as well. After the reforms in France and Spain, exchange members have been allowed to deal also on own account. In both cases, the dealership and the brokerage functions have merged, giving rise to a new type of intermediary. However, on the continent banks have always informally practiced dual-capacity dealing on a massive scale. In Germany and Italy a bank can legally complete a transaction between two traders off the exchange, or meet client orders from inventories; at the same time, it can effectively deal on the exchange via its representative (in Germany) or an exchange member (in Italy). Thus, although they are not market makers on the exchange, continental banks frequently end up being broker-dealers just like London's market makers.

Policy-makers ought to be concerned with three aspects of dual-capacity dealing: the financial solvency of dual-capacity dealers, the problem of 'front-running' (trading on own account before executing a customer order) and market liquidity. The problem of solvency is usually tackled by setting minimum capital requirements for the broker-dealers. The danger of front-running can be mitigated by setting legal restrictions aimed at separating the trading arm of security firms from
their brokerage division (it is, however, dubious whether in practice such separation would prove waterproof).

The third aspect, the effect of dual-capacity trading on the liquidity of the market, has been analysed by Roell (1989). It is reasonable to suppose that, over time, dual-capacity dealers develop the ability to identify within their clientele a subset of traders that can be classified with certainty as liquidity traders (for instance, institutional investors that trade uniquely to rebalance their portfolios) rather than as insiders. When a dual-capacity dealer knows that he is dealing with a liquidity trader, he has an incentive to satisfy part of the order from his inventory (roughly half in Roell’s example). As a result, the liquidity trader unloads on the market only the remaining part of the order, and the adverse price response is smaller than it would have been if the entire amount had reached the market. Thus, dual-capacity dealing benefits liquidity traders who are recognized as such by dealers. However, it damages liquidity traders who are unable to convince any dealer that they have no inside information: for them, the liquidity of the main market worsens.

Roell shows also that insiders’ profits decrease by an amount which exceeds the increase in the profits of broker-dealers: since the expected profits and losses of the three groups (insiders, broker-dealers and liquidity traders) sum to a constant, liquidity traders as a group gain from dual-capacity trading. Individual liquidity traders who cannot prove their innocence, however, lose.

5. Competition among European stock exchanges: where are we heading?

This article would be incomplete if we did not attempt to face the most interesting and difficult question: where is this competitive process among stock exchanges leading to, especially as the 1990 EC liberalization of capital flows comes into full force? Will the liberalization lead to a rapid process of concentration of trade on a single marketplace, or at most on a few markets, relegating the others to the role of peripheral marketplaces, specializing in small-size local companies? The obvious candidate for the role of European centre for stock trading is clearly London. It has a tradition as a major financial centre and has gained further ground by launching before the others the process of innovation. One may suggest that, after 1990, the gravitational pull of an exchange like London will become hard to resist, especially as it will be able to exploit more extensively the economies of scale in brokerage, handling and settlement systems, as well as the external economies that typify thick financial markets (see Grilli, 1989 and Pagano, 1989a).
However, as we have seen, several continental exchanges are trying to recover lost ground, or at least to avoid further losses, by reducing transaction costs and improving the liquidity and immediacy offered by their markets. In doing so, they often emulate some aspects of the British market. This process is far from being completed, and it is too early to give a definite assessment of its results. But it is likely that, at a minimum, the response of continental markets will slow down considerably the process of concentration towards London.

Moreover, economies of scale and beneficial externalities are not the only factors which determine the geographic distribution of asset trading: there are also factors which favour localized trading, such as information collection costs, localized share-ownership and the danger of future de-liberalization. In fact, the US experience suggests that, even after stocks get cross-listed in other exchanges, they tend to remain mainly traded in the exchanges where they were initially listed. In 1975 the US Congress mandated the National Market System (NMS) with the primary objective of fostering competition among exchanges. This resulted in the creation of the Intermarket Trading System (ITS), a network for price information and order transmittal among the various US trading arenas. Since ITS was installed, however, the relocation of trade among exchanges attributable to its operation has been modest: according to Hamilton (1989) ITS has had virtually no effect on order flow to regional marketplaces.

Our hunch is, therefore, that the near future is set for further competition among exchanges rather than for their specialization in distinct lines of business. The moment in which the Paris Bourse or the Frankfurter Wertpapierboerse will be regional exchanges specializing in small and medium French and German companies seem far away, and may actually never come. This may actually be good news for the final users of the exchanges, the investing public in Europe. Competition from the UK, where foreign share trading is not subject to indirect taxes, is inducing a number of countries to reduce or eliminate their indirect taxes on equity transactions. For example, Spain has dropped its transaction tax in July 1989, and Germany recently brought forward the date for abolishing its turnover tax by two years to early 1991. Since in early 1989 the burden of indirect taxation on equity trading was particularly high in Germany and France, their markets stand to gain most in terms of competitiveness.\footnote{In Germany, turnover tax on a roundtrip transaction is 0.5%; in France, 0.6% (0.3%) on transactions smaller (greater) than FF 1 m. The EC is also pressing for the elimination of indirect taxes on securities transactions (see its draft Securities Transactions Tax Directive, COM(87)139).}
Furthermore, competitive pressures may provide a useful check on the efficiency of each national market, levelling commissions and bid-ask spreads towards the lowest level (see Box 2). In this competition, each market will obviously exploit its comparative advantages, and to a certain extent try to cater to different segments of the clientele. Take for instance a French stock that is cross-listed in London: the advantages of the Paris Bourse are the speed with which new information about the stock becomes available and the tight spreads that characterize its auction market, while London market makers can bank on their ability to offer higher immediacy and on their better connections with extra-European investors.

There is only one area where competition among national exchanges may result in unwelcome outcomes. In their attempt to attract business, policy-makers may end up scrapping regulations that, though desirable, have the effect of repelling trading activity. This 'beggar-thy-neighbour' competition among national policy-makers could make regulation sink to the lowest common denominator on European stock exchanges (an area where this may occur is the regulation of information disclosure, discussed by Roell, 1988). If these regulations are desirable, one has to impose them in all countries, via a coordinated effort of national authorities and, possibly, intervention by the EC. It is an exciting task of future research to identify the specific areas where such regulatory coordination is needed, and what are the minimum standards that policy-makers should aim for.

What about the more distant future? It is likely that in due time even the issue of the geographic distribution of trade will become largely irrelevant: the creation of an integrated computerized system on a continental scale may not be far away. The demand for such a system will grow if European countries prove that they can live without capital controls and realize further progress towards monetary unification. Once currency risk is eliminated, the attraction of diversification into equities from other EC countries will no longer be limited to large institutional investors, and even medium- and small-size corporations will raise capital in a continental market.

Obviously, the technical problems that must still be solved to connect European exchanges in a single computerized network are formidable. The main ones clearly arise from the persistent national differences in trading and settlement systems. Amihud and Mendelson (1989b) suggest that the integration of European exchanges should not try to harmonize the existing trading systems across Europe, but rather should allow them to compete with each other, leaving customers free to choose the market, and thus the trading system, that suits them best. If this
Box 2. Competing markets: the intra-daily movements of the spread in London and Paris

Figure 5 displays the intra-daily movements of the market touch in London and of the *fourchette* in Paris, for cross-listed French shares: each observation is the average value of the spread for the 16 stocks listed in Figure 3, in the two trading weeks from July 3 to July 13, 1989. Before 9:00 a.m. (UK time), only the SEAQ International market in London is open, and its spread for French stocks is on average above 3%. At 9:00 a.m. the Paris Bourse opens: the London spread drops to 1.5% and stays there until the Paris market closes at 4:00 p.m. (UK time). During these seven hours, the *fourchette* stays constantly between 0.4 and 0.5%. Finally, as soon as the Bourse stops trading, the London spread shoots back up almost to 3%. Thus, in the early morning and in the evening, the SEAQ spread on French stocks is about 100% higher than in the interval from 9:00 a.m. to 4:00 p.m.

This increase in the spread exceeds by far the increase on British stocks in the London market. Using evidence reported by Lee (1989), one can estimate by how much the market touch for British stocks rises outside the 'mandatory quote period' (from 9:00 a.m. to 5:00 p.m.) on the International Stock Exchange in London. In the evening and early

![Graph showing spread in London and Paris](image)

*Figure 5. Spread in London and Paris, by time (mean % values, 3-13 July 1989)*
morning the average touch is 14.3% higher for Alpha stocks, 9.9% higher for Beta stocks and 8.2% higher for Gamma stocks. These estimates are based on a sample of 195 stocks, evenly divided among the three groups. (Lee, 1989, calculates the average ratio of the market touch to the minimum dealer spread in each stock, both within and outside the ‘mandatory quote period’. The estimates quoted above are based on his figures, on the assumption that the minimum dealer spread was constant over time. This assumption is reasonable, since Lee reports that individual market makers tend to keep their absolute bid-ask spread constant over time: for only 13 of the 195 stocks of his sample did dealers vary their spreads.)

Given their size and timing, the intra-daily swings of the market touch for French stocks on SEAQ International are clearly linked to trading on the same stocks in Paris. There are two possible interpretations, each of which probably holds part of the truth. The first one is that when the Paris Bourse is open, it exerts a competitive discipline on dealers that operate in the French sector of SEAQ. This ‘discipline’ hypothesis is consistent with most of the available evidence on the effects of inter-market competition in the US (Branch and Freed, 1977, Hamilton, 1979, Neal, 1987, SEC, 1986a, b). An alternative explanation relies on asymmetric information. When the Paris Bourse is closed, London dealers cannot count on the French prices as guide for setting their quotes and feel more exposed to traders using privileged information, possibly operating from the continent. Widening their bid-ask spread would then be a strategy to protect themselves. It turns out that the two markets are very well arbitraged: on 380 observations, all perfectly matched by time of day, we have not identified a single unexploited opportunity for arbitrage. Such close integration between the two markets squares equally well with the ‘discipline’ and with the ‘information’ view of the intra-daily movements of the SEAQ spread. In either case, it is clear that trading activity in Paris from 9:00 a.m. to 4:00 p.m. benefits also the users of the London market, by making it more liquid than it would otherwise be.

line is accepted by EC policy-makers, integration of European exchanges will increase, rather than reduce inter-market competition.

Despite obvious technical challenges, the first steps to create an integrated market are already starting to materialize. Most exchanges have accepted the proposal by the International Federation of Stock Exchanges that national central-depository systems be interconnected. In 1989 European exchanges have also agreed to create PIPE, a Europe-wide network which will instantaneously disseminate information on
prices, trading volumes and corporate announcements for the leading stocks listed in the EC. Completion of this network may be reached already by the end of 1990 (see Stevenson, 1989). Thus, rather than in the City, in Boersenplatz or in Place de la Bourse, the heart of the future European stock exchange may end up being located in a bunch of trivial silicon wafers.

Discussion

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This is a truly excellent paper which addresses squarely several important and insufficiently researched questions. The paper comes out with an abundance of revealing new evidence and stimulating interpretations. In essence, the authors' goal is to delineate the grounds on which stock exchanges compete and understand on that basis what is the current competitive position of the main European exchanges, how it has evolved in the recent past, and what it will be in the future.

Early in the paper (Section 2.1), Pagano and Roell indicate the three essential factors which, according to their prior, attract business to financial markets. These are, lower transaction costs, higher market liquidity or simply the force of tradition. They define transaction costs as 'the explicit costs that are paid in brokerage commissions and taxes to carry out a transaction, plus the implicit cost of the time required for its settlement. Any other deviation between the actual transaction price of a stock and the best estimate of its true value is instead a symptom of illiquidity'.

While these criteria may be interpreted as the authors' prior view on this issue, their own analysis, as it proceeds, suggests some revisions in this position. Indeed it appears difficult to organize the evidence solely on the basis of these three criteria and several other important elements of competition are brought in when the key options in the design of the trading mechanism are described.

Disturbing observations include the following. First, the Zurich exchange is in a strong position in terms of the turnover ratio. This is disturbing because Zurich has so far been largely bypassed by the winds of reform. Zurich is not usually praised either for high liquidity or low transaction costs (of course, this impression deserves to be documented). Should we then appeal to the force of tradition? Although this would be in line with the reputation of the Zurich financial circles as paragons of conservatism, it would also be unsatisfactory and disappointing to rely on the force of tradition as the only element of explanation. It is possible that time-series information would reveal a significant and rapid loss of market share by the Zurich exchange. This would confirm
the authors’ thesis. Yet, it is equally possible that the competitive position of Zurich has been maintained and resides elsewhere than in low transaction costs and high liquidity. This question definitely deserves further study.

A second uncomfortable observation is the more effective resistance offered by the Frankfurt market (relative to Paris) to the competition from the London exchanges. This issue is not directly addressed in the paper although the authors mention that ‘today Frankfurt has the most efficient and the safest settlement system in the world’. This statement is exemplified in the line on ‘settlement time’ in Table 3. Still, on a strict cost basis the shorter settlement time of Frankfurt relative to London (by a difference of eight days) cannot make up for the explicit transaction cost difference between the two exchanges. The difference amounts to 0.4% for large transactions made by foreign investors, according to the ‘Quality of Markets Report’; it is larger than 1% for most transactions, according to published sources (Table 3) and it is even higher for the deals settled without commission on SEAQ international. One may hypothesize that as is the case in many other industries, the Germans (and probably the Swiss as well) are concentrating on selling a higher quality, higher price service. But then the notion of ‘competing on transaction costs’ becomes quite misleading. A characteristic of the German product is a more efficient and reliable settlement system; it could, however, also include a larger dose of intermediation; for example, it could very well be sold as a package with other services, as one would plausibly expect from an exchange managed by banks. In this respect as well, further research is called for.

The third piece of disturbing evidence is closer to the heart of the paper and concerns the comparison between Paris and London. It is clear that on the basis of liquidity and transaction costs alone the superiority of London has proved harder to establish that what the authors (and the readers probably) would have thought initially. One may question the evidence: on the liquidity front, observations on extremely large orders are missing; concerning transaction costs, it seems that a sizable amount of non-UK deals are settled without commission and this may resolve the issue. Yet, one could also question the initial hypothesis (as Pagano and Roell themselves do implicitly) and other determinants of competition among exchanges than those originally listed may be relevant. In particular, immediacy and execution risk appear as important advantages of the dealership system prevailing in London.

All these observations converge to suggest that while the factors of competition initially identified – transaction costs and liquidity – are certainly the most important, and are the main objects of attention when designing trade mechanisms, they are not by far the only attributes of
the service performed by an exchange, hence not the only ones that should be given weight in the process of reform.

I have two additional comments of a slightly different nature. The evidence on the amount of inertia in the competition among exchanges, as it emerges from the paper, is mixed. On the one hand, Figure 1 shows considerable movements in the relative shares of EC equity turnover that is accounted by the various exchanges. That is to be expected in markets dominated by large institutional investors. On the contrary, the use of the force of tradition as one of the three key words would suggest there is a good deal of persistence in the relative position of exchanges and this view may be supported by our discussion of the Zurich case. Furthermore, the evidence uncovered by Pagano–Roell on the London–Paris competition could also be interpreted as the result of London having gained a first-mover advantage and being able to keep on gaining ground or at least to maintain its leadership unless the others are markedly better or more efficient. Thus, London’s superiority would be consistent with the absence of cost or liquidity advantage over the Paris market.

Are we heading towards a single European stock exchange? The preceding discussion reinforces the concluding section of the article in suggesting that there are enough attributes over which to compete to make specialization of exchanges a likely outcome, at least until everything is concentrated ‘in a bunch of trivial silicon wafers’. In this game, the first mover – London – by targetting large customers, and, in some cases, high volume stocks – has picked up the trump cards.

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Pagano and Roell (PR) are to be congratulated for tackling the problem of designing securities markets. This is a problem of great importance but daunting size. If, at the end of the day, we are unable to resolve some of the major policy questions as clearly as we might wish, this is more a reflection of the embryonic stage of research in the area rather than of shortcomings in this paper.

The authors deal with three main questions. First, how much does it actually cost to transact on the major European exchanges? Can we identify separately the deadweight costs (taxes, stamp duties, commissions etc), and the bid-ask spread and how does the bid-ask spread vary with quantity? Second, what are the merits of auction versus dealership markets in terms of the costs of transacting? Third, is trade in Europe likely to concentrate onto one exchange or will trade be fragmented? Does concentration matter and, if so, is this a question for
(say EC) public policy or should it be left to the market? A striking feature of the paper is that a number of unambiguous questions connected with market concentration, do not map easily onto the data. Thus, the distinction between different market structures is, in practice, rather blurred and the definition of market boundaries complicates discussion of concentration.

The authors identify a number of measures of transaction efficiency including transactions costs and immediacy. Both are difficult to measure but, in Section 2.2, the authors use a method suggested by Roll to estimate the spread, an important component of total transaction costs, from the serial correlation in returns measured from a sequence of transaction prices. The idea of the method is that randomness in the arrival of buy and sell orders adds noise to the equilibrium price. If the latter follows a random walk this induces negative serial correlation in returns.

The results are disappointing: for the three countries considered and using daily data the fraction of estimates greater than zero averages only 47%. With weekly data the average fraction of positive estimates rises to 56%. According to the authors, this arises because at that weekly frequency prices have adjusted more fully to new information and the inefficiency in price formation is less visible. This explanation assumes a substantial degree of inefficiency and there are some alternatives. In particular, it would be useful to know something about the robustness of Roll’s method when the variance of returns changes over time (which it certainly does) and when the spread is correlated with the variance (which it may well be). Roll’s approach seems best suited to very high frequency data when the size of the spread is a significant fraction of the average price change; to find that the method appears to work better when the frequency is lower should raise questions about all the assumptions of the method rather than just the assumption of market efficiency.

Section 3 addresses the important question of the choice of trading mechanism which the authors characterize as ‘auction’ versus ‘dealership’. Even providing a clear definition of the difference between the two turns out to be difficult and, as the authors say, the distinction between auction and dealership organization is often rather subtle. In both auction and dealership markets, investors who hold large portfolios are in a position to provide some dealer services to the market. For example, a large pension fund holding both a diversified portfolio and cash is in a position to fill customers’ orders for securities from its portfolio and to add securities to its portfolio in exchange for cash. The distinction between agents of this kind and those who are described formally as ‘dealers’ is delicate. As the authors point out, dealers typically
have certain privileges and obligations but, at least in London, the value of the privileges, at least if judged by the average profitability of equity market makers, looks small.

The empirical literature on whether an auction or dealership structure provides higher liquidity is well summed up in Section 3.1.2 but it is hard to interpret. There are a number of plausible determinants of liquidity of which market structure is one. Theory in this area does not seem to me to be sufficiently advanced to allow us to say that the reason the NYSE, say, is more liquid than the NASD (if it is) is the difference in organization. We may record spreads, tightness and depth for particular markets but this seems very partial evidence on which to draw conclusions about the efficiency of one form of organization relative to another.

In the final section PR engage in some speculation on their own account about the likely shape of European stock exchanges. In particular, they wonder whether the liberalization will lead to a rapid process of concentration on a single marketplace at the expense of peripheral markets, specializing in small local companies. Even to ask this question begs a number of others and some are raised by the authors. When we refer to ‘the marketplace’, which until relatively recently meant exactly the physical entity that the name suggest, we must now have in mind a whole collection of attributes, few of which have anything to do with physical location. A modern securities market (even this term is not broad enough since we should include the increasingly wide range of instruments, e.g. swaps, which are traded ‘over the counter’) is defined by aspects such as the set of agents to whom information is disseminated, the clearing and settlement mechanism, the regulatory structure and the set of instruments being traded. Of these, clearing and settlement and the set of instruments traded have, in some cases and at least for the time being, strong and national ties. In Europe national aspects of the regulatory system are becoming less important and information is already widely distributed internationally.

If concentration poses fewer policy problems than the authors suggest, I wholeheartedly endorse the views expressed in the paper about the dangers of ‘levelling down’ in regulation. There seems to be good reason to expect that the combination of the ‘passport’ principle embodied in EC regulation combined with home country authorization will lead to a situation where no country will be able to impose a regulatory cost on a financial institution which it could avoid by simply moving its ‘domicile’ to a country where the regulatory cost was lower. Perhaps these issues, as much as the ones which are the main focus of the paper, will determine the future shape of Europe’s equity markets.
General discussion

A number of panel members urged Marco Pagano and Ailsa Roell to draw stronger conclusions regarding the appropriate policy response from the EEC and national regulators toward the organization of stock markets. In particular, Charlie Bean wondered whether regulation should take place at the EEC rather than national level. Georges de Menil suggested that the political economy of regulation would also deserve attention. Pagano concurred and offered the view that on the continent, the major banks were the main driving force behind the new regulations.

Bean further emphasized that an adequate discussion of policy issues should be rather careful about subtle welfare implications of alternative market designs. For example, one should not take for granted that liquidity is always desirable. In markets prone to speculative bubbles, a good case can indeed be made in favour of restricting liquidity. Along similar lines, Colin Mayer warned that dealers commonly receive tax incentives. It is not clear whether such incentives are necessary to ensure the functioning of the dealership system. If it turns out that these incentives are indeed necessary, the social cost of the dealership system will exceed the private cost. Any judgment on the respective merits of auctions and dealership system should take this into account. Barry Eichengreen also suggested that the volatility of the market under the alternative systems should be examined. There is, in his opinion, a presumption that dealership systems lead to more volatility than auctions. Pagano responded that this intuition may be sound but there is no theoretical model which can sustain it. Finally, Richard Layard added that the efficiency of markets should not be the sole concern of policy; the actual location of market operators is a central issue, if only from the point of view of governments.

On the issue of competition between stock markets, Jean-Paul Lambert thought that competition would be better assessed by looking at the market shares of the various exchanges over time. Ailsa Roell agreed but indicated that time-series data on exchanges were not reliable because of numerous changes in definitions. John Black wondered whether there was considerable variation across markets in the time required to complete transactions. The time required for settlement reported in Table 4 did not, in his opinion, refer to the completion of all paperwork, including the delivery of property claims. This matters because an asset cannot be transacted again until the appropriate property claim has been delivered. Black suggested that the puzzle of London's supremacy could be partly explained by a more efficient
handling of paperwork. This was acknowledged by Pagano. Finally, Lambert wondered to what extent variation in the bid-ask spread across countries could be explained by differences in the regulation governing insider trading. In places where insider trading is more likely because of lax regulation, one could indeed expect higher spreads. Roell responded that according to previous work on this issue, at most 40% of the spread could be accounted for by insider trading.

Appendix A. Frequency of trade and volatility

In this appendix we propose a very simple model to capture the idea that an increase in the frequency of trade can affect price volatility via its effect on the number of traders participating in each auction. In the model people trade only to achieve efficient risk-sharing in the presence of heterogeneous endowments or beliefs (there is no information-based trade), and everyone behaves as a price taker.

There are two classes of traders, $N$ risk-averse speculators and $M$ liquidity (or 'noise') traders. The only difference between the two types of traders is that speculators submit price-elastic demands to the market (they buy low and sell high), whereas liquidity traders' net demands are inelastic. The demand for the stock by the $i$-th speculator ($k_i^d$) is assumed to be linear, and to contain an additive $i.i.d.$ random component $e_i$, with mean 0 and variance $\sigma^2$:

$$k_i^d = a - bp + e_i, \quad i = 1, 2, \ldots, N \quad (A1)$$

This linear demand curve can be derived from a portfolio choice problem under the assumption of mean-variance utility, or negative exponential utility and normal variates. The $i.i.d.$ individual disturbance can instead reflect cross-sectional differences in endowments or beliefs about the fundamental value of the asset.

The supply of the asset $K^s$ is given by a constant $K$ plus the aggregate net supply by the $M$ liquidity traders:

$$K^s = K + \Sigma_ju_j, \quad j = 1, 2, \ldots, M \quad (A2)$$

where $u_j$ is the supply of the asset by the $j$-th liquidity trader (an $i.i.d.$ random variable with mean zero and variance $\sigma^2$). The equilibrium price (obtained by setting $\Sigma_i k_i^d = K^s$) is

$$p = 1/b[a - K/N + (\Sigma_i e_i - \Sigma_j u_j)/N] \quad (A3)$$

It is immediate that the variance of the price is decreasing in $N$, the number of the speculators, and increasing in $M$, the number of liquidity traders:

$$\text{Var}(p) = (1/b)^2(\sigma^2 + M\sigma^2/N)/N \quad (A4)$$
As the frequency of auctions increases, the number of participants per auction—$M$, $N$ or both—will tend to decrease. The implied effect on price volatility can be understood best by plotting equation (A4) in the $(M, N)$ plane. For a given value of $\text{Var}(p)$, $M$ is a linear-quadratic function of $N$: this is represented in Figure A.1 as the $VV$ line. Along this line, volatility remains constant, at the same level as in the initial equilibrium with $M_0$ liquidity traders and $N_0$ speculators (that corresponds to point $A$).

If the liquidity traders and the speculators participating to each auction decrease in the same proportion—so that their ratio remains equal to $M_0/N_0$—we move along the ray $RR$ to the point closer to the origin, such as $C$, and price volatility increases (as we end up above the $VV$ line). The same happens if the ratio of liquidity traders to speculators increases above the initial value $M_0/N_0$ (point $B$).

If instead the ratio $M/N$ decreases, things can go either way: if it falls below the critical level corresponding to the $VV$ line, we move into the shaded area where volatility is lower (this will always occur if the number of speculators remains constant at $N_0$). If instead $M/N$ remains above this critical level, as in point $D$, volatility will increase.
Appendix B. Insider trading

Here we sketch how one can modify the simplest version of the model presented by Kyle (1985) to analyse the effect of higher trading frequency in a setup with asymmetric information. Kyle shows that in a single-auction equilibrium the expected profits of the insider are directly proportional to the standard deviation of the aggregate demand by the noise traders $M^{1/2} \sigma_u$ (using the notation of Appendix A). The reason is that a larger number of liquidity traders increases market depth for the insider and allows him to trade more aggressively on the basis of his private information. Now assume that the insider has a new piece of private information at each instant, but that his informational advantage dissolves quickly (notice that this is not the problem that Kyle analyses in the rest of his paper: there he assumes that the insider’s private information is ‘durable’, and is not revealed except through the market behaviour of the insider).

Imagine then that trading frequency is increased from a single auction to $T$ auctions. If the $M$ liquidity traders distribute themselves evenly across the $T$ auctions, the expected profits of the insider in each auction will be proportional to $(M/T)^{1/2} \sigma_u$, and the total expected profits in all $T$ auctions are going to be $(MT)^{1/2} \sigma_u$, i.e. will be an increasing function of the number of auctions. Thus, increasing the number of auctions allows the insiders to increase their average profits at the expense of the liquidity traders.

References


